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# Biodefence in the 21st Century

## A submission to the ippr Commission on National Security for the 21st Century

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## Introduction

'Be prepared. Put safety first. Follow the science.' (Daschle 2003)

Science is undergoing a revolution that will fundamentally alter global security in the 21st century. Last century, physics proved to be the defining basis for our global security, advancing developments in nuclear technology that framed the Cold War and beyond. Less than a decade into this century, however, and biology has already fully transformed our security landscape.

One month after September 11, 2001 my office in the Senate suffered the largest bioterrorism attack in US history (Daschle 2003). On October 15, 2001 one of our interns opened a simple white envelope containing weapons-grade anthrax. Earlier that month similar letters were received by television news-anchor Tom Brokaw and newspaper facilities in Florida. In the wake of these 'Amerithrax' attacks, over 10,000 people were tested for possible exposure to anthrax (Gursky *et al* 2003). More than 50 people tested positive, including almost two dozen members of my staff. Twenty-two people later became infected with the bacteria and ultimately five individuals died from the disease.[1]

To say that we were lucky is an understatement. There was no comprehensive response by the federal government, and coordination within and among federal and state agencies was woefully confused. We were continually provided with inconsistent and competing threat assessments. Strategies for response were just as muddled, and at times contradictory. In one instance, the state of New Jersey recommended that all postal workers at the two implicated post offices begin a course of antibiotics. The US Center for Disease Control and Prevention, however, disagreed with New Jersey's state health officials, and refused to release the appropriate medicine from the National Pharmaceutical Stockpile, forcing the workers to obtain antibiotics from their private physicians (Gursky *et al* 2003).

Just as threatening and pervasive as bioterrorist attacks is the spread of naturally occurring epidemics of infectious diseases. The United Kingdom in recent years has suffered more than one disease outbreak, fortunately confined to animal epizootics, with no human epidemics. Yet the severe impacts of the foot and mouth crisis in 2001 and the appearance of avian flu in 2007 serve as a warning for just how devastating a human epidemic could be.

The first case of foot and mouth disease surfaced in the UK on 19 February 2001. Within two weeks, the highly contagious viral disease, which infects cattle and pigs and other cloven hoofed animals, had spread throughout England, Wales and Scotland, eventually infecting more than 2,000 animals during the remainder of 2001 (Anderson 2002). Efforts to stop the spread of the disease – a cull of all animals in an infected area, a complete cessation of transportation of animals, and a dramatic restriction of human movements in infected areas – eventually brought the disease under control by late summer. But these measures had a devastating impact on farming production and tourism, resulting in the slaughter of more than 10 million animals and total economic losses of £8 billion (US$16 billion) (Uhlig 2002).

Six years later, in February 2007, an outbreak of the H5N1 strain of avian flu occurred at a Bernard Matthews turkey plant in Suffolk, England. The H5N1 strain can cause illness in humans and is the variant of the avian flu that could spawn a global pandemic. The source of the outbreak was turkeys shipped from another Bernard Matthews plant in Hungary. Nearly 160,000 turkeys were culled, but no humans were infected in this relatively small outbreak and the exclusion area put in place around the turkey plant was lifted after only six weeks. Yet this episode highlighted just how easily infections can be spread across borders in the modern globalised world.

The threats of bioterrorism and naturally occurring epidemics are already upon us, yet we remain under-resourced and fundamentally unprepared for this new challenge. In the United States, the Bush

1. For a full account of the anthrax attacks, see Daschle (2003).

Administration failed to release a comprehensive plan outlining the goals of a national biodefence strategy for six years after the anthrax attack on my office. Moreover, after what is reportedly the most intense investigation in FBI history, we are no closer today to identifying who carried out the attacks or determining whether those responsible have additional anthrax stocks for further attacks.

In both the UK and the US we have responded to the bioterrorist threat through some traditional but unfortunately not very effective techniques. These have been, first, to announce the importance of the threat and to convey a sense that we are doing something new by grouping all current biodefence measures together under a new label. Those US biodefence initiatives that are novel – such as the Bioshield programme, which aims to develop, manufacture and stockpile new medicines and vaccines against all chemical, biological and radiological threats – have been underfunded, understaffed, and have received little attention from policymakers.

Second, we tend to reorganise. In the US we have done this most notably by establishing the Department of Homeland Security and a White House Homeland Security Council. But reorganisation without a strategy and a clearly defined mandate to make progress on important problems will achieve little.

