Defence Research and Genetic Engineering: Fears and Dissociation in the 1970s

Jon Agar and Brian Balmer[1]

On 4th May 1978 a letter was sent to the Arms Control and Disarmament Department (ACDD) at the UK Foreign and Commonwealth Office (FCO) raising concerns about cutting-edge genetics and biological warfare. The letter came, not from a scientist, but from a distinguished historian, Michael Howard, then the Chichele Professor of the History of War at Oxford University. Howard had recently discussed the possible uses of genetic engineering for military means with a research student, Jeremy Levin, working in the field of genetics. This conversation had disturbed Howard sufficiently enough to write to the ACDD warning of 'alarming' possibilities and enclosing a briefing paper, 'Genetic Engineering and Biological Warfare' written by the student.[2] The paper suggested a range of ways that recombinant DNA (rDNA) techniques, then a relatively new area of science, could be put to military use. Possible applications included: an increase in the lethal capacity of microorganisms; an increase in their specificity to target and infect particular groups; disguising a lethal gene by removing it from a pathogen and then inserting it into a common, normally benign, organism; conferring antibiotic resistance on a pathogen; and producing toxins. The paper concluded that should any of these applications prove feasible, 'then governments will be forced to re-evaluate their policies towards the use of biological agents in warfare'.

A month later, the Arms Control and Disarmament Research Unit (ACDRU), the research arm of the ACDD, sent a response to Howard.[3] In quite direct terms, it noted that the forced reassessment of biological warfare proposed in Levin's paper was a view 'not shared by the experts in the Ministry of Defence whom we have consulted'. The letter proceeded to elaborate, using a near verbatim version of a letter sent a few days

[1] Both authors contributed equally to the research and writing of this chapter. Balmer's research for this chapter was supported by ESRC grant ES/K0ll308/1.
[2] The National Archives (Hereafter TNA), FCO 66/1228. Michael Howard to Christoper Mallaby (ACDD), (4 May 1978).
[3] TNA, FCO 66/1228. CR Dean (ACDRU) to Professor Michael Howard (1 June 1978).

before from the Ministry of Defence (MoD) to the ACDRU. This earlier letter is worth quoting at length to illustrate the Ministry's frank dismissal of Levin's views:

> We have discussed Mr Levin's paper with our experts. The general view is that it presents a grossly oversimplified picture of a highly complex subject. Many of the ideas are not as revolutionary as the author implies. And indeed a number of the proposals could be achieved by conventional means… Moreover, any newly-constructed organism will still be covered by the Geneva Treaty… Perhaps the most important fact is that it is inconceivable that the more dramatic developments suggested by Mr Levin could take place undetected, as he implies, since the existing controls over genetic manipulation experimentation are extremely rigid.[4]

So, in no uncertain terms, the FCO and MoD told Howard that his fears were unfounded. Yet, this response is at least a little puzzling. The emergence of rDNA technologies, or more colloquially genetic engineering, just a few years earlier had been accompanied by a wide-spread public discussion of numerous ways in which genetic engineering might present new risks to humans and the environment. And, as will be discussed in this chapter, the military potential of rDNA research was given earnest attention within the closed world of government and biological defence research. Moreover, this instance of 'de-coupling' of biological weapons research from genetic engineering was not isolated.

With regard to 'de-coupling', two interconnected aspects interest us. First, the discovery of rDNA techniques in the early 1970s had provoked a debate about to what extent and under what conditions "genetic manipulation" should be allowed to continue. While these debates concluded that research should be permitted under controlled circumstances, this turned the matter into a regulatory issue in which "genetic manipulation" had to be defined. Here we show that key actors, in particular the chief scientist of the British "think tank", the Central Policy Review Staff (CPRS), John Ashworth, shaped the

[4] TNA FCO 66/1228. From GH Mungeam, DS11, MOD to CR Dean, ACDU, 25 May 1978. From the context, it is clear that the 'Geneva Treaty' here refers to the 1972 Biological Weapons Convention rather than the earlier 1925 Geneva Protocol on chemical and biological warfare.

regulatory definition of what "genetic manipulation" would be. At this time, in the search for defence cuts, the Microbiological Research Establishment (MRE) at Porton Down, Wiltshire, the home of the British biological defence programme, was threatened with closure. Defenders of MRE, however, argued that it was ideally placed to develop further and deploy the new genetic engineering techniques. It would be foolish, and perhaps dangerous, they said, to shut such a facility just as promising new methods were appearing. In particular, the regulatory discussion had generated a tiered categorisation of genetic manipulation risk and the associated laboratory containment levels needed to minimise risk. The MRE could provide a rare offering to the research and policy community - containment facilities at the highest tier, level 4 But of course what could be described as "genetic manipulation" would depend on what it was defined to be. Ashworth, we will argue, was simultaneously intervening into the debate over MRE in the same timeframe as he was seeking a regulatory definition of "genetic manipulation". The search for a solution to the crisis over MRE, especially one which relied on its potential as a genetic manipulation laboratory, we show, was also complicated by the fact that MRE was associated with – and therefore required dissociation from - defence research. To explore the second aspect of de-coupling, we return to the Howard letter and subsequent discussion within the FCO about the potential of genetic engineering as it might be applied to biological warfare. In this context, we argue, a slightly different de-coupling took place. Although the potential danger from rDNA technologies was recognised, the likelihood of this posing a threat was minimised through the mechanisms of the recent Biological Weapons Convention.

