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# Pre-empting Emergence

## The Biological Turn in the War on Terror

*Melinda Cooper*

IN 2004, three years after the sporadic and still unresolved anthrax attacks that followed September 11, the Bush administration became the first in US history to implement a national defence strategy against biological threats. In the same year, US Congress also approved the largest-ever funding project for biodefence research, to be carried out over the following decade. The legislation, going under the name of Project Bioshield, authorized \$5.6 billion for the purchase and stockpiling of vaccines and drugs against bioterrorist threats, granted the government new authority to initiate research programmes and special dispensation to override drug regulations in the face of a national emergency. At the same time, a more secretive initiative was under way to establish four research centres for the testing of biological weapons defences. The US, it seems, was preparing itself for an attack of epidemic proportions. But what exactly was the US arming itself against? In his public addresses on the topic, George Bush seemed unsure whether the deadliest threat would be more likely to emanate from a deliberate bioterrorist attack or from any one of the resurgent or drug-resistant infectious diseases that now regularly afflict urban hospitals. Official documents declared that infectious disease outbreak and bioterrorism should be treated as identical threats, in the absence of any sure means of distinguishing the two. The confusion was further reflected in the allocation of resources. Much of the new funding for biodefence went to institutions that had previously been engaged in public health and infectious disease research, while the ailing biotech start-ups of the genomics era were encouraged to reinvest their energies in the new arena of military applications. For US defence, it seems, the frontier between warfare and public health, microbial life and bioterrorism, had become strategically indifferent. To be effective at all, the war on terror

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would need to arm itself against the generic microbiological threat, from wherever it might emerge.

What are we to make of the ‘biological turn’ in recent US defence policy? And how should we respond to a security agenda that conflates public health, biomedicine and war under the sign of the emerging threat? This article argues that growing interest in biological weapons is more than merely tactical and goes hand in hand with a strategic redefinition of the tenets of US defence, one in which the doctrine of mutual deterrence is replaced by full-spectrum dominance, counter-proliferation and pre-emption. As the US moves to integrate biological weapons into its defence arsenal, it is the very nature of warfare, security and the military threat that is being rethought, at the interface between public health and security, the biotech industry and military research. In such a context, where the boundaries between biomedicine and war are increasingly and quite deliberately blurred, it no longer makes sense to restrict our critical horizons to the military sphere as it is traditionally defined. This article will seek to unravel the diverse threads leading to the biological turn of the war on terror, from the recent evolution of infectious disease research to the volatile fortunes of the biotech industry and the internal transformations of US defence. I will be concerned not only with the growing institutional alliances between biomedicine and the military, but, more importantly, with the conceptual exchanges that have taken place between the two domains over the past few decades. In particular, I will be looking at the complex history of notions such as biological emergence, resistance and pre-emption, and their crossovers into US defence discourse. Only by exploring these exchanges, I suggest, is it possible to understand and respond to the full spectrum of interventions currently being explored in the name of the war on terror.

### **Germs at War**

One of the most eloquent legacies of 20th-century public health can be found in the idea that some kind of final ‘truce’ would at some point be reached between ourselves and infectious disease. Ever since the development of germ theory in the late 19th century, modern biology had imagined humans and microbes to be engaged in a merciless war; a struggle for survival from which only one of us would emerge victorious. Only after the Second World War, however, would public health institutions have the confidence to declare that the war was almost over; that infectious disease would be conquered once and for all, sequestered, quarantined, eliminated even, first in the ‘developed’ world and later in the ‘developing’ world, through the classic public health strategies of quarantine and immunization as well as the massive use of the new generation of antibiotics and vaccines. As late as 1978, the United Nations (UN) issued an accord predicting that even the poorest of nations would undergo an ‘epidemiological transition’ before the year 2000, transporting us into a new era in which the chronic diseases of old age would prevail over infection.

Ironically, this was precisely the period in which infectious disease made a dramatic come-back. At a time when public health expenditure was being heavily cut back in the name of welfare-reduction and microbiology had long been relegated to the margins of the life sciences, new infectious diseases were on the rise again while old diseases were re-emerging in new, more virulent forms. This, at any rate, was the view from the richest countries, which had long considered themselves immune from the plagues still raging ‘over there’. In the year 2000 the World Health Organization (WHO) officially announced that the truce was over: the return of infectious diseases worldwide represented a deadlier threat than war; we had been caught off guard; the microbes had been preparing an underground counter-resistance just when we thought we were finally safe (WHO, 2000). The militaristic language of classical germ theory made a spectacular return to public health discourse, but this was warfare of a different kind, one that unsettled the reassuring dogmas of the quarantine state. Pathogenic micro-organisms were proliferating from within and without; friends were turning against us; the immunological self was misrecognizing itself (auto-immune disease); our most promising cures (antibiotics) were provoking counter-resistances at an alarming rate; the apparent triumph of biomedicine was generating its own blowback effects (due, for example, to the overuse of antibiotics in the ‘developed’ world and their under-use in the ‘developing’ world); diseases that had long been considered chronic or genetic were suddenly revealing an unsuspected link to latent infections (Paul Ewald, 2002); new pathogens were crossing borders that were supposed to be impenetrable, including frontiers between species (Mad Cow and Creutzfeldt-Jakob’s disease); contagions were hitching a ride on the vectors of free trade (the deregulated blood market that enabled the contaminated-blood scandals to happen; the complex cross-border movement of food implicated in Mad Cow disease), perhaps even on the mobile vectors involved in the production of transgenic crops and therapeutics.

The same era witnessed something of a conceptual revolution in microbiology.

The new microbiology tells us that our relation to microbial life is one of inescapable co-evolution. We are literally born of ancient alliances between bacteria and our own cells; microbes are inside us, in our history, but are also implicated in the continuing evolution of all the forms of life on earth. Biologists are discovering the biospheric dimensions of microbial life (the notion of a common evolution linking plants, animals and microbes with the geology of the earth and the composition of the atmosphere) and claiming that emerging infectious diseases are indissolubly linked with climate change. In the words of Margulis and Sagan, the environment ‘is regulated by life for life’ (1997: 94) and the common vector linking all these life forms and responsible for maintaining a breathable atmosphere is provided by bacterial evolution. At the same time, recent research is throwing new light on the specific processes of bacterial evolution, suggesting that bacteria evolve through highly accelerated processes of horizontal

communication rather than chance mutation and selective pressures. It has been known, since the late 1950s, that bacteria are able to exchange sequences of DNA, often between unrelated species, through a general process of horizontal transfection.<sup>1</sup> Only recently has the full extent of this mobility become apparent: under certain conditions, mobile sequences of bacterial DNA jump across species, genera and kingdoms; once integrated into a new genome, these sequences are able to mutate and recombine; the bacterial genome itself is highly fluid, capable of mutating under stress and accelerating its own mutation rate (Ho, 1999: 168–200). While many leading infectious disease specialists continue to see microbial resistance as a form of (highly accelerated) Darwinian evolution (Lederberg et al., 1992), a growing body of new research is suggesting that bacteria don't even have to wait around for random mutation to confer resistance; they can share it amongst themselves. The new microbiology is discovering that, for bacteria, resistance is literally contagious (Ho, 1999: 178–9; Levy and Novick, 1986).

