

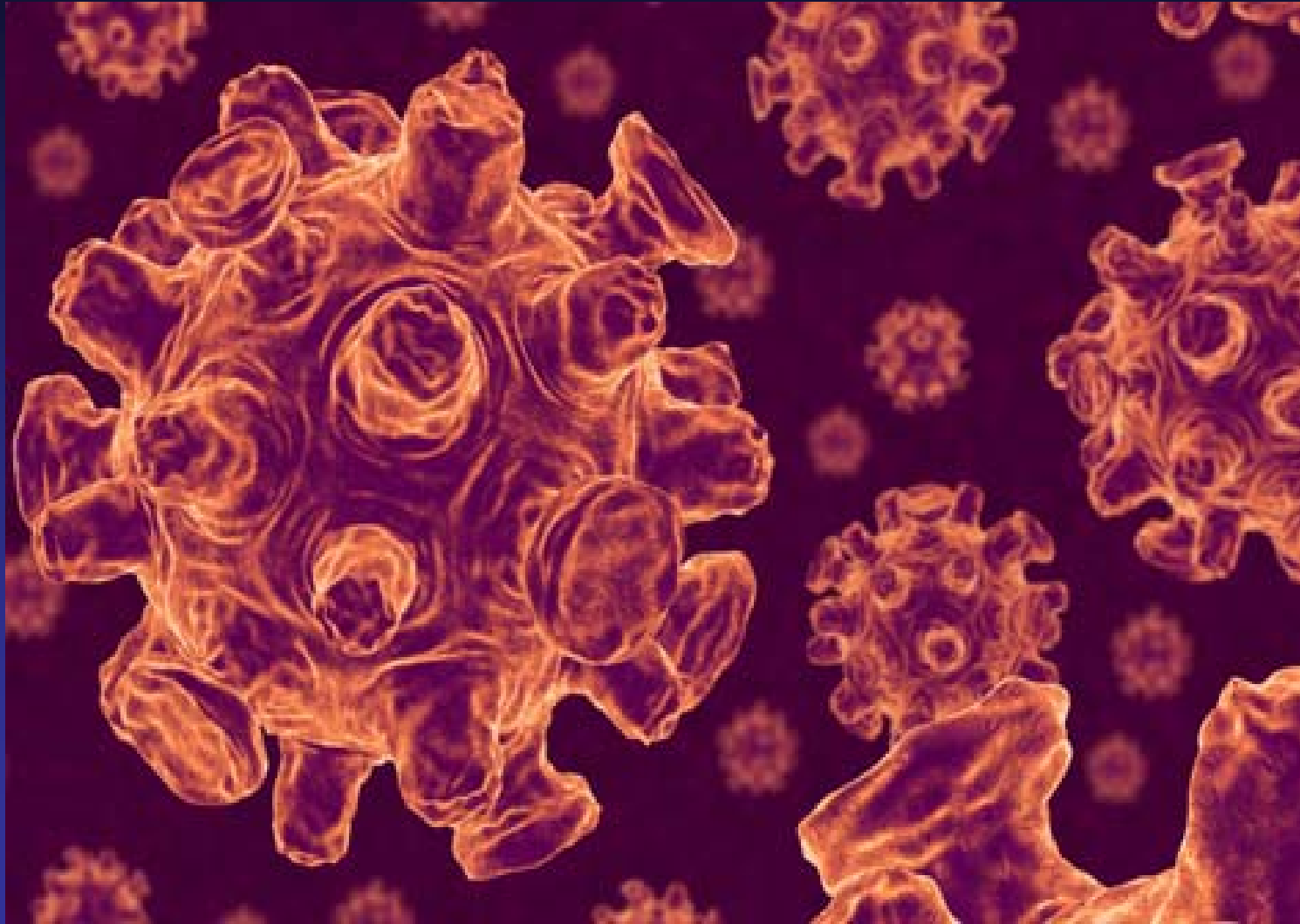
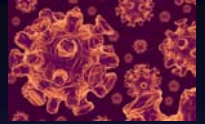
# Nanotechnology and Australian Biosecurity Policy