In this chapter we follow the forging of some of these connections and dis-connections, with a view to understanding the military dimensions of, and reactions to, early genetic engineering. In doing so, we seek to demonstrate the work that went into forging the on-going intersection and dissociation of two regimes of science and technology governance. These regimes are on the one hand, the containment and safety of genetic manipulation experiments, and on the other, arms control and biological disarmament.

The emergence of rDNA and public discussion about military applications

Techniques that enabled genetic material to be cut and spliced between organisms were discovered in the early 1970s. In 1971, Paul Berg's method, which snipped and reconnected viral nucleic acid, suggested an ability to insert foreign genetic material, using phages, into bacteria. Berg suspended his work as news of the experiment raised alarm. In 1972, Herbert Boyer and Stanley Cohen offered even more effective techniques, used to make the first genetically modified organism, an antibiotic-resistant *E. coli*. These methods, immediately patented, launched the new biotechnology industries. The scientific community, through gatherings such as the Asilomar conference near Monterey, California, held in 1975, urgently discussed rules of self-regulation under which genetic modification might be allowed to continue.

Over this period, the framing of genetic engineering as a hazard began to be whittled slowly down from a broad discussion of risks, including the application of this new technology to biowarfare, to a narrow set of issues around laboratory safety and non-human DNA.[5] Furthermore, Wright's seminal account of the governance of early rDNA technologies makes clear that the 1970s experiments did not start the debate. Science fictions involving some form of genetic or hereditary manipulation have a long heritage, and have formed a cultural reference point in numerous public discussions about the future of genetics and society.[6] And, the expressions 'genetic engineering' and 'euphenic engineering' were in circulation by 1965; a related term 'genetic surgery' was in use two years earlier.[7]

During the 1970s, wider debate about the potential benefits and harms from genetic engineering took place in a context of rising concern, with roots in the 1960s, over the social and environmental implications of new science and technology, alongside new worries about the safety of laboratories working with pathogenic micro-organisms or

[5] Wright, Susan (1994), *Molecular Politics: Developing American and British Regulatory Policy for Genetic Engineering, 1972-1982* (Chicago: University of Chicago Press); Bud, Robert (1993), *The Uses of Life: A History of Biotechnology* (Cambridge: Cambridge University Press).
[6] Turney, Jon (1998), *Frankenstein's Footsteps: Science, Genetics and Popular Culture* (New Haven: Yale University Press)
[7] Bud *op.cit.*; Wright *op cit.*

other hazardous material.[8] Between 1972 and 1974, a period covering the landmark experiments, Wright argues that 'no single discourse dominated public or private discussions of genetic engineering'.[9] Anxieties about such possibilities as new drug resistant bacteria, cancer-causing viruses, cellulose-degrading bacteria mixed freely with concerns over such matters as laboratory safety, health, the environment and biological warfare.

Turning to biological warfare, again an association with genetic engineering preceded the debates of the early 1970s. As early as 1962, military officials in the US hinted that they were interested in molecular biology[10] and, in more public arenas, popular science books such as the best-selling *Biological Time Bomb* contained a section entitled 'The Spectre of Gene Warfare'. Here, the author, British journalist Gordon Rattray-Taylor, discussed various possibilities for how 'the genetic engineers' could use genetics for malign purposes. It is notable that the discussion focused entirely on covert, and long-term, scenarios in which the genetic make-up of entire populations was weakened over time. Rattray-Taylor finished his litany of possibilities by suggesting:

> Or perhaps actual gene warfare. If viruses can be used to carry new genetic material into cells, perhaps one could tamper with the genes of another nation without their ever realizing the fact. History would simply record, as is often done in the past, that such-and-such a nation rose to power while certain other countries entered decline.[11]

In short, this 'eugenicist' notion of biological warfare was not the same notion as the deliberate engineering of pathogenic organisms that accompanied the first rDNA experiments.

---

[8] Agar, Jon (2012), *Science in the Twentieth Century and Beyond* (Cambridge: Polity Press).
[9] Wright *op.cit.* p135.
[10] Wright *op.cit.* p118.
[11] Rattray-Taylor, G (1968), *The Biological Time Bomb* (London: Thames & Hudson Ltd)

A few years later, in 1971, Joshua Lederberg warned, in an *American Scientist* article about the BWC negotiations, that recent developments in molecular biology 'offers us the prospect of engineering the design of viruses to exquisite detail', citing recent work on the chemical synthesis of viral DNA that had been achieved 'in a small laboratory on an annual research budget which is miniscule compared to weapons hardware'.[12] And, Bernard Dixon, in a 1973 *New Scientist* editorial on rDNA research outlined some of the potential benefits before adding 'other prospects are less welcome. DNA hybridisation must look an attractive proposition for biological warfare researchers (who are, of course, still about their business despite recent gestures towards biological disarmament)'.[13]

The Berg letter to *Science* and other leading journals, written in July 1974, which raised the alarm, had focussed more on particular types of experiment rather than particular applications or drivers of the research. The committee that formulated the letter had considered including a reference to military applications, but this was excised from an earlier draft. In a similar vein, at the press conference prior to the release of the Berg letter, attempts by journalists to raise the issue of biological warfare were side-stepped by scientist David Baltimore's claim that this issue would only need to be addressed if it became a reality. The deferral of particular types of experiment lasted until the Asilomar conference in February 1975, where once again, issues around biological warfare were explicitly excluded as beyond the scope of the discussion. [14]