These new insights into microbial resistance have important ramifications for our understanding of genetic engineering technologies. What molecular biology shared in common with the political philosophy of 20th-century public health was the belief that the future evolution of life could be predicted, controlled and (at worst) reverse-engineered on the basis of localized interventions. It is this shared utopia that is coming under increasing scrutiny however, as recent research points to the possible links between the re-emergence of infectious disease and the use of recombinant DNA technologies. The production of ‘transgenic’ life forms, after all, hitches a ride on the same vectors of communication that are responsible for resistance – viruses, transposons (mobile genetic elements) and plasmids (extra-chromosomal genetic elements) – while these vectors are routinely modified to render them even more prone to circulate and recombine. As the full extent of horizontal transfer comes to light, biologists are beginning to suggest that we cannot mobilize these vectors of communication without provoking and even accelerating the emergence of all kinds of counter-resistance.<sup>2</sup>

### **Emergence Re-emerging**

The microbiologist René Dubos was the first to coin the term ‘emergence’ as a way of describing the temporality of biological evolution. By ‘emergence’, he understood not the gradual accumulation of local mutations, but the relentless, sometimes catastrophic upheaval of entire co-evolving ecologies; sudden field transitions that could never be predicted in linear terms from a single mutation (Dubos, 1987 [1959]: 33). Writing at a time when the ‘health transition’ was official public health doctrine, Dubos dismisses the idea that infectious disease could ever be eliminated, let alone stabilized. There can be no final equilibrium in the battle against germs, he argues, because there is no assignable limit to the co-evolution of resistance and counter-proliferation, emergence and counter-emergence. In

Dubos's work, the concept of microbial 'resistance' is divested of its association with the pathological: resistance is merely another word for emergence, and there is no end to it; its future evolution is unforeseeable from within the present. Dubos is scathing in his criticism of the strategic vision of mid-20th-century public health, but what he offers in response is not so much a pacifist manifesto, as an alternative vision of warfare and a counter-philosophy of disease. If we are at war, Dubos contends, it is against an enemy that cannot be sequestered; a threat that is not containable within the boundaries of species life; is both inside and out; necessary for our survival yet prone to turn against us; and capable of reinventing itself in response to our 'cures'. Dubos's theatre of war presupposes a co-implication of human, bacterial and viral existence; a mutual immersion in the conditions of each other's evolution. It is inevitable – he argues – that our most violent efforts to secure ourselves against contagion will be met with counter-resistances of all kinds. Microbial life will 'strike back' and yet we can never be sure when and how it will happen: 'at some unpredictable time and in some unforeseeable manner nature will strike back' (1987: 267).

If we are to follow Dubos, the relentless nature of coevolving emergence irresistibly engages us, despite ourselves, in a form of permanent warfare, a guerrilla counter-resistance without foreseeable end, against a threat whose precise 'when' and 'how' we can only speculate on. Such an elusive vision of warfare might seem to preclude any effective strategic response – but Dubos is precisely interested in elaborating a philosophy of war which would be up to the challenge. If humans are to survive the inevitable 'counter-strike' from microbial life, he argues, we need to prepare for the unexpected; learn to counter the unknowable, the virtual, the emergent. The new science of life, he writes, must cultivate an 'alertness to the advent of the unpredictable'; a responsiveness to the threat that is merely felt or apprehended (1987: 271). We must become capable, in other words, of responding to the emergent, long before it has actualized in a form we can locate or even recognize. Life is a gamble, Dubos contends – a kind of speculative warfare (1987: 267). And war, in this view, is necessarily pre-emptive, as much an attempt to resist the counter-contagion as a creative reinvention of the conditions of human existence, beyond whatever actual limits we might have adapted to in the present.

At the time he was writing – the 1950s – Dubos could not have been more at odds with the reigning public health orthodoxy. Three decades later, however, his counter-philosophy of disease seems to have been taken up into the mainstream of microbiology. The continuing evolution of infectious disease is inevitable, microbiologists now tell us. There can be no final conquest of infectious disease, although nothing will allow us to predict when and where the next pandemic will emerge:

It is unrealistic to expect that humankind will win a complete victory over the multitude of existing microbial diseases, or over those that will emerge in the future. . . . Although it is impossible to predict their individual

emergence in time and place, we can be confident that new microbial diseases will emerge. (Lederberg et al., 1992: 32)

The new public health discourse calls our attention to *emerging* and *re-emerging* infectious disease; old pathogens that have resurfaced in new, more virulent or resistant forms; existing pathogens that have infected humans for the first time; or entirely new creations. It defines infectious disease as *emerging* and *emergent* – not incidentally, but *in essence*. What public health policy needs to mobilize against, the new microbiology argues, is no longer the singular disease with its specific aetiology, but *emergence itself*, whatever form it takes, whenever and wherever it happens to actualize (Lederberg et al., 1992: 84).

