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CHAPTER 37

Microbial Forensics in Australia—The Australian Federal Police Perspective

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INTRODUCTION

"Domestic Crime to International Terror: Forensic Science Perspectives"

This was the theme of the Australian and New Zealand Forensic Science Society's 19th International Symposium on the Forensic Sciences held at the Melbourne Convention Centre, October 6–9, 2008 (1). This theme aptly embodies the underlying ethos in contemporary forensic practice in Australia. Terrorism is a crime and is not new; rather, it has been elevated into public and political prominence through a series of major incidents. Examples include the sarin gas attack on the Tokyo subway in 1995, the Oklahoma City bombing in 1995, the 9/11 suicide attacks on the World Trade Center and Pentagon in the United States in 2001, and the 7/7 suicide attacks on London's public transport system in 2005. Australia has also been targeted by terrorist organizations; the Bali bombings in 2002 and 2004 and the bombing of the Australian embassy in Jakarta in 2005 are examples of successful attacks against Australian citizens and Australian interests, albeit offshore. In common with other countries, Australia has also had a number of domestic plots that have been thwarted in the planning phase.

Although devastating, the effects of terrorist acts of this nature are relatively short-lived and localized and are unlikely to impart a long-term influence on a community or economy. However, the anthrax attacks in the United States in 2001, and the subsequent hoaxes that followed in countries across the globe, demonstrated that acts of bioterrorism have the potential to do enormous harm to populations, infrastructure, and economies (2–5). Biological agents

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such as *Bacillus anthracis*, the causative agent of anthrax, can persist in the environment for decades (6), thereby presenting an ongoing risk of infection that can prevent the reoccupation of contaminated areas unless costly decontamination processes are undertaken (7,8). Other biological agents, such as *Yersinia pestis*, the causative agent of pneumonic plague, are highly infectious; hence the risk to the public can spread far beyond the original site of dissemination (9). Physical harm aside, the psychological impact of bioterrorism is enormous (5,10). This is understandable given that human history is peppered with descriptions of disease epidemics that have killed millions of people (e.g., 11–14); plague and smallpox are probably the most notable of all epidemic-causing agents. Not surprisingly, these organisms feature high on government lists of potential biological agents that could be used for acts of bioterrorism (e.g., 15,16, Table 37.1). History also shows that the conduct of acts of bioterrorism and biocrime is not limited to extremist groups and international terrorist organizations but can equally be perpetrated by disgruntled nationals (17). Indeed, the anthrax attacks in the United States in 2001 are examples of how a trusted insider was likely responsible for terrorist acts (18).

Since the anthrax attacks in the United States in 2001, most developed countries have sought to embed microbiology into forensic practice. Australia is no exception. This chapter focuses on the approach taken by the Australian Federal Police

Table 37.1 List of Security-Sensitive Biological Agents Regulated under SSBA National Regulatory Scheme[a]

Tier 1 Agent	Tier 2 Agent
Abrin (reportable quantity 5 mg)	African swine fever virus
Bacillus anthracis (anthrax-virulent strains)	Capripoxvirus (sheep pox virus and goat pox virus)
Botulinum toxin (reportable quantity 0.5 mg)	Classical swine fever virus
Ebolavirus	*Clostridium botulinum* (botulism; toxin-producing strains)
Foot-and-mouth disease virus	*Francisella tularensis* (tularemia)
Highly pathogenic influenza virus, infecting humans	Lumpy skin disease virus
Marburg virus	Peste-des-petits-ruminants virus
Ricin (reportable quantity 5 mg)	*Salmonella typhi* (typhoid)
Rinderpest virus	*Vibrio cholerae* (cholera) (serotypes 01 and 0139)
SARS coronavirus	Yellow fever virus (nonvaccine strains)
Variola virus (smallpox)	
Yersinia pestis (plague)	

[a]*Australian Government. Department of Health and Aging. Security Sensitive Biological Agents List. Available from: http://www.health.gov.au/SSBA#list.*

(AFP) and its role in the whole of government response to bioterrorism, to incorporate microbiology as an additional forensic discipline, as an additional form of investigation, and as an additional skill in routine forensic practice.

THE THREAT OF BIOTERRORISM IN AUSTRALIA

On December 9, 2009, the national counterterrorism alert level for Australia was medium (19), on a four-tier scale of low, medium, high, and extreme. This indicates that a terrorist act could occur; hence risk management should take place. Australia has been at a medium level of alert since the four levels of national terrorism alert were introduced in 2003. The threat of bioterrorism is not separately published by the Australian government; nevertheless, it must be considered, as no public health or security system can guarantee complete safety from a bioterrorism attack (20).