Defining Genetic Engineering for Regulatory Purposes

In the UK, the Advisory Board for the Research Councils set up a working party of senior scientists under the Master of Clare College, Cambridge, Lord Ashby, to 'make an assessment of the potential benefits and potential hazards of techniques which allow the experimental manipulation of the genetic composition of micro-organisms'. The working party's report, published in January 1975, recorded that members were 'convinced that

[12] Lederberg, J (1971), 'Biological Warfare: A Global Threat', *American Scientist* Vol. 59, No. 2, March–April 1971: 195-7,
[13] Dixon, B (1973), 'Biological Research (1)', *New Scientist* 25 October, p236.
[14] Wright, S *op. cit.*

the hazards are less serious than some of us had first thought', and that 'provided precautions are taken', research, which might have extraordinary applications in medicine and agriculture, should not only be permitted, but encouraged.[15] While Ashby recommended voluntary safety controls, later that year a different committee, the Godber committee, recommended that a Dangerous Pathogens Advisory Group be established with statutory powers to regulate both genetic engineering and dangerous pathogens. Following Ashby and Godber, another working party, under Sir Robert Williams, proposed a draft code stipulating safety precautions, including a statement that 'no genetic manipulation experiment should be undertaken in containment conditions less stringent than those used for work with common pathogens'.[16] The committee also issued a tiered categorisation of four levels of increasingly rigorous physical containment that would be required for particular types of genetic experiment. One consequence of this categorisation was that it created scarcity - the MRE was one place where category 4 experiments with dangerous pathogens could take place. We will explore the significance of this observation for the governance of MRE later in the chapter. Finally, a Genetic Manipulation Advisory Group (GMAG) was established to advise further on appropriate precautions.

When the scientific advisory board to the MRE, of which Williams was a member, discussed the working party they noted that 'no work at MRE had been carried out or was being contemplated, involving genetic engineering experiments'. (The wording here was weaselly: genetic engineering *had* been contemplated at MRE but not started.[17]) Williams also reported that allocating experiments to appropriate containment categories was a major problem for his working party. The committee did, nevertheless, recognise that with MRE's high level containment facilities there was commercial potential. Professor

[15] *Report of the Working Party on the Experimental Manipulation of the Genetic Composition of Micro-organisms* (Ashby report), Cmnd. 5880, London: HMSO, January 1975.
[16] *Report of the Working Party on the Practice of Genetic Manipulation* (Williams report), Cmnd. 6600, Lonon: HMSO, August 1976.
[17] 'It is proposed that research on the applied genetics of micro-organisms of commercial interest [specifically antibiotic-producing fungi] should be expanded at MRE and, in particular, extended to an analysis of the benefits achievable by genetic recombination'. TNA DEFE 10/861. S. Jackson, 'DSAC. BRAB. CPAC. Improvement of antibiotics-producing strains of fungi via genetic recombination', 2 March 1972.

Mark H. Richmond on the committee proposed that: 'they should perhaps develop the capability to carry out this type of work, particularly since industrial firms were showing interest but usually had only a requirement for a single type of experiment. However , he recognised the possibility of misrepresentation of any MRE research'.[18]

These interventions therefore made genetic engineering a regulatory issue. However, effective and clear regulation needed an agreed, workable definition of its subject, "genetic manipulation". Under the Health and Safety at Work Act, this regulation fell under the purview of the Health and Safety Executive (HSE). On 25 August 1976, the Health and Safety Commission proposed in a consultative document that 'No person shall carry out any activity intended, or likely to alter, the genetic constitution of any micro-organism' without informing HSE.[19] This definition of genetic manipulation immediately had scientists up in arms. Professor J.M. Thoday, head of Cambridge University's department of genetics, and president of the Genetical Society, complained that the definition was 'so broad as to include a vast range of activities most of them harmless and many of them beneficial'.[20] He provided a long list to prove his point. A fierce exchange of views, between Michael Ashburner, a member of Thoday's department, and the HSE, appeared in *Nature*.[21] Three Glasgow professors wrote directly concerning the HSE's 'sweeping and restrictive regulations' to the Secretary of State for Education and Science, Shirley Williams.[22] With complaints reaching the ears of ministers, John Ashworth, head of the CPRS, went into action. 'I had written to the Health & Safety Executive asking them not to be so stupid', he wrote to one angry scientist, 'but, alas, it was too late'.[23] Other interested bodies, including the SRC, MRC and MAFF swung behind Ashworth.

---

[18] TNA, DEFE 10/1123. Biological Research Advisory Board (BRAB), 2nd Meeting (23 January 1976).
[19] Health & Safety Commission, *Consultative Document: Compulsory Notification of Proposed Experiments in the Genetic Manipulation of Micro-organisms,* 25 August 1976.
[20] TNA CAB 184/284/2. Thoday to McDonald, 19 October 1976.
[21] Ashburner mocked the HSE, suggesting they had been influenced by the 'mutant monsters so vividly portrayed on television every Saturday evening on Dr Who'. 'An open letter to the Health and Safety Executive', Nature (4 November 1976) 264, pp. 2-3, followed by a reply from HSE's J.H. Locke, p. 3.
[22] TNA CAB 184/283, Subal-Sharpe, Williamson and Paul to Williams, 13 October 1976. This letter was widely cc-ed, including to Ashworth.
[23] TNA CAB 184/284/2, Ashworth to Williamson, 25 October 1976.