More ambiguously, the new discourse on emerging infectious disease seems also to have struck a chord with US foreign policy and international relations theorists, who over the same period were busy at work enumerating the new and ‘emerging threats’ that would define the post-Cold War era of warfare. Under the banner of the new intelligence agenda, certain defence theorists (often with the uncritical support of NGOs and humanitarian organizations) were arguing that the scope of security should be extended beyond the conventional military sphere to include *life itself* (Johnson and Snyder, 2001: 215–18). What was at issue here was first of all the securitization of human life (hence the altogether strange concept of humanitarian warfare); but increasingly US defence discourse is wanting to push further and incorporate *the whole of life*, from the micro- to the ecosystemic level, within its strategic vision.<sup>3</sup> One of the most prominent advocates of the concept of microbiological security has long claimed that ‘emerging infectious disease . . . poses a clear threat to national security’ and that US defence should develop a common strategy for confronting both emerging and drug-resistant disease and bioterrorism (Chyba, 1998: 5). And in case this might seem to represent an extreme position, it is worth noting that in the year 2000, a CIA report classified emerging ‘global infectious disease’ as a non-conventional security threat comparable to the new terrorism (National Intelligence Council [NIC], 2000), while in 2002, US Congress passed a Bioterrorism Act outlining the same emergency response procedures for bioterrorist attacks and emerging infectious disease (US Congress, 2002). More recently, the Pentagon has published a report exhorting the US government not only to wake up to the impending threat of climate change (assumed now to be closely related to the resurgence of infectious disease) but to treat it as a national security threat (Schwartz and Randall, 2003).

The future evolution of life, it warned, would be defined by permanent warfare.

### **Biospheric Risk – Countering the Emergent**

In the course of the 1980s, a new understanding of risk turned up simultaneously in the language of insurance institutions, capital markets and environmental politics. This was the concept of the *catastrophe risk*.<sup>4</sup> In the

first place, the catastrophe event was discovered in the guise of the global environmental disaster. From nuclear winter, global warming and ozone depletion to emerging disease, food-borne, transgenic and biomedical epidemics, the ‘catastrophe’ risk has come to designate a technological accident of biospheric proportions, operating simultaneously at the microscopic and the pandemic level. What is at issue here, according to the historian François Ewald (1993), is a fundamentally new calculus of the accident. Unlike the punctual accident of classical risk theory, the catastrophe cannot be insured against. The changes it threatens to introduce are irreparable, ‘not only because their scale exceeds the capabilities of any indemnity-providing organization’ but also because their long-term effects ‘affect life and its reproduction’, life and its vectors of communication (1993: 223). Inscribing itself in the ecological conditions of life on earth, the catastrophe event is disturbingly both destructive and ‘creative’.

If the catastrophe event is often presented as something of a paradox of risk-management, it is because it confounds the traditional framework of rational decision-making. Classical risk theory presumes that we can predict the likelihood of a future event, at least in statistical terms. The longer our time-scale and the wider our field of vision, the more accurate our predictions will be. If we feel that we are unable to calculate the probability of an event, we can always wait until more information becomes available before making a decision. Prediction finds the possibility of prevention. At worst, classical risk theory reassures us that, if the accident does occur, we will have been able to insure against it. Catastrophe risk, on the other hand, denies us the luxury of preparation. When and if it happens, it will be by surprise, abruptly, and on a scale that overwhelms all efforts at damage control. What we are dealing with here is not so much the singular accident, as the accident amplified across a whole event-field, a phase transition that may emerge without warning, instantaneously and irreversibly transforming the conditions of life on earth. To make things worse, the nature of these events is such that we can never be sure how far gone we already are. Disaster is incubating. We may be on the verge without even realizing it. It may already be too late to slow down, reverse the process, restore some kind of (relative) equilibrium. If the catastrophe befalls us, it is from a future without chronological continuity with the past. Though we might suspect something is wrong with the world (look at those freaky weather patterns, those locust plagues, melting ice-caps and emerging pandemics), no mass of information will help us pin-point the precise when, where and how of the coming havoc. We can only speculate.

What we do know, however, is that if such an event were realized, its consequences would be catastrophic, irreversible, of incalculable cost. As the environmental risk theorist Stephen Haller puts it, ‘we cannot afford not to decide’, and yet catastrophe risk places us in the uncomfortable position of having to take drastic and immediate action in the face of an inescapably elusive, uncertain threat, decisions which may in turn generate their own incalculable dangers (2002: 93):

My concern is about the general problem of what to do in cases where we are asked to take action meant to avoid catastrophe before we have compelling evidence of the likelihood of the catastrophe. (Haller, 2002: xii)

We must face squarely the problem of making momentous decisions under uncertainty. (2002: 87)

It is here that François Ewald identifies the defining predicament of the neoliberal politics of security. The catastrophe event, he writes, confronts us with a danger we ‘can only imagine, suspect, presume or fear’; a danger we ‘can apprehend without being able to assess’ (2002: 286). In this sense, the new discourse of catastrophe risk establishes our affective relation to the future as the only available basis for decision-making, even while it recognizes the inherently speculative nature of this enterprise. What it provokes is not so much fear (of an identifiable threat) as a state of alertness, without foreseeable end. It exhorts us to respond to what we suspect without being able to discern; to prepare for the emergent, long before we can predict how and when it will be actualized; to counter the unknowable, before it is even realized. In short, the very concept of the catastrophe event seems to suggest that our only possible response to the emergent crisis (of whatever kind, biomedical, environmental, economic) is one of speculative *pre-emption*. Again, in the words of risk theorist Stephen Haller (writing, it should be noted, before the transformation of pre-emption into official US strategic doctrine):

. . . some global hazards might, in their very nature, be such that they cannot be prevented *unless pre-emptive action is taken immediately* – that is, before we have evidence sufficient to convince ourselves of the reality of the threat. Unless we act now on *uncertain claims*, *catastrophic* and *irreversible* results might unfold beyond human control. (2002: 14, my italics)

At this point it is important to distinguish between two postures of pre-emption, passive and active, which have begun to emerge in international politics. On the one hand, the so-called ‘precautionary principle’ represents a counter-active response to emergent catastrophe risk: in the face of an uncertain future, it advises us to halt all further development of a technology suspected of harbouring some kind of latent risk-factor. The biologist Mae-Wan Ho cautions that ‘[w]e may already be experiencing the prelude to a nightmare of uncontrollable, untreatable epidemics of infectious diseases’ and that on the basis of this suspicion, ‘[w]e must call a halt [to genetic engineering] now, there is no time to lose’ (1999: 168). Remarkably, the principle of precaution has been formalized in international accords such as the Kyoto protocol and the legislation of certain EU countries, where it introduces the novel legal principle of a duty to undertake collective preventative action in the face of the unforeseeable. The text of a French law, approved in 1995, perfectly captures the philosophy of precaution when it states that ‘the absence of certainty, taking into account the state of

scientific and technical knowledge, must not postpone the adoption of effective and proportionate measures to prevent serious and irreversible damage to the environment' (cited in François Ewald, 2002: 283). Acting in the name of a generalized suspicion, the precautionary principle is perhaps less progressive than it might at first appear. It finds its political counterpart in neoliberal social policies which dismantle the buffers of the welfare state only to criminalize the slightest acts of deviance. Zero tolerance is the socio-logical face of environmental precaution.