Emergency response crews across Australia respond to potential incidents of bioterrorism on a regular basis. The bulk of responses are to false alarms or nonhazardous white powder threats and hoaxes. Like other developed countries across the globe, Australian emergency services experienced a flood of white powder callouts following the anthrax-letters attacks in the United States in 2001 (21). As public anxiety gradually reduced, the frequency of callouts reduced in parallel and, with few exceptions, have maintained at the consistent manageable level that is currently experienced. Anecdotal evidence suggests frequencies spike from time to time in accordance with emotional public events and other incidents that occur around the world.

There is no public record of any incidents of bioterrorism within Australia; however, there have been incidents where nonpathogenic endospore-containing powders have been used as threats. Not surprisingly, these have evoked a higher level of concern to authorities than incidents that involve the innocuous powders that are commonly used, such as flour and talcum powder.

Regardless of the low level of risk, threats and hoaxes are taken seriously by Australian authorities. Indeed, one of the main reasons for the establishment of the Australian Chemical, Biological, Radiological and Nuclear (CBRN) Data Center was to provide a central repository in which records of suspicious substance incidents could be collated and analyzed to provide support to law enforcement in their endeavor to track down and prosecute these public menaces.

THE AUSTRALIAN CBRN DATA CENTER

Established in 2007, the Australian CBRN Data Center is one of three data centers in the Forensic and Data Centers Portfolio of the AFP, the other two being

the Australian Bomb Data Center and the Australian Illicit Drug Data Center. The objective of the Australian CBRN Data Center is to enhance Australia's capability to prevent, prepare, and respond to the malicious use of CBRN agents within and against Australia and its interests. It does this by bringing together technical, intelligence, and law enforcement capabilities related to CBRN threats.

One of the main roles of the center is to be the national repository for CBRN incident information and intelligence and to provide technical advice to support prevention, preparedness, and response issues related to CBRN material. Specifically, the center collects and assesses data from all sources about CBRN agents, their precursors, and methodologies required to prepare and disseminate them. It assesses the availability of the agents and the feasibility and impact of their misuse in Australia, conducts trend analysis on threats, and evaluates new and emerging technology and methodology (22).

The Australian CBRN Data Center has strong links with the Australian Public Health Laboratory Network, which includes representatives from major public health diagnostic laboratories in all Australian jurisdictions, as well as health departments and agencies at the commonwealth and at state and territory levels. (Note that the Commonwealth of Australia consists of six states and two major territories, all of which are self-governing, and a number of smaller territories under the administration of the Commonwealth government.) The center conducts analysis and provides advice on biological threats as they pertain to the malicious use of biological materials or the deliberate spread of disease (22).

The center is an integral component of AFP criminal investigations and forensic operations, providing a link among the policing, forensic, and intelligence communities, allowing AFP operational portfolios to prepare for potential threats in a pre-emptive and proactive manner. It is also an integral component of emergency responses being available to provide technical advice on an around-the-clock basis.

THE AUSTRALIAN FEDERAL POLICE AND ITS ROLE IN PREVENTING, COUNTERING, AND INVESTIGATING TERRORISM

The AFP is Australia's national policing agency, enforcing commonwealth criminal law and protecting commonwealth and national interests in Australia and overseas (23). The AFP also provides community policing services to the Australian Capital Territory, Jervis Bay, and external territories; contributes to the Australian government's international law enforcement interests such as regional peacekeeping and regional capacity building; and provides the security for major Australia airports. The AFP works closely with other law enforcement

bodies at state and territory, commonwealth, and international levels to fight multijurisdictional and transnational crime and to contribute to global security. The prevention of terrorist attacks in Australia and on Australian interests overseas is a high priority for the AFP and its partner agencies.