Ashworth now took the lead in negotiating definitions of "genetic modification" in the UK. In November 1976 he suggested the rule 'No person shall carry out any activity intended to transfer or likely to transfer genetic information into an organism in a way that circumvents the natural species barrier to such transfer…', running successive drafts, via the HSE and directly, past an "old boy-net" of senior scientists.[24] Agricultural scientists objected, for example, to the above wording because it would cover and limit basic techniques, such as the use of colchicine to double chromosome numbers.[25] Ashworth's next rule was run past Oxford biochemical geneticist Walter Bodmer.[26] In summary, in late 1976, John Ashworth was at the centre of negotiations over the regulatory meaning of "genetic manipulation". Simultaneously, he was centrally involved in whether the Microbiological Research Establishment should be saved from closure because it could exploit genetic engineering techniques, if they could be named as such. Whether intentional or not, the new definition of genetic modification, into which Ashworth intervened, was wide enough to be congruent with the campaign to save the MRE, crucially, once it had been dissociated from the military.

The Microbiological Research Establishment: Close or Move?

Although institutions for research into biological warfare had existed at the Porton site since 1940, the MRE had been established in 1957 with a primary military objective to define and assess the possibilities of offensive use of biological warfare and to devise defences against such possibilities.[27] Over two decades its research programme had diversified, and included not only defence work, but also fundamental microbiological research and research with commercial ties to industry. Built at Porton Down, next to the

[24] TNA CAB 184/283, Ashworth to Williamson, 27 November 1976, stated that the HSE were 'anxious, as indeed am I, to avoid the fiasco of their first attempt [at regulation] and I promised them that I would try out, on a strictly confidential "old boy-net" basis, various thoughts'. Riley at Cambridge was another member of this network.
[25] TNA CAB 184/284/2. Henderson to Ashworth, 10 December 1976.
[26] TNA CAB 184/284/2. Ashworth to Bodmer, 14 December 1976. 'What do you think of the following definition'? asked Ashworth, 'No person shall carry out any activity which, by using biochemical manipulation of extra-cellular nucleic acids, is intended, or likely to: (a) insert genetic information into organisms; (b) circumvent the natural barriers to such insertion, and (c) propagates this information'.
[27] Balmer, B (2001), *Britain and Biological Warfare: Expert Advice and Science Policy, 1935-65* (Basingstoke: Palgrave). The UK abandoned its offensive BW programme in the mid-1950s.

Chemical Defence Establishment, by 1976 the MRE employed 105 scientific and professional staff, 190 industrial employees, excluding support staff. The main building had three floors, two of which housed 185 laboratories, each equipped with filtered ventilation and capable of disinfection. In addition MRE possessed an animal wing of 36 laboratory modules ('for work with pathogenic microorganisms [with]…provision for separate handling of clean and infected animals and for sterilization of all effluent'), an engineering workshop, and, one mile distant, a microbial products section with large culture vessels geared for mass production.[28] Finally, a vaccine production unit, two miles distant, had been converted from an old animal isolation facility. MRE formally worked under the Procurement Executive of the Ministry of Defence. MRE's annual expenditure ran at £2.5 million, nearly three-quarters of which fell on the defence budget. However, asked to locate cuts in the stringent economy of the mid-1970s, the MoD announced that it wanted to withdraw its sponsorship. The options were either for MRE to close, or to find a new home and perhaps new roles.

Defence cuts of £3 billion were agreed by Cabinet in December 1975. In part fulfilment of these cuts, the MoD 'decided that the defence need for the MRE at Porton was now so reduced that … it could be closed down', with funding ceasing from April 1978.[29] The acting chief scientific adviser, Robert Press, set out the repercussions in a report to the Cabinet Secretary, John Hunt, in June 1976.[30] Closure was 'foreseeable, indeed inevitable, unless additional civil support is forthcoming'. Departmental interest – on the Rothschild customer-contractor principle – may not alone justify the 'continued existence of a national centre of excellence which provides unique facilities and offers services which are likely to be increasingly required'. Press found 'significant potential in commercial terms'.[31] He also, in the full accompanying report, noted that the 'facilities [were] readily adaptable to "genetic engineering"', indeed might be described as an 'ideal

[28] TNA CAB 184/283. 'The Microbiological Research Establishment, Porton Down. A note by the Ministry of Defence', undated (1976).
[29] TNA PREM 16/2228, Hunt (Cabinet Secretary) to Prime Minister, 18 November 1976.
[30] TNA CAB 184/285, Press to Hunt, 30 June 1976, enclosing 'Future of the Microbioloical Research Establishment. Note by Chairman of an Interdepartmental Group', 30 June 1976.
[31] The predicament of MRE was recognised as a case where the Rothschild approach, championed during his leadership of the CPRS, endangered laboratories that were forced to contract, through 'what the trade calls sociology of organisations'. See TNA CAB 184/285, Ross to Jones, 27 September 1976.

site for all such work … [Such] a solution could be expected to be acceptable to the general public'.[32] So, if MRE was to survive it must chase greater commercial ties, but there was also a hint that the establishment might find a new biotechnological role.

