

Bioterrorism — an Australian perspective

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Microbes are the foot soldiers of the 21st Century

Jeremy Rifkin (quoted by Thatcher)¹

BIOTERRORISM (the deliberate use of biological weapons by a terrorist group) has become a major concern of medical, government and military agencies over the past two to three years. Various reputable newspapers and journals now talk of “Bioarmageddon”,² “Bioterror”³ and “germ weapons”,⁴ and terrorists with biological weapons have been the subject of popular novels, from John Case’s *The First Horseman*⁵ to Tom Clancy’s *Rainbow 6* (which imagines bioterrorism at the Sydney Olympic Games).⁶ While response planning to a bioterrorist attack has been a major issue in the United States since 1996,⁷ Australia is only now coming to terms with the issues involved and the possibility of Australia being a target.

The threat of bioterrorism is increasing in Australia and other countries around the world. The dimensions of this threat, from capability to intent, need further exploration to enable a realistic appreciation of the response required. The United States has committed a budget of \$1.4 billion to address the problem.⁸ Australia is unlikely to devote comparable resources to the task, so a critical review of the issue, from both an Australian Defence Force and civilian infrastructure perspective, is required.

Biological weapons

Biological weapons have been used in one form or another for over 2000 years.⁹ Despite advances in detection and therapy, biological warfare remains a threat on the modern bat-



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Synopsis

- ◆ The possibility that biological agents will be used for terrorist purposes is growing as the necessary skills and technology become more widely available.
- ◆ Biological warfare agents have been developed in several national military programs.
- ◆ Agents of concern could include anthrax, brucella, plague, tularaemia, typhoid, botulinum toxin, ricin and Q-fever.
- ◆ Although production of agents is easier than mass dissemination, both are more difficult than is popularly portrayed.
- ◆ The keys to defence against bioterrorism are intelligence gathering (to identify threatening groups and activities), counter-acquisition strategies (to deter nations and groups from developing or using biological weapons), epidemiological surveillance systems (to identify biological attacks promptly) and consequence mitigation (to reduce the impact of any attack).
- ◆ Since the Gulf War, the ADF has increased its preparedness for countering biowarfare.
- ◆ In 1998, the Australian Medical Disaster Coordination Group identified major deficiencies in civilian preparedness for a chemical or biological terrorist attack and has set out, with Emergency Management Australia, to rectify these deficiencies.

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tlefield. The Russian and Iraqi biological warfare programs have shown their utility and the ease with which covert programs can be hidden.¹⁰ There have also been historical attempts of a more covert or terrorist nature to spread disease. In 1495, Spanish soldiers gave French forces wine mixed with blood from leprosy patients¹¹ and, in 1763, the British gave smallpox-inoculated blankets to various tribes during the French-Indian War.¹²

Terrorism

There are many definitions of terrorism. One of the more succinct defines terrorism as “politically or religiously motivated acts of violence causing non-combatant casualties.”¹³ Australia, like the United States in the 1970s and 1980s, has



Front portion of an R400 aerial bomb, used for biological agents by Iraq, recovered from the Euphrates River in December 1995.

However, the 1990s saw a fundamental change in terrorist operations. Analysis of the Rand–St Andrew’s University Chronology of International Terrorist Incidents, a database of over 8000 incidents dating back to 1968, has shown some disturbing trends.¹⁵ While there has been an overall fall in the number of terrorist incidents, there has been a rise in the percentage of incidents with fatalities. In 1995, 29% of all terrorist incidents involved fatalities, compared with 17% of attacks in the 1970s and 19% of attacks in the 1980s.¹⁵