The role of the AFP in the coordinated nationwide effort to counter terrorism and its consequences is outlined in the Australian National Counter-Terrorism Plan (24). In essence, the primary responsibility to prevent, counter, and respond to acts of terrorism resides within the jurisdictions. The nature of terrorism means its implications may cross jurisdictional boundaries and hence requires a cooperative interjurisdictional coordination of capabilities. As such, each of the states and the two self-governing territories within Australia have a capability to investigate, respond to, and prosecute acts of terrorism, which includes the capability to detect and identify biological agents that could be used for terrorist and criminal purposes. This capability is coordinated through the Australian (Counter) Bioterrorism Laboratory Network (ABLN), which contains representatives from key public health, defense, and law enforcement laboratories, as well as health departments and agencies at the commonwealth, state, and territory levels, and includes the AFP forensic laboratory and the Australian CBRN Data Center. The ABLN is administered by the Department of Health and Aging, the commonwealth government agency that administers the coordination of health systems within Australia. The role of ABLN is to advise on issues relating to the detection and analysis of security sensitive biological agents (SSBAs) and to establish, maintain, and expand collaborative links between public health and law enforcement agencies.

THE AUSTRALIAN FEDERAL POLICE MICROBIAL FORENSICS PROGRAM

Most of the traditional forensic disciplines, such as fingerprints, chemistry, biology, and pathology, have been entrenched as forensic disciplines and are applied commonly in criminal investigations. Microbiology is also an established discipline but until recently has rarely been used in forensic application. In the quest to integrate microbiology into forensic operations, the AFP faced the reality that the law enforcement community had virtually no experience with microbiology and, conversely, the microbiology community had virtually no experience with forensic application or law enforcement. The AFP solution was to establish a basic microbiology capability in-house and then to promote partnerships with diagnostic and specialized laboratories for more intensive investigations. The AFP emphasis is on extending the capability for screening and preliminary identification of potential biological agents at the scene beyond that of first responders. The role of the AFP also includes application of normal forensic procedures from the crime scene to the laboratory.

The feasible presence of a microbiological agent does not alter, or reduce, the need to recognize, record, and recover all potential forensic materials and to maintain the integrity of the evidence from the crime scene to the laboratory and through analysis. With that said, the possible presence of a microbiological agent does have implications for these processes.

Within Australia, the expertise needed to identify and discriminate biological agents of human significance largely resides in public health diagnostic laboratories that have PC3 (i.e., BSL3) and/or PC4 (i.e., BSL4) laboratory containment facilities for culture. One notable exception in the law enforcement community is the police laboratory within the state of New South Wales, which has established a PC3 laboratory specifically for forensic analysis and culture of suspicious biological substances. Logically, partnering of law enforcement and diagnostic laboratories is an important aspect of a microbial forensic capability. In this respect the AFP and the Australian CBRN Data Center work closely with major jurisdictional public and animal health laboratories, as well as health departments and agencies at the commonwealth and at state and territory levels, to ensure that this capability is available to assist law enforcement. In a similar manner, the AFP and Australian CBRN Data Center encourage and support research conducted within academia, industry, and other government departments that have the specialized skills and knowledge required to conduct detailed characterizations of biological agents. The AFP and Australian CBRN Data Center also work closely with international law enforcement partners in the United Kingdom, Canada, and the United States. Indeed, the expertise, experience, and cooperation of international partners are important aspects of the Australian microbial forensic capability.

The forensic operations arm of the AFP itself has a basic but sound microbial forensic program. The program spans all aspects of forensic operations from sample collection to the interpretation of results from the laboratory. In this respect the program is multilayered. The AFP has a general capability across all forensic disciplines to conduct investigations and examinations in chemical and biological (CB) contaminated environments. This capability extends to all AFP personnel required to enter a scene that may contain hazardous substances. This practice is applied in a manner in which all hazards are considered—chemical, biological, radiological, nuclear, and explosives (CBRNE). With that said, the AFP requires the assistance of personnel from the Australian Nuclear Science and Technology Organization (ANSTO) and the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) to conduct investigations and examinations in environments containing radiological and nuclear (RN) hazards and to examine evidence that contains RN hazards. Crime scene personnel and laboratory staff are trained to enter CB contaminated environments in various levels of personal protective equipment to process exhibits and scenes, collect appropriate evidence, and document accordingly. AFP scientists regularly exercise with personnel from

other emergency agencies, such as the fire brigade and ambulance, and from ANSTO and ARPANSA to coordinate efforts at the scene and ensure that the scene is processed logically and thoroughly in a manner that will best collect pertinent evidence and thus can withstand strict legal scrutiny. Exhibit packaging, decontamination of packaged exhibits, chain of custody, and exhibit transport, receipt, security, and storage are protocols that are all well established. Where possible these are identical to or closely follow existing practices. This is important, as in a multiagency response situation, procedures are more likely to be followed when they are already normal, embedded best practice. Where the decontamination of exhibits is required prior to laboratory examination, the AFP seeks expertise from other ABLN laboratories that have relevant experience with the decontamination of exhibits.