On the other hand, the concept of pre-emption is increasingly being brandished as a justification for aggressive counter-proliferation, particularly in the US. This is most obviously the case with the US government's new doctrine of military pre-emption. But the move to pre-emption was already visible in the US's changing position on environmental, biotechnological and biospheric risk. Under George W. Bush, the US withdrew from the Kyoto protocol and a new UN agreement to enforce the BTWC (Biological and Toxins Weapons Convention) of 1972 (although it should be noted that Clinton had already initiated bio-weapons research which flouted the non-proliferation accord on germ warfare). What the US is already beginning to formulate here is a legal right to aggressive counter-proliferation, where the point is no longer to halt innovation on the mere suspicion of its incalculable effects but precisely *to mobilize innovation in order to pre-empt its potential fall-out*.

In the economic domain, one very practical application of catastrophe risk has been the invention of new speculative instruments such as cat bonds, which since the mid 1990s have allowed reinsurers to hedge for natural and technological disasters on the capital markets. Catastrophe bonds covering natural and aerospace catastrophes are now regularly traded, but proposals have been made to issue titles for everything from acts of terrorism to climate change and genetic accidents. The usefulness of the catastrophe bond, in place of the more cautious asset investments of the past, is again commonly attributed to the very nature of the catastrophe event – which reinsurance companies declare to be uninsurable, at the limits even of the calculable. As one industry report puts it, the potential for accidents associated with the new biotechnologies demands that we 'think the unthinkable and quantify the unquantifiable'. The catastrophe bond resolves the apparent dilemma by transforming uncertainty itself into a tradeable event, protected by a legally binding contract. In the process, it invents a form of property right that seeks to capture the speculative biological future at its most unpredictable – literally, before it has even emerged.

It is all of these aspects of the catastrophe event – economic, biospheric and military – that come together in the new strategic discourse on bioterrorism.

### **Emerging Threats**

When the Nixon administration renounced its biological weapons programme in 1969, it was because germ warfare seemed to offer none of the

advantages of the nuclear bomb or even chemical weapons. In their submissions to a Senate inquiry into biological warfare, US defence advisers argued that germ warfare was naturally resistant to the strategic aims of mutual deterrence and should be abandoned: biological agents were unpredictable in their effects, responsive to uncertain climatic and environmental conditions, indifferent to national borders and prone to backfire on those who used them, making it difficult to defend the boundaries between the civilian and the military spheres, friend and enemy, over here and over there (Novick and Shulman, 1990: 103; Wright, 1990: 39–40). Not only was bio-warfare unworkable within the strategic framework of mutual deterrence, they claimed; it threatened to undermine the very ‘balance of powers’ on which this doctrine was predicated. Several of Nixon’s advisers warned that the dissemination of germ warfare would lend itself to non-state resistance movements, democratizing the use of weapons of mass destruction in a way that would permanently undermine the strategic advantage of both the US and Soviet Union (Wright, 1990: 40). What bio-weapons threatened to propagate was not only a specific pathogen, but another mode of warfare altogether. Beyond their immediate and deadly rivalry, these advisers argued, the superpower states shared a common interest in preventing the emergence of non-sovereign enemies. For all of these reasons it seems, the US had no qualms in unilaterally giving up its offensive bio-weapons programme, whatever the USSR chose to do. In 1972, the Biological and Toxins Weapons Convention, banning the use and possession of biological weapons, was signed in London, Moscow and Washington.<sup>5</sup>

Three decades later, bio-warfare has moved back from the margins to the centre of US defence policy, while the doctrine of mutual deterrence has given way to the war on terror, full-spectrum dominance and pre-emptive strikes. In 2001, George W. Bush inaugurated his presidency by withdrawing the US from a new UN effort to enforce the BTWC of 1972. And, following the anthrax attacks of 2001, Bush called upon US Congress to approve a massive decade-long funding scheme for ‘defensive’ bio-weapons research. The era of biological non-proliferation was officially over.

Like many of George Bush’s spectacular military manoeuvres, the turn towards a strategy of biological counter-proliferation was already prefigured in the strategic revolution that was the RMA (Revolution in Military Affairs). Initiated in the early 1990s, the RMA was never anything more than an attempt to *simulate* the hypothetical future of warfare, and yet it also set forth a number of tacit prescriptions for the strategic reorganization of US defence (many of which were carried out under Clinton). What informed this literature was the certainty that the solutions of the Cold War era were no longer capable of shoring up the hegemonic position of a superpower state such as the US.<sup>6</sup> The era of state-centric, bipolar conflict had established a certain kind of equilibrium – the shared risk aversion of mutual deterrence. In the post-Cold War era – RMA strategists warned – the US would increasingly find itself alone in a world in which terror was ‘out of balance’. With the breakdown of the Cold War stand-off, the exodus of defence and

bio-weapons experts from the ex-USSR and the proliferation of illegal weapons, the capacity to commit acts of violence on a massive scale would no longer be the sole prerogative of the superpower state. The RMA literature predicted that 21st-century warfare would be dominated by terrorism, but of a different kind to the state-sponsored, state-identified terrorism of the past. The new terrorism might be funded by one or several states (think of the relation between Al-Qaeda and the Saudi Arabian elite), and yet its operations, infrastructure and militants would not be confined to the territorial boundaries of the state. Rather than classify these ‘emerging threats’ according to their national, political or religious alliances, the RMA defined the new terrorist networks by their common indifference to the state-centred logistics of the Cold War period. The new terrorism – it was argued – could no longer be countered with traditional models of prediction, risk assessment and decision-making. In the words of defence specialist Anthony Cordesman, ‘there is no “standard distribution curve” of past events that can be used to predict the future’ of terrorist attack (2001: 421). With no state or nation to defend, the new terrorism could not be contained within the affective limits of mutual deterrence (mutual fear as a source of risk aversion). It was by definition ‘uncertain’, ‘emerging’ and pandemic. Hence its ‘catastrophism’, according to Clinton’s defence advisers.<sup>7</sup>

At the same time, the RMA literature anticipated that the rise of ‘catastrophic terrorism’ would bring about a shift in the kind of weaponry deployed. The nuclear and chemical arms of the Cold War period, underwritten by the massive industrial infrastructure of the superpower states, might not become completely obsolete, but increasingly (it was argued) would be marginalized by information and especially biological warfare. During the 1990s, the idea that biological agents would be the weapon of the future hardened into official public discourse. Revelations about the former Soviet Union’s bio-weapons programme and the exodus of its scientists into Iraq, followed by Iraq’s own admission of a smaller programme, fed into media-channelled fears that the US had dangerously neglected this ‘weapon of the poor’. The Clinton administration pointed to various abortive attempts at anthrax attacks by cult groups in the US and Japan as a sign that the new warfare would be bioterrorist, while bio-weapons experts warned that genetic engineering provided new opportunities for the creation of novel, highly virulent pathogens (Block, 1999; Fraser and Dando, 2001; Miller et al., 2001).