Third, we tend to throw money at the problem. This occurs to a greater extent in the US than in the UK. There is evidence that in some states improvements have been made in public health response and hospital preparedness. But progress is modest and uneven, and as with relabelling and reorganisation, money without a meaningful strategy simply leads to constituencies capturing funds to increase what they were previously doing or to do largely irrelevant things without beneficial progress. For example, in the US some fire chiefs have started listing fire equipment as biodefence measures.

Nor is it clear that the amounts of money involved are particularly meaningful when measured against the complexity of the problem and the magnitude of the risk. In recent years, the US has invested US$5.4 billion (FY06 actual), $5.1 billion (FY07 estimate), and $5.4 billion (FY08 budget) in civilian biodefence across all agencies of the federal government (Franco and Deitch 2007). UK defence officials estimate that £30 million ($60 million) has been allocated for biodefence. In the broader picture of both countries, each is spending less than a tenth of one per cent of its security budget on bioterrorism. In my judgement, these levels of investment in biodefence are simply insufficient.

## Assessing the threat from bioterror attacks and epidemics

Bioterrorist attacks and large-scale, naturally occurring epidemics are potentially devastating events and are likely to occur in the 21st century. Mechanisms to launch bioterror attacks are growing increasingly accessible and advanced. The threat of bioterror is further increased by the advance of globalisation, which likewise enhances the threat of naturally occurring infectious disease epidemics that can lead to widespread social and economic disruption.

### Bioterrorism

In 2006, a United Nations Report of the Secretary General on terrorism concluded that, 'The most important under-addressed threat relating to terrorism, and one which acutely requires new thinking on the part of the international community, is that of terrorists using a biological weapon' (United Nations General Assembly 2006: 11).

Indeed, the threat of bioterrorism will increase exponentially because biological agents used to carry out such attacks will continue to become more accessible and more technologically advanced, just as our social networks become more interconnected as a result of globalisation. The US Defense Science Board has reported that: 'Major impediments to the development of biological weapons – strain availability, weaponization technology, and delivery technology – have been largely eliminated in the last decade by the rapid global spread of biotechnology' (Office of the Under Secretary of Defence for Acquisition, Technology, and Logistics 2001).

The US National Intelligence Council has judged that a bioattack is more likely than a nuclear detonation because individuals or terrorist groups could create and wield bioweapons without the support or technological infrastructure of a nation state. The knowledge and materials needed to build and disseminate powerful bioweapons are widely available and relatively cheap. Progress in molecular biology and in the pharmaceutical industry has eliminated most technical barriers to the construction and use of bioweapons. Most bioweapons agents are available in the natural world, and turning pathogens into weapons that could infect tens or even hundreds of thousands of individuals can be done with skills and equipment that are routinely used for legitimate purposes. For example, dissemination of aerosolised bacteria is now a common agricultural activity, and the necessary equipment – cold foggers and backpack sprayers, for example – is widely available.

Although most experts recognise that bioweapons are poor tools for 'force on force' warfare, bioweapons could cause death and disruption on a large scale if used against civilian populations. We know now that al Qaeda had an anthrax bioweapons programme that was not detected by US intelligence until troops discovered the abandoned lab in Afghanistan. There are strong indications that al Qaeda continues to seek bioweapons. One of the reasons biological weapons are attractive as 'asymmetric weapons' is that detection and interdiction of bioterrorism efforts is extremely difficult. Bioweapons manufacture requires only 'dual-use' materials readily available in the open market, and leaves no specific signature. Assigning attribution to bioterrorism attacks is exceedingly difficult, evident in the American failure to identify the perpetrators of the 2001 'Amerithrax' case despite a massive FBI investigation.

Just as devastating as the potential loss of life is the economic fall-out that would result from bioterror attacks. The US Center for Disease Control and Prevention has estimated that a release of anthrax would generate costs of $26 billion per 100,000 persons exposed, for health care and through lost productivity (Kaufmann *et al* 1997). The 2001 anthrax attack in the US cost the government more than $1 billion in decontamination costs (United States Commission on the Intelligence Capabilities of the United States Regarding Weapons of Mass Destruction 2005). A carefully developed analysis published in the Center for Disease Control's journal calculated that if a kilo of anthrax were released in aerosol form in Manhattan, the decontamination task would take around 44 years (Wein *et al* 2003).