This trend is associated with the growth throughout the 1990s of radical religious terrorist groups. These groups, arising from a wide spectrum of religious backgrounds, see violence as a “divine” duty and an expedient way to achieve their eventual aims.¹⁶ The religious terrorist group members are not inhibited by the political or even “moral” constraints of the more traditional terrorist groups. Interested only in themselves, and the small religious group they represent, these groups are not interested in defending a perceived aggrieved constituency, but instead aim to radically change the existing order.¹⁵ As outsiders, the religious terrorists are able to contemplate far more destructive and deadly attacks to fulfil this aim.¹⁶ As such, the religious terrorist groups have come closest to the effective use of weapons of mass destruction. The deliberate infection of the populace of The Dalles, Oregon, with *Salmonella typhimurium* in 1984 by the followers of the Bhagwan Shree Rajneesh was to be a forerunner to the Aum Shinrikyo cult’s more deadly 1995 nerve gas attack on the Tokyo subway,¹⁷ a historical watershed in terrorist tactics. Hoffman and many others believe that attack was a harbinger of things to come.^{15,17,18}

been relatively immune to the spread of terrorism.¹⁴ Certainly, Australia has not seen anything on the scale of the World Trade Centre or the Oklahoma City bombings and there were no major terrorist incidents in Australasia in 1998.¹³

Australia, however, has not been totally immune. Small scale terrorist attacks have included the bombing of the Sydney Hilton in 1978, the assassination of the Turkish Consul-General by the Justice Commandos of the Armenian Genocide in December 1980, and the bomb attack on the Israeli consulate-general’s offices by 15 May Organisation in December 1982.¹⁴ Australia has also been the focus of various extortion attempts and hoaxes over the last 30 years. These include the “Mr Brown” Qantas extortion in 1971, the Woolworths bomb extortions in 1975,¹⁴ and the Coca-Cola extortion attempt in 1998.

The terrorist threat is changing. Bruce Hoffman, in a seminal article, reviewed the terrorist threat from the 1970s until the present day.¹⁵ Hoffman noted that terrorist groups, while politically radical, have generally been conservative in the way they have carried out their attacks, being more “imitative than innovative”.¹⁵ Most groups are far more interested in getting their message across than in killing lots of people. Consequently, while a few groups dabbled with the idea of weapons of mass destruction, the only incidents involved food tampering as a form of economic sabotage. These include terrorist attempts at different times to poison Israeli oranges with mercury and to lace Chilean grapes with cyanide.¹⁵



A castor bean plant growing at the Fallujah 3 castor oil production facility near Fallujah, Iraq, January 1996. The bags in the background contain castor beans. The oil production facility can be seen in the top right corner. Aside from castor oil, ricin is derived from the castor bean.

Bioterrorism

Biological weapons may have great utility for terrorist groups. The Aum sect has both researched and tried to use, unsuccessfully, anthrax and botulinum toxin.² Other terrorist groups, like Osama bin Ladin's organisation, have indicated a strong interest in acquiring these agents as weapons.¹⁹

Bioterrorism-related incidents can be divided into threats, attempts to acquire and actual use. While there have been several suspected cases, no major terrorist attack with biological weapons has yet occurred.²⁰

Threats have included the January 1984 threat to release foot and mouth disease in Queensland, and threats during the Gulf War to release biological weapons in Europe and Canada.^{20,21}

Attempts to acquire biological weapons have included an attempt to blackmail a US Army officer for pathogens in the 1970s and an attempt by two Canadians to acquire botulinum toxin in 1984.^{20,22} Chicago members of the right wing group "Order of the Rising Sun" were arrested in 1972 for possession of 30–40kg of typhoid culture. The typhoid was intended for use in the water supplies of Chicago and St. Louis.²⁰

Alleged use of biological weapons includes the biological contamination of water holes during the Rhodesian war and small scale biological attacks by South Africa's Roodeplaat Research Laboratories against the African National Congress and other opponents.²¹

Various authors claim that there are many potential biological weapons occurring naturally in the environment or in legitimate medical research. They also claim that they can be developed with limited technical expertise, are easily concealed and transported, and can be disseminated with low technology devices.²⁰ Some argue that biological weapons may be the ideal terrorist "poor man's atomic bomb".²¹ Much of this reasoning is based in fact, but the final conclusion needs closer analysis.

Purver, in his 1995 paper for the Canadian Security Intelligence Service, has developed an analytical framework to review the alleged benefits of biological warfare agents for terrorist groups.²⁰ This framework, which covers acquisition, likely agents, production, means of delivery, and lack of use, forms a good basis for review of the potential bioterrorist menace.