How do we assess this overwhelming, highly mediated conviction on the part of the US government, that the future of warfare will be biological, given that the actual instances of bioterrorist attack in the US remain rare, underwhelming and (in the case of the 2001 anthrax attacks) of dubious origin? Whatever the likelihood of these future scenarios, the US’s sudden preoccupation with bio-warfare needs to be understood, above all, as an effect of the deliberate *self*-transformation of US defence, a revolution in military affairs that in any case threatens to blur the difference between real and imagined threat. US strategy has moved full-circle since the Cold War.

Where once the point was to stave off the emergence of minoritarian, non-state guerrilla movements, the US now aims to prevent the re-emergence of a Soviet-style superpower state.<sup>8</sup> In line with the strategic vision of the RMA, the US is restyling itself as an emergent guerrilla resistance movement on a worldwide scale (albeit one supported by massive state funding), transforming war into a process of permanent neoliberal counter-revolution.<sup>9</sup> As a consequence, the doctrine of mutual deterrence has been demoted as the organizing principle of US defence. Under Clinton, it was tentatively replaced by the concept of counter-proliferation – a move that was already criticized at the time as a first step towards pre-emptive warfare.<sup>10</sup> The Bush administration has gone further and merged counter-proliferation with full-spectrum dominance and pre-emption to formulate a pervasive, future-oriented space-time of military responsiveness. It is in this very particular strategic context that the US has come to affirm the importance of biological weapons research. US defence advisers and bio-weapons experts now claim that the very traits that made biological weapons so useless for the Cold War superpowers are precisely what might recommend them to the new generation of terrorists (Chyba, 1998, 2000). More pertinently, it seems clear that US defence is incorporating bio-weapons research of an ostensibly defensive nature into its own long-term restructuring of military affairs. At stake here is much more than a tactical reorganization of military R&D, weapons stockpiling and funding. The potential usefulness of biological warfare, as envisaged by US defence, is both strategic and affective: or rather strategically affective because, as noted by experts in the burgeoning field of terrorism psychology, biological weapons ‘are especially effective at causing terror’ (Hall et al., 2003: 139). With their ability to spread without detection, to incubate and produce delayed effects, biological agents are capable of transforming emergence itself into the ultimate military threat. In the early 21st century, it would seem, bioterrorism is becoming the paradigmatic threat of US defence policy, the virtual, characteristically emergent event around which it is reorganizing its whole vision of warfare.

### **Pre-emption**

As various commentators have pointed out, pre-emption is not a new concept in international law. Traditionally, however, the right of pre-emption authorized a state to counter-strike when it had warning or visible evidence of an *imminent* attack. The US’s National Security Strategy of September 2002 outlined a radically new doctrine of war which specifically legitimates the use of pre-emptive action against a threat that is not so much imminent as *emergent*; a threat whose actual occurrence remains irreducibly speculative, impossible to locate or predict.<sup>11</sup> Unlike the reliable Cold War opponent, George Bush warned, the new terrorist networks and rogue states are oblivious to the persuasive force of mutual deterrence. Their movements are incalculable, uncertain in time and place, of indeterminable cost – and this, we are told, is precisely why the US can’t afford to wait:

The greater the threat, the greater is the risk of inaction – and the more compelling the case for taking anticipatory action to defend ourselves, *even if uncertainty remains as to the time and place of the enemy's attack*. To forestall or prevent such hostile acts by our adversaries, the United States will, if necessary, act pre-emptively . . .

America will act against emerging threats before they are fully formed. (*National Security Strategy*, 2002: 14, 4)

The pre-emptive strike has been decried as a departure from all existing principles of legitimate warfare. But it would be better understood (and countered) on its own terms, as a radically new formulation of law, one that founds the legitimate use of violence on ‘our’ collective apprehension of the future, however uncertain, rather than the predictive calculus of risk. In this sense, the concept of pre-emption has more in common with the principle of precaution, itself increasingly at work in international *environmental* law, than any prior doctrine of warfare. Both pre-emption and precaution endow our suspicions, fears and panics with an active force of law. Both insist on our absolute, uninsurable exposure to an uncertain future; our co-implication in events that recognize no sovereign boundaries. But whereas the precautionary principle advises on a course of absolute intolerance to the future, the doctrine of pre-emptive warfare assumes that the only way to survive the future is to become immersed in its conditions of emergence, to the point of actualizing it ourselves. Pre-emption transforms our generalized alertness into a real mobilizing force, compelling us to become the uncertain future we’re most in thrall to. As a mode of anticipation, it is *future-invocative* rather than predictive or representative, since the future it calls forth is effectively generated *de novo* out of our collective apprehensiveness. What the US *National Security Strategy* of 2002 wants to affirm – by force of law – is that the mobilizing condition of warfare can only be speculative.

Since it was first elevated to an official doctrine of US defence in 2002, the concept of pre-emption has travelled far outside its original context and is increasingly at work in US policy on emerging environmental and health crises, ranging from global warming to infectious disease. In 2002, shortly after George Bush’s national security report was released, the editorial of a respected foreign policy journal suggested that the new doctrine of pre-emption should be extended to climate change:

... by pushing for preemptive military action in the name of national self-defense, the US has forced a new post-Westphalian definition of the limits of sovereignty when facing the new cross-border threats of the 21st century. And those threats include not only terrorism, but climate change as well. . . . Like future terrorist actions, we can't be absolutely certain what will happen, but all the signs are there. . . . Rather than wait until it is too late – when floods, droughts, rising sea levels, melted glaciers and new diseases abound – why not take the wise course and preempt that possibility by acting now. . . .