Perhaps the most troubling aspect of this growing threat is that we are still at a relatively early stage of its growth and it is not likely to go away anytime soon. The extraordinary pace and trajectory of advances in bioscience today guarantee the future creation of more diverse, powerful bioweapons. For example, it is already possible to synthesize many viruses from non-living components. The polio virus and Ebola, along with the 1918 flu genome, have already been synthesized. The first complete bacterial genome has just recently been synthesized. Many scientists expect that in the next five years, techniques will evolve such that experts will be capable of synthesizing any virus or bacterium – even the virus that causes smallpox. In the near future, 'designer microbes', perhaps having novel capabilities such as the ability to evade usual diagnostics, vaccines, or therapies, may be created. Much of this work will be aimed at legitimate scientific and medical purposes, but these advances will also open the way for malignant applications.

Secondary school students now do work that 20 years ago was the exclusive domain of Nobel Prize winners. College and graduate students have access to powerful technologies and potent materials that could be turned into extremely dangerous biological agents. That access will proliferate in the time ahead. This will be a source of much good. But it can also be a substantial source of much harm.

### Naturally occurring infectious epidemics

Investing in biosecurity is imperative not just because of the threat of bioterrorism, but because epidemics of naturally occurring infectious disease are becoming more likely in the 21st century – and more likely to spread quickly and cause social and economic disruption.

Many factors contribute to the increased risk of disease outbreaks, including the development of many 'megacities' containing tens of millions of people, many of whom lack adequate nutrition, clean water or basic sanitation, and who live in close proximity to their animals. Global mobility and inter-connected systems of production and marketing connect these central nodes and, alongside many positive consequences, enable the development and spread of disease. More than 30 new infectious diseases have emerged in the past two decades, sometimes as a result of human intrusion into once remote areas where people now come in contact with viruses such as Ebola. In many instances, diseases once limited to animals 'jump' species and cause human disease, as happened with SARS and is happening with avian flu now.

Globalisation and the increased interconnectedness of modern life also contribute to the growing risk of epidemic disease. In 1918, an age of steamships and trolley cars, a new influenza strain took six months to circle the globe and ignite a flu pandemic. Nearly a century later in 2003, a single person infected with SARS transmitted the disease to four others staying in the same hotel. These individuals then boarded aeroplanes and spread SARS to four continents in 24 hours. One of the first SARS patients travelled from Singapore, to New York, to Frankfurt before his symptoms became apparent. That epidemic was relatively small – about 8000 SARS cases occurred worldwide and about 800 died of the illness – but the social and economic consequences were significant. The epidemic was estimated to have cost the affected regions $60 billion in gross expenditure and business losses over just one quarter in 2003 (World Health Organization 2007: 39).

As with the threat of bioterror, the economic impact of an infectious epidemic could be crippling. The US Congressional Budget Office (CBO) has estimated that a severe influenza pandemic (similar to the 1918 pandemic) would result in a 4.25 per cent decrease in US GDP over one year (US Congressional Budget Office 2005/06). The World Health Organization (WHO) estimates that an infection rate of up to 1 per cent of the world's population would decrease global GDP by 5 per cent, with an additional loss of 1 per cent per additional percentage increase in infection rate (World Health Organization 2007). The WHO reports that Africa's overall GDP is estimated to be 32 per cent lower as a result of malaria, equivalent to a loss of US$100 billion annually. The HIV pandemic in Sub-Saharan Africa is just as devastating, and it is expected that by 2010, per capita GDP in some of the hardest-hit countries will drop by 8 per cent, with heavily affected countries losing more than 20 per cent (US Institute of Medicine 2003). Globally, the economic costs of tuberculosis (TB) to the poor are estimated to be $12 billion per year (World Health Organization 2002).

## Recommendations on bioterrorism

The threats we face from bioterrorism are perilous, but not insurmountable. In order to best defend against them, the US and the UK must embark on a robust and comprehensive collaboration to ensure greater preparedness in the face of harm from biological resources ('biopreparedness'). Aggressive action now could greatly mitigate the consequences of such events, and because of the revolutionary state of modern biology, could also reap enormous benefits for global health and economic security. Resilience must therefore be placed at the centre of our bioterror policies.