Acquisition

Potential biological warfare agents can be acquired from natural reservoirs, stolen from medical or research facilities, bought from legitimate or "black market" suppliers, or procured from a "friendly" government.²⁰ While acquiring the agent from a natural reservoir may be advantageous from a

security standpoint, the more advanced technical skills required to sample, isolate and identify the organism may militate against its use. As most civilian biological research facilities have minimal physical security, terrorists could acquire cultures by subterfuge or theft.²² In Australia, anthrax, brucella, Q fever, botulinum toxin, melioidosis and ricin (derived from castor seeds) could be easily acquired from natural sources, hospital laboratories or research facilities.

Until relatively recently, many biological agents were readily available from the American Type Culture Collection (ATCC) and other supply houses.²³ In May 1995, Larry Wayne Harris, a member of the Aryan Nations white supremacist group, used forged credentials to order *Yersinia pestis* (plague) from ATCC. Fortunately, ATCC staff became suspicious and were able to recover the vials unopened.²⁴ Closer to Australia, the London *Sunday Times* allegedly received a commitment by Indonesia's Biofarma vaccine company to supply anthrax and plague cultures, no questions asked, as recently as November 1998.²⁵

While biological warfare agents are readily available in various national programs, the countries concerned are believed to be reluctant to supply terrorist groups because of fear of serious retaliation if linked to the attack, and a fear the groups may use them against the supplying country or an unauthorised third party.²⁰

Likely agents

Biological warfare agents include both pathogenic microorganisms and the toxins produced by living organisms, including animals, plants and microbes. In selecting a suitable agent, a terrorist group would need to consider its availability or the degree of difficulty in producing it, the ease of dissemination of the agent and the protection a defined population may have against it. Other factors that may need to be considered include the robustness of the agent, its detectability, contagiousness and potential uses.²⁰ The requirements for an agent designed for a small-scale attack will differ from those required for a large-scale attack.

So what are the likely agents? Bacterial agents are more likely to be used than either viruses or rickettsias due to cultivation and production problems with the latter.²² Toxins have the advantages of stability and, in some cases, toxicity and ease of manufacture.²² The most commonly agreed agents of concern are anthrax, brucella, plague, tularaemia, typhoid, botulinum toxin, ricin and Q-fever.^{20,21,22} In Australia, with the exception of tularaemia and plague, these agents are available from local sources. Given its availability, melioidosis should be added to an Australian list.

There has already been interest in some of these agents by different groups. Anthrax was one the agents the Aum sect researched²⁶ and was the basis for a series of hoaxes in the United States during 1998 and 1999.²⁷ Anthrax has also been the focus of many articles on bioterrorism.^{2,3,8} Plague

has also been of interest, as highlighted by the arrest of Harris in 1995. The Aum sect was interested in Ebola virus (sending an expedition to Zaire in 1992) and botulinum toxin.¹⁷ Cultures of botulinum toxin were seized from a Red Army Faction safe house in Paris in 1984.²² Ricin has also been studied by various groups. An Arkansas man was arrested in December 1995 with 130 grams of ricin, while two members of the Minnesota Patriots Council, a US anti-tax group, were convicted for the possession of ricin in 1995.^{15,17,26} Recently, Henderson, the Director of the Center for Civilian Biodefense Studies, has raised concern about the use of smallpox as a terrorist weapon.¹⁸ Henderson cites the previous successful Russian biowarfare effort to mass produce smallpox weapons, noting many of the scientists involved have moved on to other countries, some with their own biological weapons programs.¹⁸

On a positive note, most analysts believe that, at present, the terrorist use of genetically engineered organisms is unlikely, as greater technical skills would be required and the classical agents remain highly effective.²⁸

Production

While opinions vary, most authors believe that an individual or individuals with a modicum of technical skill could acquire the necessary expertise to produce biological weapons.²⁰ While terrorist groups in the past may not have had the necessary technical expertise,¹⁵ the previously esoteric skills required are now readily available. American industry employs around 60 000 biologists and there are nearly 1900 biotechnology companies in the United States and Europe.²⁴ This expertise, coupled with that available from scientists from past biological weapons programs, gives terrorist groups a plethora of capable people.¹⁸