Whether the Bush administration comes to this view or not, its new preemptive doctrine has already galvanized the international community, inadvertently providing a rule book and a logic for multilateral action on other cross-border threats, including climate change. (Gardels, 2002: 2–3)

This journalist was by no means alone in his vision of the military future. In late 2003, the Pentagon published a report on the potential consequences of abrupt climate change for US security (Schwartz and Randall, 2003).<sup>12</sup> The authors of the report outline the now familiar dilemma of catastrophe risk: although the risk of climate change is inherently ‘uncertain’ (Will it happen? Is it happening already? How severe will the effects be? Are we on the verge of some irreversible phase transition?), its consequences are ‘potentially dire’ and therefore necessitate urgent action (2003: 3). The point, according to the report, is not only to ‘think the unthinkable’, but more importantly to actively pre-empt the emerging catastrophe through what they refer to as adaptive strategies. In particular, the authors suggest that the US should explore ‘geo-engineering’ options designed to transform the earth’s climatic conditions by unleashing various active gases into the atmosphere. What the Pentagon is proposing then, is a ‘solution’ that is both speculative and biotechnological (in the widest sense of the term). It recommends that we intervene in the conditions of emergence of the future before it gets a chance to befall us; that we make an attempt to unleash transformative events on a biospheric scale before we get dragged away by nature’s own acts of emergence.

In the meantime, DARPA (Defence Advanced Research Projects Agency), the Pentagon’s centre for funding cutting-edge military technology, is working on a similar response to the problems of emerging infectious disease and bioterrorism (Miller et al., 2001: 306–7). One of DARPA’s current projects includes the creation of biological sensors – living cells on chips or three-dimensional cell matrices – that respond to both known and *previously uncharacterized* agents to give a warning sign of attack.<sup>13</sup> But DARPA’s research is not limited to advanced detection technologies; it is also engaged in the development of drugs that are similarly responsive to the unknown. Using the new technique of DNA shuffling (hailed as the second generation of genetic engineering because of its highly accelerated capacity for randomly recombining whole segments of genomes), DARPA is attempting not only to perfect our defences against existing threats but, more ambitiously, to create antibiotics and vaccines against infectious diseases that *have not yet even emerged*. Molecular geneticists associated with this research have appropriately referred to DARPA’s experiments with the DNA shuffling method as a form of anticipatory evolution (Bacher et al., 2002). While this research is being carried out under the banner of biodefence, DARPA finds itself in the paradoxical situation of having first to create novel infectious agents or more virulent forms of existing pathogens in order to then engineer a cure. Blurring the difference between defensive and offensive research, innovation and pre-emption, the Pentagon seems to have

decided that aggressive counter-proliferation is the only possible defence against the uncertain biological future. This is a ‘solution’ without reprieve – if the emergence of biological resistance is inexhaustible, DARPA’s pre-emptive war against evolving infectious disease and bioterror can only be of indefinite duration.<sup>14</sup>

Already, biologists are warning that the massive new biodefence research institution being built in Fort Detrick looks as if it is preparing for both offensive and defensive bio-weapons research (Leitenberg et al., 2004). In any case, the very nature of the bio-weapon makes it almost impossible to disentangle the two.

### **Economies of Emergence**

In the mid 1990s, the official rate of US productivity growth suddenly took off in the statistics after a long 25-year slump, seeming to confirm that the ‘information revolution’ was indeed beginning to bear fruit. This sudden burst of exuberance was hailed as the sign of an emerging post-industrial revolution, whose two cutting-edge sectors, bio- and information technologies, would relaunch the US economy into a golden era of indefinite growth. As venture capital flooded into digital and biotechnologies, it seemed that speculation itself had become the driving force behind unprecedented levels of innovation, allowing whole industries to be financed on the mere hope of future profits. What was at stake here, even according to the most sceptical of observers, was much more than an irrational bubble or the delirious financialization of the economy (Brenner, 2002). Far from representing a final abstraction of the virtual from the tangible world of bodies, the rise of venture capitalism institutionalized a model of economic growth in which *production itself* was made to hinge on the vagaries of stock-market investment. This could not have been more evident than in the biotech sector where the most material of productions – the experimental regeneration of life itself – became intimately infused with the virtual temporality of speculation. The political theorist, Christian Marazzi, has described the venture capital model of accumulation as an economy of emergence, where the so-called ‘fundamentals of production’ are replaced by the traditional affective skills of the professional speculator – the ability to sense and respond to crowd movements before they take hold; to initiate new product-lines before a market exists for them; to promote belief, euphoria or panic in the face of an event that has not yet materialized:

Everyday productivity is increasingly determined by the capacity to respond in unforeseen and unforeseeable situations, *emergent situations*, those situations that obviate any kind of programming and posit *occasionality* as central. (Marazzi, 2002: 48–9)

During the late 1990s, whole sectors of the economy were held aloft on a wave of media-induced expectation – expectation of profit, in the first place, but also a kind of collective faith in the soon-to-be-realized possibilities of

the new information and life science technologies. At a time when most biotech companies had yet to develop a marketable product, let alone make a profit, capital investment in the new technologies was sustained by the hope that the Human Genome Project, and genomics in general, were about to deliver an unheard of revolution in health care, an era of designer drugs and precision-targeted interventions into the germ-line.

In March 2000, though, the venture capital frenzy of the late 1990s came to a fittingly millennial end when the dotcom stocks collapsed, followed later in the same year by the mass protests at Seattle.<sup>15</sup> It was in this atmosphere of impending political and economic crisis, announcing the decline of the neoliberal triumphalism of the Clinton era, that Bush came to power. And in retrospect, it seems clear that the war on terror was as much a political response to the downturn of the new economy as to the terrorist attacks of 11 September 2001. Bush's answer to the technophilic optimism of the Clinton era was an equally megalomaniac plan for indefinite war, encompassing the whole globe within his strategic vision.

For a while, venture capital continued to invest in the life sciences, with the lingering hope that the promised new economic growth would at least become tangible here. But when the HUGO and other genome sequences were published, there was a sudden sobering consensus that the life sciences would need to move into the 'post-genomic' era before the anticipated medical breakthroughs could be realized. In 2003, the fortunes of the biotech sector slumped to an all-time low – and it was at this point that the US government came to the rescue with a massive plan to fund 'biodefence' research for the following 10 years (Guillemin, 2004). The plan included generous incentives for drug development that seemed as much designed to overcome the time lags of commercialization as to counter the threat of bioterrorism. New biodefence legislation made sure that any 'national health emergency' would become the perfect occasion for pushing through a drug without clinical trial.<sup>16</sup> Biotech would live again, but this time federal funding of life science research would be tagged to the US's new strategic vision. The long-neglected domains of public health and infectious disease research would be rehabilitated and merged with biodefence while venture capital investment would again be courted, but this time on the pretext of permanent war rather than permanent growth.