The AFP also has a basic capability to detect and identify biological agents. This capability provides a presumptive level of identification for a number of biological agents, including *B. anthracis* and ricin, the two biological agents reported most frequently in the media. The AFP approach is to take this analytical capability to the scene rather than bringing samples back to the laboratory for analysis. This approach provides a higher degree of certainty of identification early in the processing of a scene, thereby allowing scene examiners to process the scene in accordance with the type of agent present. This analytical capability is housed primarily within a mobile laboratory, which can be deployed to a scene or used on base. The detection capabilities used within the Mobilab are also deployable separately. The AFP also has a laboratory for the triage of potentially contaminated exhibits, thereby minimizing the risk of contamination of the main laboratory. The mobile laboratory and triage laboratory are discussed in more detail later.

Quality management is treated no differently from other forensic capabilities within the AFP. All protocols and equipment within the microbial forensic program, whether field or laboratory based, are validated, reviewed, tested, and maintained in accordance with the AFP FDC quality management framework and are accredited to International Standard ISO/IEC 17025:2005. Compliance is tested by the National Association of Testing Authorities, Australia (NATA) (25), to the aforementioned standard and supplementary requirements for accreditation in the field of forensic science. In this respect, the AFP microbial forensic program is the only forensic microbiology capability in Australia accredited under the standard NATA forensic science program. In this manner, evidence collected and analyzed within the AFP microbial forensic program meets the same standards of admissibility as traditional forensic evidence. In comparison, public health laboratories are accredited under the NATA medical testing program, and other laboratories involved in microbiological analysis of forensic evidence are accredited under the NATA veterinary testing or biological testing programs. Some of these laboratories have included the NATA forensic science module to assist with the provision of chain of custody procedures and court testimony capability.

THE AUSTRALIAN FEDERAL POLICE MOBILE AND TRIAGE LABORATORIES

Most AFP forensic capabilities have a fundamental need to be mobile. AFP forensic operations provide support to all AFP operational areas, including those in the Australian Capital Territory, the major Australian airports, embassies and consulates within Australia, most Australian embassies, and the Christmas, Cocos, and Norfolk Islands. The AFP also provides police and forensic assistance to countries in southeast Asia, Australasia, and the Pacific. Until recently, forensic services have largely been provided through the deployment of portable detection and analysis equipment, which have been set up in temporary laboratories at, or near, the site of an incident. In 2006 the AFP commissioned a mobile forensic laboratory to complement deployable capability. The ultimate aim of the mobile laboratory is to provide a safe, secure, and clean laboratory that can be deployed by road, rail, or air virtually anywhere in the world.

The primary purpose of the mobile forensic laboratory, known as the Mobilab, is to facilitate rapid on-site screening for chemical and biological agents in cases of suspected CB incidents. With that said, it is also suitably equipped to assist the forensic investigation of other incidents that are chemical in nature, such as those that involve illicit drugs, toxic industrial chemicals, explosives, and accelerants and those that require the analysis of environmental samples. Further, the Mobilab can be equipped according to requirement and hence can enhance the deployment capability of most forensic disciplines.

The Mobilab is a large caravan fitted with two independent compartments (Figure 37.1). Compartments are accessed from the outside by external air-tight doors and between compartments with an internal air-tight door. The laboratory is powered through two shore power connections or two onboard diesel generators. Water is supplied via a town water connection through a standard hose fitting or an onboard 110-liter water tank. An identical tank holds waste water for decontamination prior to disposal. Both cabins are fitted with recycled air conditioning units, and an air management system provides the capability to establish air pressure gradients between the compartments and the compartments and the external atmosphere. Variable speed intake and exhaust fans, fitted with high-efficiency particulate air (HEPA) filters, make it possible to create negative or positive atmospheric pressures in each compartment. Positive pressure differentials are created to minimize contamination of the cabins from environmental contaminants. This is useful during investigations such as those for trace levels of explosives and is particularly useful during transport on roads where dust is a problem. Negative pressure differentials are used to contain contaminants within the laboratory. In this manner, PC3 (i.e., BSL3) laboratory-level atmospheric pressure gradients

FIGURE 37.1
The Mobilab.

are created for the analysis of samples from possible biological incidents. In this application the rear compartment is used as the PC3 laboratory and the forward cabin is treated as the antechamber.