Taking these biological agents to the next stage, the apocalyptic “bioarmageddon” scenario, is considerably more difficult. The necessary skills and equipment needed to identify a particularly pathogenic agent, to produce that agent in large quantities and to install that agent in weapons are far more difficult to procure.^{8,18} The two possible exceptions are anthrax and smallpox, which are easily produced and hardy microorganisms.¹⁸ Small amounts of agent could also be used successfully in more discreet attacks or assassination attempts, as highlighted by the murder of Georgi Markov in 1978 with a ricin-tipped umbrella.²⁰

Means of delivery

There are many means of delivering biological weapons. They could include dispersal of the biological agent as a vapour or aerosol, contamination of food or drink, direct contact (by injection or inoculation) or even by inoculating insect or other vectors.²⁰ However, most authors agree that effective delivery of a biological agent is more difficult than its production.²⁴ The drying and milling of the agent is considerably more difficult and has the potential to make the terrorist the first victims if not performed correctly.²⁴

Poisoning of a large water reservoir is not as simple as sometimes postulated. An attack would require large quantities of agent and still may not be successful due to problems with access to the site, hydrolysis and chlorination.^{20,29} An alleged South African attempt in 1989 to contaminate water supplies in Namibia with cholera was reported to have been foiled by the high chlorine content of the water.²¹

Tampering with food, particularly on the production line, may be a more viable option, but food processors’ concentrated efforts to prevent normal background chemical and biological contamination mean that food tampering is likely to have limited effect.

The use of vectors is both inefficient and difficult, as the terrorists are faced with two organisms that need to be maintained and contained.³⁰

The most commonly proposed means of terrorist delivery is by the use of some sort of aerosolisation process. Scenarios include the use of planes, trucks, and even ships, fitted with some type of cheap aerosoliser, spreading a biological cloud over a city.^{2,22} This process,

fortunately, is more difficult than it first appears.³¹ There are significant technical problems in keeping a biological agent in a cloud viable for long enough to infect or intoxicate the victim.²¹ Humidity, sunlight, smog, temperature and winds will all impact on the final dose received.³⁰ Even with a good technical background, the Aum Shinriyko terrorist group was unable to successfully aerosolise anthrax and botulinum toxin in Tokyo, despite a number of attempts.^{31,32} The variability of climactic conditions also means that it is difficult for terrorists to be sure of hitting their intended target by this means. An attack on the West Bank would be equally deadly to the Arab and Israeli communities.²²

A smaller scale attack confined to an enclosed area, including buildings with air-conditioning systems, domed sports stadiums and subway systems, is more feasible.²⁰ Indeed, the US Army demonstrated the effectiveness of



Blue-green algae produces a nasty hepatotoxin, microcystin.

spreading biological agents in simulated attacks on airports, bus stations and subway systems during the 1950s and 1960s.³³

The two biological agents cited as being of most concern are anthrax and smallpox. Anthrax is simple to produce, very stable in a dried form, easy to disperse and lethal.³⁴ In 1979, an accidental release of spores from a military bioweapons facility in Sverdlovsk, Russia, led to the death of 66 people. Meselson, in his review of this incident, estimated that less than one gram of anthrax spores was released.³⁵ Release of larger quantities could be devastating. Smallpox, given its highly infectious nature and the current lack of protection against it, would be even worse. While smallpox is not readily available, there are concerns that there may be other storage sites for the virus apart from the Russian State Research Centre of Virology and Biotechnology facility in Koltsovo, Novosibirsk, and the Centers for Disease Control

and Prevention in Atlanta, Georgia.^{34,36} Should smallpox become more available, its role as a possible bioterrorism agent would have to be reassessed.