The difference between Clintonian neoliberalism and Bush's neoconservatism needs to be qualified then: both economies mobilize speculative affect, attuning it to the emergence of the unpredictable. What has changed is the affective valence of 'our' relation to the future – from euphoria to panic to fear, or rather alertness (a state of fear without foreseeable end). Where the celebrants of the new economic growth reassured investors that there was no end to innovation, holding hope aloft with a constant barrage of short-lived promises, the neoconservatives want to convince us that there is no end to danger, that the war against terror can only be indefinite in time and scale.<sup>17</sup> In the aftermath of 11 September, permanent warfare has become the new driving force behind US economic growth, feeding off its own

ineptitude as it generates a seemingly inexhaustible demand for security services of all kinds. Within this new configuration of powers, the life sciences have been promoted to a commanding position. The Bush administration has achieved something the theorists of Clinton's new intelligence agenda only ever dreamed of – the actual institutional conflation of security and public health research, military strategy, environmental politics and the innovation economy.<sup>18</sup>

What is being articulated here is a profoundly new strategic agenda where war is no longer waged in the defence of the state (the Schmittian philosophy of sovereign war) or even human life (humanitarian warfare; the human as bare life, according to Agamben) but in *the name of life in its biospheric dimension, incorporating meteorology, epidemiology and the evolution of all forms of life, from the microbe upwards*. The extension of pre-emptive warfare to include the sphere of environmental and biopolitics conflates the eternalization of war with the evolution of life on earth – as if permanent war were simply *a fact of life*, with no other end than its own crisis-driven perpetuation. 'It may never end. At least not in our lifetime', according to Dick Cheney (quoted in Woodward, 2001).

Inevitably, such a delirious prognosis on the future of warfare demands that we also rethink the shape of a possible anti-war politics. Perhaps, given the recent nature of the events analysed here, the problematic of resistance can be most forcefully posed in the interrogative form. What becomes of an anti-war politics when the sphere of military action infiltrates the 'grey areas' of everyday life, contaminating our 'quality of life' at the most elemental level (Brower and Chalk, 2003)? In what sense is it even possible now to claim a right to 'life', social security, public health – the peculiarly vital rights of the welfare state – without falling into the trap of legitimating permanent warfare? And how do we counter a politics that turns the possibility of ecological crisis into a tradeable catastrophe risk on the capital markets?

One response to these questions has been to redefine security in human, biological or even biospheric terms, as if this were the only way to salvage something of the vitalist politics of the welfare state. But such a strategy is reformist at best and falls straight into the hands of the new intelligence agenda, with its manic desire to revitalize the legitimacy of security. Rather than plead for a security politics with a human face then, a more promising vector of resistance, I would suggest, lies in the attempt to undermine the nexus between military security, the politics of life and new forms of speculative capitalization. In the face of a politics that prefers to work in the speculative tense, what is called for is something like a creative sabotage of the future; a pragmatics of pre-emptive resistance capable of actualizing the future outside of the police-able boundaries of property right. This is an abstract formula for resistance that applies to such diverse questions as the capitalization of health and old age insurance; biological patents of all kinds; and even the commercialization of the 'elements', from privatized water to tradeable pollution rights and environmental catastrophe bonds. Such a formula could describe any number of recent conflicts around the

neoliberal politics of life, from the court case opposing Aids activists to pharmaceutical companies in South Africa; the revival of popular pharmacologies in the face of the depredations of a global drug market; and to projects in open-source biology initiated by scientists across the life sciences, to name but a few. What is new about the current context, however, is the creeping militarization of these sites of biopolitical tension. The domains of life that neoliberalism sought to incorporate into commercial and trade law throughout the last two decades are now being forcibly recruited into an expansive politics of military security. Increasingly, then, any resistant politics of health, ecology and life will need to engage with the pervasive reach of the war on terror; to contest, in other words, the growing collusion between neoliberalism's politics of life and the imposition of a permanent state of war.

#### *Notes*

1. These processes of 'horizontal gene transfer' include transduction (viral infection between bacteria), transformation (the direct uptake of a DNA sequence from the environment), conjugation (involving cell-to-cell contact and mobile pieces of extra-chromosomal DNA called plasmids). Research into horizontal gene transfer boomed in the late 1980s and 1990s. For one of the first overviews, see Levy and Novick (1986).
2. Certain biologists argue that the sudden upsurge in microbial resistance from the mid 1970s onwards cannot be ascribed to the overuse of antibiotics alone; and may well be linked to the commercial-scale use of transgenic organisms (Ho, 1999: 181–2, 192–200).
3. There exists an extensive body of international relations theory arguing for the concepts of human, biological and microbiological security (as well as other variations such as food and water security). See in particular Christopher Chyba (1998, 2002), the articles collected in Andrew T. Price-Smith (2001) and the recent RAND report by Brower and Chalk (2003).
4. For an overview of the concept of the catastrophe risk in these three domains, see François Ewald (1993, 2002), Bougen (2003) and Haller (2002) respectively.
5. This is not to suggest that the BTWC was ever successfully enforced. Susan Wright (1990) points out that, from the beginning, the BTWC lacked an enforcement protocol and allowed room for research and limited stockpiling. Already under Reagan, there was a return to bio-weapons research in the US, although this was considerably stepped up under Clinton.
- Ironically, while the Nixon administration was responsible for withdrawing the US from bio-weapons research, it was Nixon who launched the first War on Drugs, initiating a campaign of transnational counter-insurgency whose modus operandi in many ways anticipates the War on Terror. See Alfred W. McCoy, *The Politics of Heroin* (2003: 387–460). This precedent was suggested to me by Richard Doyle's paper 'Bioterror: Meshing the Network', presented at *Security Bytes* conference, Lancaster, July 2004.
6. The most pertinent references here are Ashton B. Carter, 'The Architecture of Government in the Face of Terrorism' (2002) and Ashton B. Carter and John P. White (eds) *Keeping the Edge: Managing Defense for the Future* (2001), because of their interest in the concept of 'catastrophic terrorism'.