In the summer of 1976, Press was retired and John Ashworth, as chief scientist at the CPRS, took over his responsibilities. What is striking is that Ashworth, over the following year, built a case for rescuing MRE based on both of Press's suggestions – pursuing commercial contracts and playing up the suitability of the facilities for the exciting new "genetic engineering" at the same time as negotiating a relatively relaxed definition of the latter.

MRE had always had a commercial arm, producing enzymes, vaccines and marketable substances such as asparaginase.[33] But now it was asked to push products harder. A press release of the time, for example, is invitingly headed 'We sell bacteria by the kilogram'.[34] In July 1976, Sir Kenneth Berrill, head of the CPRS, suggested testing more widely the commercial potential of MRE's research, starting with what he called 'the ethical drug companies'. In fact, the CPRS contacted at least twenty-eight companies, not only Berrill's suggested 'ethical' exemplars, Boots and Glaxo.[35] Generally, with a few exceptions, companies either replied that they could conduct any necessary research in-house, or offered relatively small levels of contracted research. Nevertheless, one feature that did excite interest was the high-containment facilities – always necessary for dangerous pathogens, but also, now, likely to be necessary for riskier genetic engineering - at MRE. Alfred Spinks of ICI, for example, wrote:

> we have defined some areas where MRE has facilities that we lack: the most significant of these is probably the availability of specialist containment facilities at the level of category 4 of the Williams Committee Report. We have a sizable

[32] Ibid, p. 3 and p. 20.
[33] TNA CAB 184/284/1, Harris, 'The industrial context of MRE', 22 October 1976, describes the commercial work in some detail, naming firms and substances.
[34] TNA CAB 184/283. Press release, 14 September 1976.
[35] TNA CAB 184/283 contains a list of companies, contacts and much of the subsequent correspondence.

> molecular genetics project… [Our category 3 research] is mainly concerned with the transfer of DNA from bacteria to bacteria … but any work that we might wish to do with human genes would probably need to be contracted to Porton, initially.[36]

Likewise the European Molecular Biology Organisation (EMBO) was also sounded out about placing contracts with MRE. But the stumbling block here was the perceived military orientation of Porton. John Kendrew, the eminent molecular biologist and EMBO's director, wrote that 'as soon as the Defence connection is ended he would be in a position to place EMBO… contracts' with MRE.[37] There would be no European sponsorship of Porton research, including perhaps genetic engineering, *before* de-coupling it from its military association.

The second feature of Ashworth's strategy was to amplify MRE's capacity for genetic engineering.[38] Genetic engineering had only been a passing reference in Press's report. This emphasis came as a ministerial clash over the MRE's future reached crisis point. David Owen, minister for health, had dropped by MRE, unexpectedly, in late July 1976, and pronounced himself impressed by the facilities.[39] In September 1976, William Rodgers, minister of defence, loudly complained in Cabinet about the dragging of feet and demanded swift implementation of cuts. The issue was punted to the Science and Technology ministerial (STM) committee, a rarely used body where ministerial fights

[36] TNA CAB 184/283, Spinks to Berrill, 22 December 1976. Category IV facilities were nearing completion when GMAG visited in May 1978. 'GMAG visits Porton', *New Scientist*, 25 May 1978.
[37] TNA CAB 184/283, Ashworth to Gibson, 25 November 1976.
[38] There is evidence that some attention was being paid to this area at the establishment, a confidential 1976 review of defence work at the MRE noted that expert advice on bacterial genetics was part of the establishment's research programme, adding that 'the possibilities for modifying potential agents by genetic procedures require continuous appraisal in relation to the rapid development of microbial genetics. There is potential spin-off in the 'breeding' of new microbes which produce substances valuable to medicine or commerce'. TNA DEFE 55/427 MRE Programme Review (75-76) Major Field 18, Biological Defence (April 1976). 'Modifying potential agents by genetic procedures' may not mean rDNA.it could also mean induced mutation.
[39] TNA CAB 184/285, Newman, 'Visit of Dr D Owen…', 27 July 1976. The immediate context was a proposal to transfer the staff of the North London-based National Institute for Biological Standards and Control to the remote MRE Porton. He would also have gauged staff concerns about rumours of closure.

could be played out. Against this background Ashworth composed the first of a series of influential, and to some extent controversial, documents on the future of MRE:

> the impact of "genetic manipulations" on the status of Porton has been seriously underestimated… The moratorium on these experiments focussed attention, inevitably, on the possible dangers – what has not been sufficiently publicised is the tremendous excitement that there is amongst the academic research workers on the one hand and the larger chemically/microbiologically orientated industries on the other. The benefits of this work will be immense and, as things go, quick – say within 5-10 years.[40]

Porton could be the commercial supplier (perhaps 'world supplier') of microbial enzymes necessary for genetic engineering. The growth of genetically engineered microbes and the testing of genetically engineered organisms and agents (such as viruses for 'pest control') would require level 4 – Porton – containment. 'By the greatest of good fortune we have one of the two centres which are recognised, world-wide, as "safe" for microbiological work', Ashworth concluded, 'To close such a centre just at the moment when there is going to be an immense increase in demand for such facilities is too short-sighted'.