### Preparation

Preparation is the best defence against bioterror. Whether the threat comes in a form of an attack or a naturally occurring epidemic, the response will be largely the same. Success will depend on our ability to strengthen several broad capacities: the ability to care for the sick, protect the well, communicate with and engage the active cooperation of the public, and maintain sufficient awareness to make informed decisions in order to minimise social and economic disruption. In large epidemics or bioterror attacks, these capacities will be exercised on the international stage and decisions, mistakes, inconsistencies, and misunderstandings could have global consequences.

**As a first priority we need to plan thoroughly and in close coordination.** We have made some headway in planning for a natural influenza epidemic. But it is very disturbing that we do not have comparably detailed plans for responding to a bioterror attack. In the event of an outdoor aerosol anthrax attack on London or New York, for example, how will we know who was infected, who needs antibiotics, whether this is a single attack or the beginning of a campaign of attacks? How would we manage supply of our cities, share our drugs, adopt effective policing practices to identify the attacker(s), capture them, and reduce the likelihood of a repeat attack? These questions are not yet answered satisfactorily. The development of such plans should be a short-term priority.

Over the longer term, **the key to our success will be to harness the powers of the source that creates these threats in the first place: biology**. Our growing understanding of biology should enable the development of new drugs and vaccines, new ways of making these medicines faster and more cheaply, and should make it possible – if we prepare properly – to get ahead of threats of bioterror and destabilising epidemics.

It is important to recognise that *preparation matters* when it comes to these threats, whether they originate from natural causes or are the result of a planned attack. The response to both is largely the same. We can use information technology, medicines and vaccines to greatly mitigate the suffering and disruption that usually flow from disease epidemics. This is quite different from the situation with nuclear weapons, where prevention is the only viable option. But adequate biodefence requires that we be ready: we cannot start development of vital vaccines when the epidemic is upon us.

### Collaboration

The UK and the US should take the lead in engaging the international community's efforts to prevent and mitigate epidemics caused by either bioterrorism or naturally occurring infectious disease. Building resiliency to large-scale, lethal disease outbreaks should be at the core of our policies. A robust capacity for biodefence may be the best deterrent against bioattacks and will diminish the suffering and consequences of natural disease.

**First, we should increase our collaboration in the development and manufacture of biodefence countermeasures** – medicines and vaccines needed to treat or protect against the most likely bioweapons agents. Both countries are already pursuing such products, but we could heighten our cooperation by identifying areas of comparative capability and investment. The UK's expertise in foot and mouth disease, for example, is ahead of the curve. The US for its part is invested more heavily in developing defences against anthrax. Both countries need to invest in anti-virals and other drugs that can have broad spectrum applicability. Our model for moving forward should be found in the World War II cooperative efforts between our nations on such vital projects as the pursuit of radar and atomic weapons.

**Second, through exercises and a detailed planning process we should strengthen UK-US lines of communication, shared situational awareness and mutual assistance** during bioattacks or large-scale epidemics. Although both countries' military and intelligence agencies regularly and formally exchange information, views and people, and although there are professional exchanges between British and American public health officials, there are no protocols for and little practical experience with information exchange or cooperation during public health emergencies.

**Third, we should establish bioterrorism preparedness and response to large-scale epidemics and other disasters as a key function of NATO** and the role of other international organisations should be bolstered where appropriate. NATO's disaster response capabilities have typically taken a back seat to core military functions and its responsibilities in the wake of a bioattack on a member state have only recently been considered. Much talk of NATO's role in the world post-Cold War has been on 'out of area' activities, but there is also a new need to focus on the security of the NATO 'homeland'.

Additionally, other international organisations have important roles to play in biosecurity. For example, the WHO's revised International Health Regulations (IHR) need full support. A large epidemic or bioattack is likely to overwhelm the response capacities of individual member countries of any multilateral organisation, including NATO and the European Union.

## Conclusion

As in so many areas, the UK and the US have a better exchange on biopreparedness issues than most countries. But in recognising our vulnerabilities, the rapid biological advances of the modern world, the proliferation and dissemination of relevant technologies, and the resulting elevation in our risks, we must increase the urgency with which we prioritise biopreparedness in our national defence strategies. Our countries must think more strategically about the problem, and we must do this together. Aggressive action now could greatly mitigate the consequences of such events, and because of the revolutionary state of modern biology, could also reap enormous benefits for global health and economic security.

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