7. The concept of ‘catastrophic terrorism’ was promoted in the late 1990s by Clinton’s Assistant Secretary of Defense, Ashton Carter, among others, and has become a commonplace of US defence discourse since the attacks of 11 September (see Carter, 2002; Carter and White, 2001).
8. According to the Pentagon’s draft ‘Defense Planning Guidance’ for the period 1994–9, drawn up in 1992, the first objective of the US in the post-Cold War era should be to ‘prevent the re-emergence of a new rival, either on the territory of the former Soviet Union or elsewhere, that poses a threat of the order of that formerly posed by the Soviet Union’ (quoted in *New York Times*, 1992).
9. In their recent book, *Multitude: War and Democracy in the Age of Empire*, Michael Hardt and Antonio Negri suggest that an alternative genealogy of current US strategy can be traced back to the Nixon era and the beginnings of the ‘neoliberal revolution’. In this sense, the Nixon administration can be situated at the cross-roads between two eras of warfare. While on the one hand Nixon continued to aggressively uphold the Cold War status quo against the emergence of newer kinds of enmity, the US was already engaging, on the sidelines, in its own politics of counter-insurgency, from Vietnam to Latin America to the War on Drugs (surely an early form of bio-warfare; Hardt and Negri, 2004: 38–40). It is these counter-insurgent tactics that have now come to dominate US defence strategy.
10. On this point see Harald Müller and Mitchell Reiss, ‘Counterproliferation: Putting New Wine in Old Bottles’ (1995), who note that many within the Clinton administration ‘feared that the United States, as the world’s lone superpower, was now devising the means to unilaterally and preemptively destroy the nuclear programs of countries in the developing world’. They go on to note that ‘[a]lthough some Pentagon officials privately admit that counterproliferation still envisions preemptive military strikes, more senior officials, especially Assistant Secretary of Defense Ashton Carter, have explicitly and repeatedly disavowed any such role’ (1995: 139). The difference between US defence under Clinton and under the influence of the neoconservatives can be pin-pointed in the latter’s willingness to unequivocally embrace pre-emption.
11. Conversely, the ‘emergent’ nature of the terrorist threat has been used to justify the US’s relative inaction prior to the attacks of 11 September. ‘When was 9/11 imminent?’ was the rhetorical question put forward by George Bush’s neoconservative faction. For an extended commentary on this far-reaching shift in the understanding of pre-emption, see O’Hanlon et al. (2002). It should be noted that the neoconservative understanding of pre-emption is indebted to the work of military strategists Albert Wohlstetter and Roberta Wohlstetter, particularly the latter’s study *Pearl Harbor: Warning and Decision* (1962). This work is concerned with the limits of mutual deterrence when faced with situations of unpredictable surprise and represents a very early argument in favour of the doctrine of pre-emption. Significantly, Roberta Wohlstetter’s work includes an extensive discussion of the psychology of future-oriented perception, surprise and the operative power of ‘wifefulness’.
12. The report is entitled ‘An Abrupt Climate Change Scenario and its Implications for United States National Security’. It was written by Peter Schwartz, CIA consultant and former head of planning at Royal Dutch/Shell, and Doug Randall of the US-based Global Business Network. For further detail on this report, see Townsend and Harris, ‘Now the Pentagon Tells Bush: Climate Change Will Destroy Us’ (2004).
13. See <http://www.darpa.mil/dso/thrust/biosci/biosci.htm> for details of this and other programmes in the biological sciences. See also ‘Interview with Michael

Goldblatt, Director, Defense Sciences Office, DARPA' (Travis, 2003). In this interview, Goldblatt notes that the 'original focus of the DARPA efforts in biological warfare defense were aimed at protection from genetically engineered threats – where you have to protect against the unknown and perhaps unknowable' (2003: 158).

14. DARPA is not alone in its pre-emptive vision of bio-warfare. In a recent article overviewing the current state of bio-weapons research in the US, Susan Wright points to a general trend towards 'pre-emptive' visions of biodefence, where the aim is 'to defend not only against *known* pathogens but also against *futuristic* ones – genetically altered microbes that could overcome existing vaccines or antibiotics or attack the immune system in novel ways, and so forth' (2004: 60).

15. Not surprisingly, some of the best accounts of the so-called 'new economy' are retrospective ones. See for example Doug Henwood, *After the New Economy* (2003).

16. First announced in 2002, Bush's BioShield Project was stalled in Congress for over a year and received a less than enthusiastic response from the pharmaceutical and biotech companies it was supposed to entice (Wright, 2004: 62–3). The final version of the project not only contained generous funding provisions for the creation of medical responses to bioterrorist attack, but also measures allowing for the fast tracking of clinical trials and federal drug approval. For full details of the BioShield Project, see US White House, Press Release (2003). For a more extensive account of US legislation on bioterrorism from the closing years of the Clinton administration onward, see Wright (2004).

17. On the differences and continuities between Clinton's 'new economy' and the era of permanent warfare, inaugurated with 11 September, see in particular Marazzi (2002: 147–60) and Mampaey and Serfati (2004). Mampaey and Serfati note that:

... [a]fter the wars in Afghanistan and Iraq, American 'markets' are perhaps beginning to 'internalize' into their behaviour the inevitability of new wars and military operations; to forge as it were a convention based on the idea of 'war without limits', in which the *discretionary* use of military force by the US represents their new horizon. (2004: 250)

More forcefully, Marazzi argues that 'the war . . . against terrorism represents *the continuation of the New Economy by other means*' (2002: 154).

18. It should be noted that Clinton was already moving in this direction. In the late 1990s, the Clinton administration introduced new counter-terrorism laws (already blurring the difference between military emergency and domestic law enforcement), while approving a massive increase in counter-terrorism funds (a sizeable portion going to bio-weapons research) (Dreyfuss, 2000; Hammond, 2001–2002: 43; Miller et al., 2001: 287–314). In the meantime, Clinton's defence advisers were suggesting that the Department of Defense needed to invest in the cutting-edge sectors of the new economy, particularly those areas that had remained resolutely civilian – information and *especially biotechnologies*. In a statement that was as much prescriptive as diagnostic, they argued that 'the biotechnology revolution [would] have implications for security that [would] probably exceed those of the nuclear and information revolutions that preceded it' (Carter and White, 2001: 17). According to Edward Hammond, when Clinton turned towards biodefence research in the late 1990s, it was not only in response to the Pentagon but, more importantly, to lobbying from the ailing genomics sector, which was looking for an emerging market to invest in as the genome sequencing projects came to an end (2001–2002: 43).

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