While some in Whitehall were more sceptical (perhaps more realistic), including the departing Dr Press, the CPRS notes for the ministerial meeting urged not closing MRE until the CPRS fully assessed the industrial consequences of genetic engineering, alongside the secure financing of the station.[41] On the 13 October, the ministerial committee on science and technology agreed this line. The stakes were still high. In November, the Prime Minister, James Callaghan, sought reassurance, after the minister of defence complained that he was not receiving the support of colleagues in the search for cuts, that the MRE situation would be resolved soon.[42]

---

[40] TNA CAB 184/285. Note by Ashworth, 8 September 1976. Handwritten draft in TNA CAB 184/283.
[41] TNA CAB 184/283, 'Cabinet. Ministerial Committee on Science and Technology. Future of Microbiological Research Establishment, Porton Down. Note by CPRS', 8 October 1976. Drafts in TNA CAB 184/285.
[42] TNA CAB 184/283, Hunt to Prime Minister, 18 November 1976.

The outcome, largely shaped by Ashworth at the CPRS, was acceptance, agreed in January 1978, for a slimmed down MRE, more focussed on commercial services, available for genetic engineering work, and dissociated from the military. As part of this solution, the Ministry of Defence had announced, in December, that the small number of military microbiology staff would be transferred to the Chemical Defence Establishment, also, of course, at Porton Down.[43] After flirting briefly with the notion of HSE playing the role (precisely in the month – October 1976 – when Ashworth was also negotiating definitions of genetic engineering), the recommendation made was for the DHSS to be the sponsoring department and the Public Health Laboratory Service (PHLS) to manage the MRE.[44] While some genetic engineering contracts did come to MRE – the Wellcome Research Laboratories invested £50,000 in 1977 – it was never a major programme.[45] De-coupling from the military was an essential prerequisite for this investment, indeed the MRC, which had been tasked with reviewing the civil research capability of the MRE, made it a condition that any 'connection with defence work would have to be clearly and decisively severed' to head off largely foreign fears of application to biological warfare.[46] The MRC continued: 'There is strong feeling in, for example the United States and in Eastern Europe, that these new techniques of genetic manipulation have potential for application to biological warfare'. Supporting evidence for this claim is the reported statement that the European Commission DGXII considered a '*civilian* Porton Down' to be a 'prime contractor' for genetic engineering funds. But the importance of this divorce was more symbolic – the excitement and high expectations for biotechnology had been cashed in to secure a future for MRE.

---

[43] The Institute of Biology, in a press release, 8 December 1976, noted that this demilitarisation created the 'opportunity to establish a centre for important work … developing biochemical engineering and in genetic manipulation'.

[44] TNA CAB 184/331. 'Future of the Microbiological Research Establishment, Porton Down. A report by the CPRS', 20 January 1977.

[45] TNA CAB 184/332. GEN 61 Cabinet sub-committee, 1977, lists new commercial orders, including £230,000 for aspariginase to France, a "Porton cabinet" for Nigeria (potentially £426,500), £80,000 microbial decontamination work for Seveso, amongst others, in addition to the Wellcome funds. The Wellcome's interest in MRE's high-security as well as potential genetic engineering is spelled out in TNA CAB 184/331, Vane to Berrill, 17 January 1977. The extraordinary background to the microbial ecology solution to the contamination at Seveso is described in Ashworth to Berrill, 12 January 1977.

[46] TNA CAB 184/333.MRC, draft report of the committee on the use of MRE Porton for civil research, September 1977. TNA CAB 184/331, Ashworth to Vickers, 12 July 1977.

The Biological Weapons Convention and the Threat from Genetic Engineering

Howard's letter to the FCO in 1978, which opened this chapter, was therefore written in the wake of these attempts to de-couple the MRE from biological warfare, and re-connect it with genetic engineering. With respect to the regulatory framing of the debate, the archive copy of Howard's letter in the FCO files has, handwritten on it, a note stating: 'we looked at genetic engineering as a possible MDW [Mass Destruction Weapon] in 1976, and came to the conclusion that existing safeguards in the UK on this type of research are reinforced by the finding of the Williams working party'.[47] It is interesting to note that the dismissal of the problem was not about whether or not genetic engineering could be applied for military purposes. Instead, there was first an appeal to the 1972 Biological Weapons Convention, which banned biological weapons and had entered into force in 1975, and the observation that, notwithstanding their novelty, genetically modified agents would still fall under its prohibitions. Second, officials placed their faith in existing UK regulations to either uncover or prevent work that was being undertaken with military use as a goal.

But, the response to Howard certainly did not represent the full range of opinion within the Ministries. Put rather more bluntly by one ACDRU official: 'the MoD's letter to Mr Dean [ACDRU] of 26 May and consequently our reply to Professor Howard were somewhat disingenuous… It is unwise to mislead the (informed) public in the way that the MoD has persuaded us to do'.[48] Such dissension rested on a lengthy desk office memorandum, titled 'Genetic Engineering (Recombinant DNA Technology): The Military Significance of the Threat', that had been prepared by Gradon Carter from the Defence Intelligence Staff's Directorate of Scientific Intelligence.[49] Classified as 'secret discreet', it opened with the caveat that the views expressed were those of the author and

[47] TNA, FCO 66/1228. Michael Howard to Christoper Mallaby (ACDD), 4 May 1978.
[48] TNA FCO 66/1228. Secret. PA Towle (ACRDU) to Mr Innes Hopkins (ACDD). Genetic Engineering and the Military Significance of the Threat (4 July 1978).
[49] Carter returned to Porton in 1979 and later became the official historian for the chemical and biological defence Establishments.

that it was intended as a rapid means to disseminate information.[50] Yet Carter wrote with some authority. He had worked at Porton Down since 1948 and joined the Ministry of Defence's Directorate of Scientific and Technical Intelligence in 1976.