Lack of use

Various theories have been proposed for the lack of use of biological weapons by terrorists. Hoffman cites a lack of innovation in the groups and a desire to limit the number killed.¹⁵ Purver contends that the inherent unpredictability of biological weapons, personal fear of biological agents, fear of collateral damage to friends, anticipated governmental response to an attack and a general satisfaction with current measures have all contributed to the terrorist's reluctance.²⁰ Most analysts agree, however, that with the growth of religious terrorism and availability of agents this situation is unlikely to last.^{18,20}

Effects, prophylaxis and treatment of biological warfare agents

Agent	Incubation period	Symptoms and signs	Prophylaxis	Treatment
Inhalation anthrax	1–6 days	Fever, severe respiratory distress, widened mediastinum	US licenced vaccine	Ciprofloxacin, doxycycline
Botulinum toxin	1–5 days	Ptosis, cranial nerve signs, symmetrical descending flaccid paralysis	US Investigational New Drug vaccine	Trivalent antitoxin
Brucella	5–60 days	Irregular fever, headaches, arthralgias, myalgias	No vaccine	Doxycycline and rifampicin
Cholera	4 hours–5 days	Vomiting, abdominal cramping, voluminous diarrhoea	Australian vaccine — limited efficacy	Tetracycline, doxycycline, ciprofloxacin
Glanders	10–14 days	Fever, pleuritic chest pain, papular-pustular rash	No vaccine	Sulfadiazine
Pneumonic plague	2–3 days	Fever, headache, severe respiratory distress	Australian vaccine — limited efficacy	Streptomycin, doxycycline
Q-fever	2–14 days	Fever, cough, pleuritic chest pain	Australian Q-Vax vaccine	Tetracycline, doxycycline
Ricin	18–24 hours	Fever, cough, pulmonary oedema	No vaccine	No specific therapy
Smallpox	7–17 days	Fever, headache, pustular centrifugal rash	Vaccinia vaccine	Vaccinia immune globulin
Tularaemia	1–21 days	Fever, headache, prostration, weight loss	US Investigational New Drug vaccine	Streptomycin, gentamycin

Source: Eitzen E, Pavlin J, Cieslak T, et al. Medical management of biological casualties handbook. 3rd ed. Fort Detrick: USAMRIID, 1998.

Potential results of bioterrorism

A successful bioterrorist attack might be disastrous. Even a relatively small attack might quickly overwhelm medical capabilities.³⁷ Death and disease would be only part of the problem. The panic, quarantine, evacuations, rioting and looting that might follow would impact greatly on the infrastructure and operations of any country. In 1994, over half a million people fled the Indian city of Surat because of a suspected pneumonic plague outbreak.³ The economic impact might also be monumental. Kaufmann has modelled the economic impact of a bioterrorist attack, showing that for every 100 000 persons exposed the financial impact could range from \$477.7 million for a brucella attack to \$26.2 billion for an anthrax attack.³⁸

Defence against biological terrorism

Defending against biological terrorism is a daunting task. Unlike chemical or nuclear weapons, the current biodetection systems are limited in their scope and availability, so emphasis has to be placed on other measures. Sensitivity analysis has shown that preventive programs are cost-effective in defending against biological terrorism.³⁸ Defensive measures can be grouped into four main areas.²⁰

Intelligence gathering

This intelligence gathering, with appropriate funding,³ should focus on monitoring terrorist groups of concern and their state sponsors, the movement of microbiological equipment and the cataloguing of epidemics as a baseline.^{39,40} The ProMED internet epidemic surveillance system has been very effective in establishing baseline data. Links should be established between intelligence agencies and the medical community,³⁹ and all agencies should ensure that information is shared to assist in creating a coherent picture of the problem.⁴⁰

Counter-acquisition strategies

Countries must both threaten, and be willing to carry out, massive retaliation against terrorists and their state sponsors should biological weapons be used.⁴⁰ Economic and moral pressure should be brought on “rogue” states to comply with international conventions, including the Biological Weapons Convention.³ The availability of dangerous microorganisms, including smallpox, must be tightly controlled and attempts to trade in this area should be universally condemned.^{25,41}

Police and customs officers also require the necessary training to identify these biological agents and the equipment required for their production and transport.²⁰

Passive protection

New, innovative and rapid biological detection systems are a cornerstone of early and appropriate response.⁴⁰ Similarly, effective disease surveillance systems are critical. Adequate epidemiology and pathology resources are key facets of this surveillance.⁴² As Cohen et al eloquently argue, funding of national and international public health systems which can adequately detect natural disease outbreaks will be far more beneficial than narrowly focused and ill-conceived antibioterrorism programs.⁴³ Protection should also cover the stockpiling of vaccines and therapeutic agents; improved water supply, air-conditioning and food production security; development of better individual protection equipment; and increased research into medical defences against biological weapons.^{20,26}



A staff member at the US Army Medical Research Institute of Infectious Disease working in a fully encapsulated suit in the biosafety level 4 laboratory.