The rear compartment is designed primarily for the analysis of biological samples and for initial processing of suspicious samples. It houses a large Class 3 biological safety cabinet (Figure 37.2), which has a HEPA-filtered intake duct and a series of two HEPA filters and a TEDA carbon filter on the exhaust duct. This allows both biological and chemical specimens to be examined safely. The Class 3 biological safety cabinet also has an internal power outlet and a USB port, allowing computer analysts to interrogate contaminated computers and other electronic data storage devices. It also has a nitrogen outlet so that chemists can concentrate samples prior to chemical analysis if required. Nitrogen can also be used to evacuate oxygen from the cabinet in the event of fire within the cabinet; as an inert gas, nitrogen is also used to conduct leak tests on the cabinet. The rear compartment also houses a small Class 2 biological safety cabinet, a stainless steel sink, and a small amount of bench space (Figure 37.3).

The larger forward compartment is fitted with significantly more bench and storage space. The forward compartment is used for chemical analysis, report writing, electronic communications, general laboratory techniques (Figure 37.4),

FIGURE 37.2
Class 3 biological safety cabinet in the rear compartment of the Mobilab.

FIGURE 37.3
Rear compartment of the Mobilab showing sink, available bench space, and Class 2 biological safety cabinet.

FIGURE 37.4
Forward compartment of the Mobilab showing GC-MS/DFPD and available bench space.

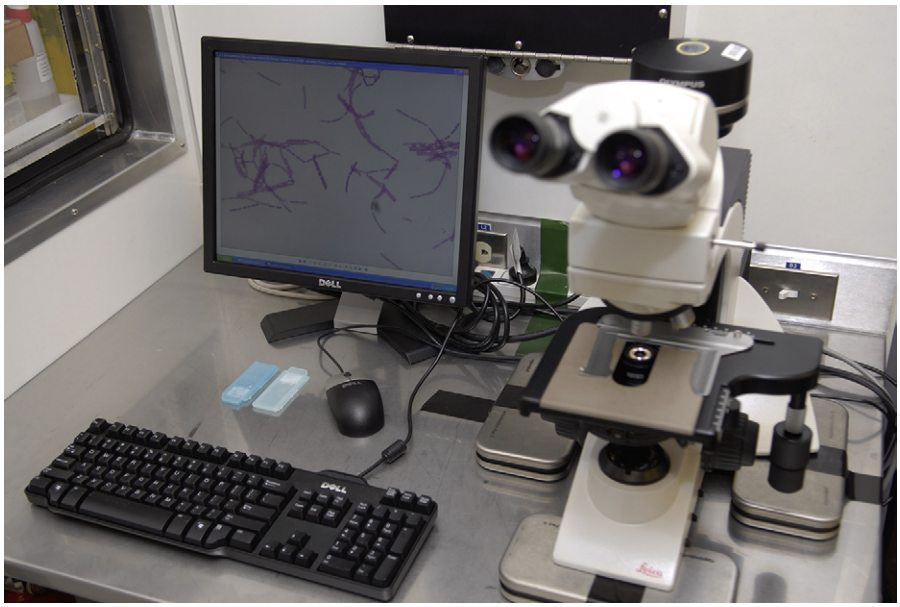

FIGURE 37.5
Microscopy bench in forward compartment of the Mobilab.

and microscopy (Figure 37.5). A small refrigerator/freezer is located under the bench and is maintained by a bank of onboard batteries when generator power or shore power is not available. Gas lines for helium, hydrogen, nitrogen, and air span the walls of the forward compartment, all of which are plumbed into gas cylinders housed in a cylinder cupboard mounted on the drawbar of the trailer. The only instrument that is mounted permanently within the Mobilab is the combination gas chromatograph, mass spectrometer, and dual flame photometric detector for sulfur and phosphorous (GC-MS/DFPD) (Figure 37.4), which is used for the analysis of organic chemicals, including chemical warfare agents. Other equipment is imported as required.

The Mobilab has been accredited by NATA under ISO/IEC 17025:2005 as a static and mobile forensic testing laboratory. The Mobilab is also a member of the recently created Chemical Warfare Analysis Laboratory Network (CWALN). This allows the laboratory to provide presumptive-level identification of chemical warfare agents. Laboratory facilities, ventilation, protocols, and work practices are compliant with the Australian Standard AS/NZS 2243.3:2002 for a PC2 laboratory as a minimum. The laboratory can be deployed within an hour of notification and is fully operational within 2 hours of arrival; this includes cleaning, setting up, initializing, and quality checking of instruments and background checks for contamination. Laboratory procedures are tailored and practiced to return results to investigators within 60–90 minutes of

FIGURE 37.6
Mobilab garaged on base immediately adjacent to the ERTL.

receipt of sample. Information on the Mobilab, Mobilab procedures, and integration of the Mobilab into the investigation of hazardous materials incidents is presented in more detail in other publications (26,27).

