Biosecurity

Biosecurity is a set of preventive measures designed to reduce the risk of transmission of infectious diseases, quarantined pests, invasive alien species, living modified organisms. While biosecurity does encompass the prevention of the intentional removal (theft) of biological materials from research laboratories, this definition is narrower in scope than the definition used by many experts, including the United Nations Food and Agriculture Organization.[1] These preventative measures are a combination of systems and practices put into its place at legitimate bioscience laboratories to prevent the use of dangerous pathogens and toxins for malicious use, as well as by customs agents and agricultural and natural resource managers to prevent the spread of these biological agents in natural and managed.[2] Although security is usually thought of in terms of "Guards, Gates, and Guns", biosecurity encompasses much more than that and requires the cooperation of scientists, technicians, policy makers, security engineers, and law enforcement officials.

Components of a laboratory biosecurity program include:

- Physical security
- Personnel security
- Material control & accountability
- Transport security
- Information security
- Program management

Animal biosecurity

Animal biosecurity is the product of all actions undertaken by an entity to prevent introduction of disease agents into a specific area. Animal biosecurity differs from biosecurity which are measures taken to reduce the risk of infectious agent theft and dispersal by means of bioterrorism.[3] Animal biosecurity is a comprehensive approach, encompassing different means of prevention and containment. A critical element in animal biosecurity, biocontainment, is the control of disease agents already present in a particular area, and works to prevent novel transmissions.[3] Animal biosecurity may protect organisms from infectious agents or noninfectious agents such as toxins or pollutants, and can be executed in areas as large as a nation or as small as a local farm.[4]

Animal biosecurity takes into account the epidemiological triad for disease occurrence: the individual host, the disease, and the environment in contributing to disease susceptibility. It aims to improve nonspecific immunity of the host to resist the introduction of an agent, or limit the risk that an agent will be sustained in an environment at adequate levels. Biocontainment, an element of animal biosecurity, works to improve specific immunity towards already present pathogens.[5]

Biosecurity means the prevention of the illicit use of pathogenic bioorganisms by laboratory staff or others. Biosafety means the protection of laboratory staff from being infected by pathogenic bioorganisms.

Challenges

The destruction of the World Trade Center in Manhattan on September 11, 2001 by terrorists, and subsequent wave of anthrax attacks on U.S. media and government outlets (both real and hoax), led to increased attention on the risk of bioterror attacks in the United States. Proposals for serious structural reforms, national and/or regional border controls, and a single co-ordinated system of biohazard response abounded.

One of the major challenges in biosecurity is the increasing availability and accessibility of potentially harmful technology.[6] Biomedical advances and the globalization of scientific and technical expertise have made it possible to greatly improve public health. However, there is also the risk that advances can lead to make biological weapons.[7]

The proliferation of high biosafety level laboratories around the world has many experts worried about availability of targets for those that might be interested in stealing dangerous pathogens. Emerging and re-emerging disease is also a serious biosecurity concern. The recent growth in containment laboratories is often in response to emerging diseases, many new containment labs' main focus is to find ways to control these diseases. By strengthening national disease surveillance, prevention, control and response systems, these labs are raising international public health to new heights.

UNU/IAS Research into Biosecurity & Biosafety emphasizes "long-term consequences of the development and use of biotechnology" and need for "an honest broker to create avenues and forums to unlock the impasses."[*citation needed*]

In the October 2011 Bio-Response Report Card, the WMD Center cites the major challenges to biosecurity: detection and diagnosis, attribution, communication, medical countermeasure availability, medical countermeasure development and approval process, medical countermeasure dispensing, medical management, and environmental cleanup.