Carter noted in his memorandum that, unless they had access to specialised expertise and equipment, there was little threat from terrorist groups using genetic modification. Likewise, he expressed scepticism about cancer-causing weapons, which would take too long to take effect for military purposes, and "ethnic weapons" designed to target specific populations. On the other hand, he was far less sceptical about the possibility of using genetic engineering to enhance the features of existing biological warfare agents, for example by making them grow faster or produce greater quantities of toxins. Carter suggested that the 'main advantage' of genetic engineering would be to insert genes from pathogens into common harmless organisms, making the cause of any illness difficult to identify. The effect would be to 'impede the selection of therapy and cause panic and disruption'. This said, Carter was also insistent that none of his assessment should imply that existing agents were ineffective. The memorandum finished with an outline of the paucity of intelligence information about the USSR, not only on genetic engineering but on biological weapons in general. The difference in the tenor of this memorandum and the message conveyed to the FCO and beyond suggests that the MoD were keen to play down the military significance of the new techniques.

FCO and MoD officials returned to the topic of genetic engineering early the following year, this time in relation to preparation for the first review conference of the Biological Weapons Convention (BWC), scheduled for 1980.[51] Part of this preparation involved some discussion about a meeting held at MIT in 1977 to discuss the applicability of the BWC to rDNA technology.[52] The group considered whether or not genetically modified

[50] TNA FCO 66/1228. Ministry of Defence, Defence Intelligence Staff, Directorate of Scientific and Technical Intelligence. Genetic Engineering (Recombinant DNA Technology): The Military Significance of the Threat. Desk Officer Memorandum prepared by Mr GB Carter (9 May 1978).
[51] Five yearly review conferences after the date that treaty entered into force (1975) were scheduled into the treaty regime under Article XII of the BWC.
[52] The meeting took place on 9 August 1977 under the auspices of the Program in Science and Technology for International Security, Department of Physics, MIT. It was attended by David Baltimore, Bernard T

organisms were beyond the scope of the BWC, and whether or not rDNA technology could produce more controllable and predictable weapons. The Convention, they concluded, would cover putative novel organisms. As to the likelihood of such organisms being manufactured, they argued that:

> Although new pathogens and toxins might be created using recombinant DNA techniques, there is little reason to suspect *a priori* that they will differ in a militarily significant way from natural pathogens and toxins. New natural pathogens are constantly being discovered in remote parts of the world, these discoveries do not appear to have significantly altered capabilities or incentives for biological warfare.[53]

So, while creating new types of organism was possible, those at the meeting argued that 'operational specificity of effect is more difficult to achieve than clinical specificity'. In other words, even an augmented pathogen would still face a host of challenges shared with older biological agents, such as dispersal, survival, confinement to targets and so on. These challenges, the authors argued, meant there was little incentive in the near future for would-be bio-weaponeers to turn to genetic modification, Above all, under international law, their use would still be illegal and so 'would invite sanction and retaliation'. The covering memorandum, written to the MoD by Alan Bebbington, a scientist from the Chemical Defence Establishment (CDE) at Porton, noted that the conclusions of the meeting 'correspond precisely with our earlier advice to you' (although they did not correspond to Carter's assessment of dangers).

The same position was rehearsed at a meeting, held to discuss scientific developments relevant to the BWC, between MoD and FCO representatives in May 1979. Here, the

---

Field, Maurice Fox, Walter Gilbert, Matthew Meselson, Alexander Rich, and Kosta Tipis. A version of their report later appeared in the November 1978 *Bulletin of the Atomic Scientists*.

[53] TNA FCO 66/1438. Report attached to: To Gordon S Mungeam, DS11 MOD from Dr Alan Bebbington, Deputy Director (chemistry) procurement executive, MOD, CDEE. Biological Weapons Convention. 9 February 1979.

MoD representatives argued that the drivers of genetic engineering were almost anyone but the military, such that flagging the problem of military applications was:

> … in danger of giving the distorted impression that new types of BW agents and techniques had recently emerged which had given new impetus or significance to this type of warfare. This was not so and the changes and developments that had taken place were of significance largely because of the exposure given to them by the press… Pressure such as pure science, medicine and commerce was spurring research in these fields and the fact that some areas may have military significance does not necessarily mean that they would be attractive military options.[54]

This line of thinking, including the suggestion that in the public domain possibilities had been conflated with actualities, fed into discussions with US officials about putting together a background paper on new scientific and technological developments relevant to the convention. The paper was to be authored by representatives from several nations, but Dr Robert Mikulak of the US Arms Control and Disarmament Agency (ACDA) had already shared with the UK delegation to the UN Committee on Disarmament his early drafts on what he wanted the section on rDNA technology to look like. In the draft, he outlined the by now familiar notion that existing organisms could be modified to enhance their suitability as biological warfare agents. He also sounded a note of caution, warning that organisms could not be 'engineered to order' and that 'engineering a radically different organism would represent a truly Herculean undertaking'.[55] The draft also contained the caveats that modified organisms might not differ in militarily significant ways from unmodified pathogens, and that they 'would not be fundamentally different from the organisms and toxins which were known in 1971', in other words, prior to the 1972 Biological Weapons Convention.