While on base, the Mobilab is garaged immediately adjacent to the evidence recovery and triage laboratory (ERTL) (Figure 37.6) and is used as the analytical laboratory for samples taken from exhibits being processed in the ERTL. The ERTL is a stand-alone laboratory, which, as the name suggests, is used as a triage for exhibits being received into the main forensic laboratory. Triaging may be performed if it is suspected that exhibits contain, or are contaminated with, trace levels of CBRNE. This minimizes the risk of contamination of the main laboratory, ensuring that routine forensic investigations are not disrupted by investigations of this nature. The ERTL is a PC2 laboratory that in the event of a biological incident can be ramped up to mimic a PC3 laboratory level of containment. The ERTL houses a large Class 3 biological safety cabinet in the same format as that in the Mobilab (Figure 37.7), two large Class 2 biological safety cabinets, and a large fume hood that can accommodate four scientists simultaneously (Figure 37.8). Fume hood exhaust is passed through two HEPA filters and a charcoal filter prior to release into the atmosphere. When the fume hood is running, the atmospheric pressure within the ERTL is

FIGURE 37.7
View of the ERTL showing Class 3 biological safety cabinet.

FIGURE 37.8
View of the ERTL showing Class 2 biological safety cabinets and fume hood.

strongly negative, which assists with the containment of potentially hazardous materials. The ERTL is also used when exhibits require analysis by scientists from a number of disciplines. The simultaneous examination of complex exhibits by multiple scientists is more efficient than consecutive examinations and also provides a forum through which plans can be developed to maximize the recovery of evidence. A third important use of the ERTL is as a surge capacity laboratory. Utilization of the ERTL for investigations that require the processing of large numbers of exhibits allows examinations to be conducted with less impact on the normal operation of the main laboratory.

NATIONAL REGULATORY SCHEME FOR BIOLOGICAL AGENTS OF SECURITY CONCERN

In September 2007, new legislation was passed in the Australian Parliament to enhance the security of biological agents in Australia. Part 3 of the *National Health Security Act 2007* (28) introduces a national regulatory scheme for biological agents of security concern. The list of SSBAs regulated under this legislation is shown in Table 37.1. Agents on the list are derived from the Council of Australian Governments (COAG) Report on the Regulation and Control of Biological Agents, from which the COAG biological agents list was developed in 2006 (29). In the process of developing the list, nearly 200 biological agents were considered. The review included an assessment of terrorist interest, availability of the agent, ease of production, ease of dissemination for threat, morbidity/mortality of the agent, transmissibility of the agent, and difficulty to treat for consequence (30). The list was divided into two tiers—tier 1 agents, which pose the highest security risk to Australia, and tier 2 agents, which pose a high security risk. The regulatory scheme was implemented by the Australian Department of Health and Aging in January 2009 for tier 1 agents and January 2010 for tier 2 agents. An important component of the regulatory scheme is the national register of Australian entities handling SSBAs. The scheme also provides an instrument through which the government can evaluate whether entities have legitimate purpose to handle SSBAs. If approved, entities must comply with the act's regulations and relevant standards, and all entities that handle SSBAs, temporarily or otherwise, must abide by the mandatory reporting requirements.

The National SSBA Regulatory Scheme applies to all laboratories that handle SSBAs with the exception of law enforcement laboratories, which are exempt but only to carry out their functions under commonwealth, state, or territory law. Law enforcement laboratories are not exempt if they hold SSBAs for use as reference samples or controls for analytical or diagnostic purposes.

From the perspective of the AFP, implementation of the National SSBA regulatory scheme is an important milestone in the effort to reduce the risk of

bioterrorism and biocrime in Australia. The exemption provided by the *National Health Security Act 2007* allows law enforcement agencies to carry out their functions under commonwealth, state, or territory law. Where possible, the AFP microbial forensic program utilizes noninfectious simulants, nonviable or nonpathogenic organisms, noninfectious products of pathogens, and inactive toxins or nontoxic subunits as controls and references; when needed, the AFP enlists assistance and expertise from ABLN laboratories.