Communication between the citizen and law enforcement officials is imperative. Indicators of agroterrorism at a food processing plant may include persons taking notes or photos of a business,theft of employee uniforms,employees changing working hours,or persons attempting to gain information about security measures and personnel. Unusual activity should be reported to law enforcement personnel promptly.[8] [9]

Biosecurity incidents

- 1984 Rajneeshee religious cult attacks, The Dalles, Oregon
  - Objective: Gain control of the Wasco County Court by affecting the election
  - Organism: Salmonella typhimurium, purchased from commercial supplier
  - Dissemination: Restaurant salad bars
  - 751 illnesses, Early investigation by CDC suggested the event was a naturally occurring outbreak. Cult member arrested on unrelated charge confessed involvement with the event
- 1990s Aum Shinrikyo attempts in Tokyo, Japan
  - Objective: Fulfill apocalyptic prophecy
  - Organisms: Bacillus anthracis (Vaccine strain), Clostridium botulinum (Environmental isolate, Avirulent strain) Aum Shinrikyo ordered Clostridium botulinum from a pharmaceutical company, and Ebola virus (Attempted to acquire from Zaire outbreak under guise of an “Humanitarian mission”)
  - Dissemination: Aerosolization in Tokyo (B. anthracis and Botulinum toxin)
  - Leader Asahara was convicted of criminal activity
- 2001 Anthrax attacks in the US
- 1995—Larry Wayne Harris, a white supremacist, ordered 3 vials of Yersinia pestis from the ATCC

- 1995—Laboratory technician Diane Thompson removed Shigella dysenteriae Type 2 from hospital's collection and infected co-workers
- Professor Thomas Butler, United States, 2003
  - 30 vials of Yersinia pestis missing from lab (never recovered); Butler served 19 months in jail
- Dr. Mario Jascalevich, New Jersey doctor, accused of poisoning 5 patients with this plant-derived toxin - Tubocurarine: 1966
- Arnfinn Nesset, nursing home operator in Norway, killed 27 residents at a nursing home with curacit: May 1977 – November 1980
- Dr. David Acer, Florida dentist, infects 6 patients with HIV, unclear if this was a deliberate act: 1987–1990
- Dr. Ray W. Mettetal, Jr., a neurologist in Virginia, was found in possession of ricin after arrest on another issue: 1995
- Debora Green, a physician, convicted of trying to murder her estranged husband with ricin
- Richard Schmidt, a gastroenterologist in Louisiana, convicted of attempted second degree murder for infecting nurse Janice Allen with HIV by injecting her with blood from an AIDS patient: 1998
- Brian T. Stewart, a phlebotomist, sentenced to life in prison for deliberately infecting his 11-month-old baby with HIV-infected blood to avoid child support payments: 1999
- Physician reports theft of a vial of Mycobacterium tuberculosis: June 1999
- Japan 1964-1966, Dr. Mitsuru Suzuki was a physician with training in bacteriology
  - Objective: Revenge due to deep antagonism to what he perceived as a prevailing seniority system
  - Organisms: Shigella dysenteriae and Salmonella typhi
  - Dissemination: Sponge cake, other food sources
  - He was later implicated in 200 – 400 illnesses and 4 deaths
  - Official investigation started after anonymous tip to Ministry of Health and Welfare. He was charged, but was not convicted of any deaths
- Hospital in Dallas, TX, 1996, Diane Thompson was a clinical laboratory technician
  - Objective: Unclear, possibly revenge against former boyfriend and cover-up by infecting co-workers
  - Organism: Shigella dysenteriae Type 2, acquired from clinical laboratory
  - Dissemination: Contaminated pastries in the office breakroom
  - Infected 12 of her coworkers, She was arrested, convicted, 20 year sentence

Role of education in biosecurity

The advance of the life sciences and biotechnology has the potential to bring great benefits to humankind through responding to societal challenges. However, it is also possible that such advances could be exploited for hostile purposes, something evidenced in a small number of incidents of bioterrorism, but more particularly by the series of large-scale offensive biological warfare programmes carried out by major states in the last century. Dealing with this challenge, which has been labelled the `dual-use` dilemma requires a number of different activities such as those identified above as being require for biosecurity. However, one of the essential ingredients in ensuring that the life sciences continue to generate great benefits and do not become subject to misuse for hostile purposes is a process of engagement between scientists and the security community and the development of strong ethical and normative frameworks to compliment legal and regulatory measures that are being developed by states.[10]

Biosecurity regulations

Biosecurity sign for use on a farm or agricultural area experiencing swine fever (Dutch example).