[54] TNA FCO 66/1438 BW Review Conference Scientific Developments. PJ Robinson (ACRDU). 9 May 1979.
[55] TNA FCO 66/1438. Draft R. Mikulak (2 June 1979). Recombinant DNA Techniques.

When UK experts were asked to comment on Mikulak's draft paper, there was some disagreement. The general view at Porton was that Mikulak had underestimated the potential of genetic engineering, even though 'the question of who would want to do this is another matter'.[56] Moreoever, Bebbington challenged the proposal that modified pathogens would fail to differ from natural pathogens, adding 'this is precisely the reason for world-wide concern about recombinant DNA'.[57] With echoes of the discussion prompted by Howard the previous year, it was noted that 'Porton feels there should be reference to the great public concern about the potential safety hazards of genetic manipulation as demonstrated by the moratorium agreed several years ago which will tend to inhibit research'. This reassurance was intended as a 'counter-balance' to the potential military applications of genetic engineering.

These disagreements did not alter the overall consensus that whatever novelty these organisms might or might not possess, they were still covered by the BWC. Although not mentioned explicitly in any documentation, the rationale underpinning this conclusion was the General Purpose Criterion enshrined in the first article of the BWC. This states that *all* micro-organisms are outlawed by the treaty *unless* they can be justified for peaceful purposes. In other words, the illegality of any State possessing micro-organisms depends on that State's intent to cause harm rather than the nature or identity of the living organism itself. Along these lines, Porton had already advised the FCO and MoD that 'the BW Convention as it now stands covers all new agents and toxins produced by new biological agents including those (i.e. biological agents) which have been derived by genetic engineering techniques'.[58]

This perspective was endorsed at a meeting to consider the scope of the background paper on 20 July 1979, where everyone in attendance agreed that rDNA techniques were the most important issue to consider, but also that the 'aim of the paper will be largely descriptive but would aim to show implicitly that any recent technological or scientific

[56] TNAFCO66/1438. UK Comments on the Mikulak Draft on Recombinant DNA Techniques (n.d.)
[57] TNAFCO66/1438. UK Comments on the Mikulak Draft on Recombinant DNA Techniques (n.d.)
[58] TNA FCO 66/1438. Miss L. Ress DS11, MOD to GC Ford ACDD, FCO. BW Convention Conference. 30 May 1979.

techniques do not undermine the Convention'.[59] And by the end of the year, the USSR, USA and UK as the depositary nations for the BWC had met in New York where, according to Gradon Carter 'there was complete agreement that no new scientific developments were unembraced by the Convention and that no new amendments were needed'.[60] And, indeed, this was the general stance eventually adopted at the first review conference when it took place in 1980. Although this was a temporary position, as concerns about the military threat from genetic engineering grew during the 1980s. That said, even as late as 1984, US Nobel laureate Joshua Lederberg echoed the line that had prevailed until the first review conference when he wrote that, in the near-term: 'The added input of biotechnology is small compared with the revolution in politics and warfare that would follow the introduction… of BW whether with existing or actual applications'.[61]

Conclusions

We started this research because we were curious about whether there was a military interest in genetic engineering, perhaps even one that led to changes in defence research carried out in the UK. We found no evidence that the UK in the 1970s exploited genetic engineering techniques as a source of new weapons or defences. However, we have shown that the discovery of rDNA techniques, the powerful tools of the new genetic engineering, led to several significant acts of dissociation that reconfigured the landscape of possibilities and conjectures around this new technology. The two regulatory regimes of arms control and laboratory safety were brought into and out of alignment by the activities of scientists, civil servants and a wider public. We have shown three such acts. First, in order for MRE to be saved and reoriented towards civil, commercial research, it had to be divorced from direct military patronage. In this respect, concern for economic competitiveness shaped the governance of both genetic engineering and biological

[59] TNA FCO66/1438. PMW Francis (UK Delegation to the Conference of the Committee on Disarmament, Geneva) to GC Ford (ACDD, FCO) Biological Weapons Convention Review Conference: Depositary Paper on New Scientific and Technological Developments (23 July 1979).
[60] TNA FCO66/1438. Gradon Carter to GC Ford. 3 December 1979.
[61] US National Library of Medicine. Lederberg Archive. Comment to DSB on the significance of advanced biotechnology to CW and BW. 10 October 1984. http://profiles.nlm.nih.gov/ps/access/BBGLZL.pdf

weapons, configuring them for the time being as separate issues. Second, insofar as the MoD and FCO reaction to Michael Howard's letter can be taken as an indicator of a wider stance, the military potential of genetic engineering was publically denied. Finally, despite anxieties expressed both within and outside Whitehall about the potential use of genetic engineering in biological warfare, such concerns were dampened by invoking the provisions of the Biological Weapons Convention.