POTENTIAL EXPANSIONS TO THE AUSTRALIAN FEDERAL POLICE MICROBIAL FORENSIC CAPABILITY

One of the primary objectives of the Mobilab is to provide a detection and presumptive level identification capability for biological agents within 60–90 minutes of the receipt of a sample (26,27). Technologies that are currently used or are under development for use in the Mobilab include microscopy, colorimetric assay, immunoassay, capillary electrophoresis, and nucleic acid analysis. The application of GC-MS for the detection of biomarkers such as ricinine (31) and abrine (32) is also under investigation. Fourier transformed infrared spectrometry is often used when it is confirmed that a suspicious powder is not biological in nature or an explosive but the identity of the powder remains unknown.

Microbiological culture is not performed within AFP laboratories and is not being considered in the immediate future. The AFP recognizes that culture is currently considered the gold standard for the identification of biological agents; however, it has been avoided in favor of faster, albeit presumptive level identification technologies that can be taken to the scene. With that said, a new laboratory-based technology that the AFP is planning to investigate in collaboration with overseas partners is the use of multilocus polymerase chain reaction and electrospray iononization–mass spectrometry to obtain confirmatory level identification of biological agents directly from samples without the need for culture. This technology shows enormous promise, is attracting considerable interest, and has direct application in clinical and forensic disciplines (33–37).

THE AUSTRALIAN FEDERAL POLICE IN THE WHOLE OF GOVERNMENT APPROACH TO BIOTERRORISM

The formal application of microbiology to answering questions of forensic relevance is still relatively new but has evolved considerably since the emergence of microbial forensics as a discipline. The U.S. anthrax incidents in 2001 and

their extensive subsequent investigation certainly highlighted many important aspects and issues for any future major microbiological incident. Although only a small number of people died as a result of the U.S. anthrax incidents, the scale of the consequences, economic and otherwise, were almost tsunami-like in their impact and effect. The incident classically illustrated the need to treat such an incident as a whole of government (or at least multiagency) response. With respect to the forensic dimension, this also needed to be managed in a broad and holistic way.

Australia authorities have attempted to learn lessons from such incidents. In common with the experience of many countries, Australia experienced a wave of anthrax-related scares and hoaxes in the aftermath of the U.S. incident (21). This necessitated the rapid development of response protocols and procedures based on existing assets, which, in the early days following the U.S. anthrax letters, were informed and enacted by an immature response community. This is no longer the case. Australia has been proactive in putting in place appropriate protocols and procedures at a whole of government level, with the overall control residing with the Australian National Counter Terrorism Committee (NCTC). As the lead commonwealth law enforcement agency, the AFP has an important role in realizing the goals and objectives of the NCTC and the commonwealth government. As the only broad-based forensic provider for the commonwealth, forensic responsibilities also reside with the AFP. Given the federal nature of Australia, this necessarily means that the AFP works in concert with state and territory counterparts. The Australian National Institute of Forensic Sciences (NIFS) plays an important role in co-ordinating forensic science in Australia, and CWALN has been established under the NIFS framework.

The AFP has had almost a decade to evolve its model for a forensic microbiology capability. The AFP model is intended to be capable of meeting the needs of Australia while recognizing the AFP's broader role as Australia's representative on appropriate international fora. There are unique aspects of the AFP model but also elements that are similar in approach to those developed in many other countries. This is to be expected and indeed it is to be encouraged, as there is no mileage in reinventing the wheel. The challenges and issues are mostly common, and it should be no surprise that common solutions will continue to emerge.

Perhaps the most unique part of the AFP approach is interoperation of the Australian CBRN Data Center and AFP forensic operations. This is enhanced by the placement of these units under one portfolio and under one senior manager. This structure allows the AFP to bring together the specialist intelligence dimension, critical to a proper understanding of the threat, and the appropriate forensic response. The role of the Australian CBRN Data Center is to interface between forensic practitioners and highly specialized organizations such as Australia's

Defense Science and Technology Organization and the Commonwealth Scientific Industrial Research Organization with whom AFP has formal cooperation agreements in place. Many hazard response agencies and law enforcement agencies normally do not have access to security classified information where information relevant to bioterrorism threats resides. In Australia, one of the key roles of the Australian CBRN Data Center is to appropriately share information that might otherwise not be known to relevant agencies.