Consequence mitigation

Finally, there must be work on measures that mitigate the effect of an attack. These measures should include better and more specific biological disaster planning, public health coordination, and evacuation planning.²⁰ Above all, the emergency and medical services require education and training in responding to bioterrorism.^{26,42}

Overseas response

With some notable exceptions, very few countries have grappled seriously with the threat of bioterrorism.³² In the United States, Congress unanimously approved the setting up of a Department of Defense Domestic Preparedness Program in 1996, with an initial budget of \$150 million.^{41,44} The Chemical and Biological Defense Command was tasked to help cities and State governments get ready for a chemical or biological terrorist attack. Simulations have already shown the various and potentially devastating problems posed by bioterrorism.⁴¹ National Guard rapid response teams have been established and Defense is training first-response teams in 120 of the largest US cities.⁴⁵

The US military already has considerable chemical/biological counterterrorism technology expertise. The Technical Escort Unit (TEU) provides worldwide expertise in recovering and neutralising chemical and biological weapons, while the Chemical/Biological Antiterrorism Team is responsible for developing the hardware for TEU and other units to carry out their role.⁴⁶

Despite this investment, both the Congress and the Government Audit Office are concerned that the money allocated for terrorism defence is not being appropriately targeted towards biological and other terrorist threats.^{41,47} Many believe that a biological terrorist attack in the United States is inevitable and that the country remains unprepared.

The Australian perspective

Australia faces the challenge of many developed nations: the face of terrorism is changing and Australia, like most countries, is unlikely to be immune in future. The move to religious terrorism increases the probability that future terrorist attacks will involve biological or chemical weapons. Improved technical skills and equipment make a bioterrorist attack both more probable and more likely to be successful, particularly if done on a small scale. Australia has been underprepared for biological terrorism but is now addressing the problem. Given the imminent Olympic Games in Sydney this year, it is a problem that requires due consideration.

The Australian Defence Force has made substantial progress in this area since the Gulf War. The ADF is able to decontaminate and render safe chemical and biological munitions while protecting its forces through detection systems, protective equipment, medical countermeasures and research. Doctrine for the management of biological munitions and casualties has been developed, and instructors, specialist advisers and medical officers have been trained. Such preparations are focused on troops in the field and not on terrorist threats.

The civilian community, however, has been generally underprepared. Until relatively recently, there was no policy, training or planning in this area. An effective epidemic surveillance and national public health network were the only preparations. In 1998, the Australian Medical Disaster Coordination Group identified major deficiencies in the preparations for a chemical or biological terrorist attack and has set out, with Emergency Management Australia, to rectify these deficiencies. Doctrine for the management of chemical and biological casualties is being developed and a training program for medical staff commenced late last year. Various States have looked at the contingency planning, training, protective equipment and detection requirements of such preparations.

Sharp, in his review of medical preparedness for the 1996 Atlanta Olympics, outlined the resources available to counter a biological weapons attack.⁴⁸ They included a specialist site assessment team, a science and technology centre to provide technical support, stockpiles of antimicrobials, specialised



Training in ADF mark 4 suits and S10 masks, December 1998 — part of medical officers' nuclear, biological and chemical defence training.

training for first-responders, enhanced public health surveillance, and a Chemical Biological Incident Response Force to decontaminate and stabilise casualties.⁴⁸ The Australian bioterrorism emergency response infrastructure is being progressively developed and should be equal to world's best practice by the time of the 2000 Olympic Games.

Bioterrorism will not disappear as a potential problem and will remain an area of political and media interest. Fortunately, the successful completion of even a small scale attack is far more difficult than portrayed by much of the media. Yet even a very limited attack may have a major effect, because the resultant panic may severely hamper emergency responses. The Australian medical and emergency response communities have finally started to face the threat and will be better prepared to face both the bioterrorist and emerging exotic disease challenges of the new century.

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