- US Select Agent Regulations
  - Facility registration if it possesses one of 81 Select Agents
  - Facility must designate a Responsible Official
  - Background checks for individuals with access to Select Agents
  - Access controls for areas and containers that contain Select Agents
  - Detailed inventory requirements for Select Agents
  - Security, safety, and emergency response plans
  - Safety and security training
  - Regulation of transfers of Select Agents
  - Extensive documentation and recordkeeping
  - Safety and security inspections
- Biological Weapons Convention addresses three relevant issues:
  - National Implementing Legislation
  - National Pathogen Security (biosecurity)
  - International Cooperation
  - States Parties agree to pursue national implementation of laboratory and transportation biosecurity (2003)
- UN 1540
  - urges States to take preventative measures to mitigate the threat of WMD proliferation by non-state actors
  - “Take and enforce effective measures to establish domestic controls to prevent the proliferation of . . . biological weapons . . .; including by establishing appropriate controls over related materials”
- European Commission Green Paper on Bio-Preparedness (November 2007)
  - recommends developing European standards on laboratory biosecurity including Physical protection, access controls, accountability of pathogens, and registration of researchers
- Organization for Economic Cooperation and Development
  - published “Best Practice Guidelines for Biological Resource Centers” including a section on biosecurity in February 2007
- Kampala Compact (October 2005) and the Nairobi Announcement (July 2007)
  - stress importance of implementing laboratory biosafety and biosecurity in Africa

References

[1] http://www.fao.org/biosecurity
[2] http://www.sciencemag.org/cgi/content/full/295/5552/44a Meyerson and Reaser 2002, Science 295: 44
[3] 1. Thomson, J. Biosecurity: preventing and controlling diseases in the beef herd. Livestock Conservation Institute; 1991; 49-51.
[4] 5. Anderson, F. Biosecurity - a new term for an old concept: how to apply it. Bovine Practitioner; 1998; 32:61-70.
[5] 8. Thomson, J. Biosecurity: preventing and controlling diseases in the beef herd. Livestock Conservation Institute; 1991; 49-51.
[8] Criminal Investigation Handbook for Agroterrorism|2008|U.S. Government Printing Office|Washington, D.C.|pages=34-36
[9] Bio-Response Report Card. The Bipartisan WMD Terrorism Research Center. October 2011. http://www.wmdcenter.org/wp-content/uploads/2011/10/bio-response-report-card-2011.pdf
[10] Bradford Project on Dual use/Biosecurity education http://www.bradford.ac.uk/bioethics/

Further reading

- *Biosecurity and Bioterrorism: Biodefense Strategy, Practice, and Science* (http://www.liebertpub.com/Products/Product.aspx?pid=111&AspxAutoDetectCookieSupport=1), ISSN 1538-7135, Mary Ann Lieber
- **Biosecurity Commons**, a Wiki Database (http://biosecuritycommons.org/index.php?title=Main_Page)
- Laboratory Biosafety and Biosecurity Guidance
  - WHO Laboratory Biosafety Manual, 3rd edition, 2004
    - Chapter 9 on Laboratory Biosecurity
  - WHO/FAO/OIE joint guidance – Biorisk Management: Laboratory Biosecurity Guidance, 2006
  - CDC/NIH Biosafety in Microbiological and Biomedical Laboratories, 5th edition, 2007
    - Extensive recommendations on biosecurity
  - Laboratory Biosecurity Handbook, CRC Press, 2007
  - Handbook of Applied Biosecurity for Life Science Laboratories (http://books.sipri.org/product_info?c_product_id=382), Stockholm International Peace Research Institute, 2009

External links

- Biosecurity for Agriculture and Food Production (http://www.fao.org/biosecurity) at the FAO
- Asia-Pacific Biosecurity Association (http://www.a-pba.org/)
- Animal Biosecurity (http://www.inspection.gc.ca/english/anima/biosec/biosece.shtml) - Canadian Food Inspection Agency
- Biosecuritycodes.org (http://www.biosecuritycodes.org/events.htm) - A detailed list of past and future Biosecurity events dating from 1928. Brought to you by the International Futures Program of the OECD

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