In developing the capability of the AFP to respond to bioterrorism, it was important for it to be appropriate to the threat and to recognize the existing roles and responsibilities of other agencies. The first responders to most incidents in Australia are the hazard response agencies, usually within fire services. Following the U.S. terrorism incidents in 2001, Emergency Management Australia, the commonwealth government agency tasked with coordinating government responses to emergency events, rolled out off-the-shelf capabilities to such agencies to conduct presumptive field testing of potential biomaterials. In the event of a positive presumptive test, a sample(s) would then go to a laboratory within the Australian health network for confirmatory testing. The policing agencies are primarily responsible for the forensic investigation. In this respect, the AFP approach differs from that followed by most other Australian policing agencies. In broad terms, the AFP fills an important forensic role that sits between the hazard response agency and the health agency but to some extent is overlapping. In this role, the AFP aims to add value to the equation but not replicate. Hence, the AFP has invested in evaluating available field equipment with a view to adding value through these being used by a microbiologist with forensic training or crime scene operatives with appropriate training. It is the view of the AFP that where an incident warrants it, this forensic intervention can play an important role in reducing disruption to normal activities. As such incidents can be in significant transport hubs, the benefit of quick action is obvious. Further, early identification of the biological agent provides a sound basis from which protective strategies can be implemented to minimize risk to personnel and from which appropriate sampling strategies can be formulated. Development of the Mobilab and associated triage center (ERTL) is aimed at balancing the need to sample the potentially active agent while protecting staff and the community from contamination but also protecting potential broader forensic evidence that may be vital in subsequent investigation. The latter is just as important in dealing with hoaxes. Of course, this approach will only be successful if roles are understood and the role of the crime scene officers and forensic microbiologist is fully recognized and incorporated into the whole of agency response plans. It is our view that, in much of the world, this broader role for forensic personnel is still immature or not well recognized. The focus of the AFP forensic response is to continue to improve field testing to provide as full

an answer as possible and as quickly as possible, while recognizing the gold standard for identification remains culture.

Adaptation and overlaying of principles of microbiology across forensic and policing portfolios has been a necessary challenge for the AFP and will continue to be a challenge as the discipline evolves. A fundamental awareness has been installed across all AFP portfolios. Further, most AFP forensic disciplines have the capability to extend routine examinations to biologically contaminated scenes and exhibits. The safety of AFP personnel is an important consideration behind all AFP activities; hence the implementation of strategies to minimize risk is paramount. This includes ongoing training to maintain skills and knowledge in the use of personal protective equipment and handheld detectors for entry into potentially contaminated sites. It is also one of the primary reasons for establishment of a capacity to detect and identify biological agents at the scene. Early identification of the biological agent provides a sound basis from which protective strategies can be implemented to minimize risk and a sound basis from which strategies can be developed to maximize the evidence gathered from the scene. It also ensures that strategies can be implemented to minimize the risk of loss or contamination of biological evidence. This is particularly important given that the maintenance of the viability of biological agents is often vital for confirmatory identification and subsequent detailed physical, biochemical, metabolic, and genetic analyses.

The AFP has not developed the capacity to fully investigate a pathogenic agent. Rather, the AFP believes this is the responsibility of highly specialized laboratories. The AFP approach is to understand what is feasible and to establish collaborative arrangements with such specialized laboratories, which would be activated if necessary. The AFP adds value in this capacity by ensuring that (i) the correct forensic quality standards are applied and (ii) all potential forensic evidence is considered.

CONCLUSION

Regrettably, the threat posed by terrorism will remain for many years ahead. Bioterrorism remains a real threat, but because actual incidents remain at a low level, complacency is a constant enemy; hence the continuing background of false alarms may indeed be beneficial, encouraging responding agencies to keep practiced and alert. The AFP model of an integrated intelligence and forensic approach is, we believe, a useful model for other nations of similar size or maturity to consider as a measured contribution to a whole of government approach to threats posed by bioterrorism.

The Australian microbial forensic capability is reliant on the combined and coordinated efforts of numerous government facilities, departments, and

agencies within law enforcement and public health at the state, territory, and commonwealth levels, as well as the private sector. It is a shining example of how a coordinated effort can provide a comprehensive capability that does well to protect the Australian community. The AFP and Australian CBRN Data Center also work closely with international law enforcement partners in the United Kingdom, Canada, and the United States. The contribution of these and other international partners cannot be understated in the ongoing united effort to protect the citizens and assets of Australia and other countries against bioterrorism.

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