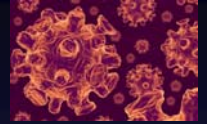
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National Biosecurity Centre  
Biosecurity Challenges for Australia and its Region  
11-12 Feb 2008

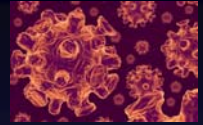
# Nanotech. In Biosecurity





## BWC and CWC and International Law

- “The 1972 Biological and Toxin Weapons Convention (BWC) and the 1993 Chemical Weapons Convention (CWC) serve as cornerstones of the global biological-chemical regime, which has expanded to include rules and procedures rooted in measures ancillary to the two treaties.”
- U.S. National Academies *Globalization, Biosecurity, and the Future of the Life Sciences*
- Article X (2) of the BWC: This Convention shall be implemented in a manner designed to avoid hampering the economic or technological development of States Parties to the Convention



## Definition of Nanotechnology

- Nanotechnology can usefully be defined as ‘the design, characterisation, production and application of structures, devices and systems by controlling shape and size at the nanometre scale’.
- The nano scale is best be defined as 100nm down to 0.2nm (the size of atoms) as this is when the properties of materials change significantly.
- The unique properties of particles on the nano scale allow for the manufacture of products that are highly favourable in strength, speed and accuracy, many of which are already rapidly emerging in the market.

# Nanotech in Biosecurity

**The United States Department of Justice (DOJ) National Institute of Justice (NIJ) has two separate biosecurity-related projects that incorporate nanotechnology -**

- 1) DNA Research: to develop a nanotechnology device that will be integrated into the current crime laboratory processes and protocols to rapidly and accurately analyze forensic DNA samples.**
- 2) Chemical detection: developing a wearable, low-cost device to provide better warning of exposure to unanticipated chemical and biological hazards than current approach relying on vapor exposure of an immobilized enzyme surface.**

M.C.Roco.National Nanotechnology Investment in the FY 2003 Budget Request by the President. National Science and Technology Council's  
subcommittee on Nanoscale Science, Engineering and Technology

# Nanotech in Biosecurity

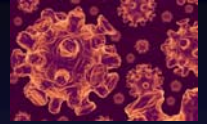
- **The Forensic Science Center at Lawrence Livermore National Laboratory in the US aims to develop nanostructured materials for the collection, concentration and detection of chemical weapons or other related compounds :**
- **Silica-based nanomaterials,**
- **Molecular imprinted polymers and**
- **Silicon platforms**
  - Reynolds J.G.;Hart B.R Nanomaterials and Their Application to Defense and Homeland Security , 2004; 56 (1): 36-39
- **US Defense-funded basic research programs include 16 multimillion-dollar annual grants to university researchers as part of the defense university-research initiatives in nanotechnology and some 25 grants under the multidisciplinary university-research initiative.**

## Dilemmas from US-China interests in military nanotechnology

**The Institute for Soldier Nanotechnologies (ISN), is a research collaboration between the United States Army and the Massachusetts Institute of Technology (MIT).**

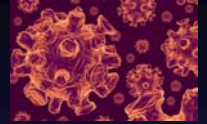
**The ISN combines basic and applied research into military applications of nanoscience and nanotechnology in: protection, performance improvement, injury intervention and cure.**

**The Center for Nanotechnologies at the Chinese Academy of Sciences (CAS) in Beijing opened in 2000. Uniting over a dozen CAS institutes and several university laboratories, the aim of the center was to upgrade scientific cooperation while accelerating nanotech industrial development in Beijing.**



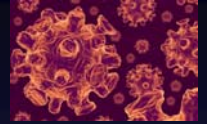
## National Nanotechnology Strategy

The options paper for the recently announced Australian Government National Nanotechnology Strategy does not specifically mention the potential for nanotechnology-biosecurity applications



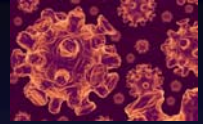
## Recent Legislation

- *National Health Security Act 2007*
- Establishing a national health security system which links state and federal governments, and establishes information sharing mechanisms with the World Health Organisation (WHO).
- Nanotechnology not specifically mentioned.



## National Health Security Act 2007 (Cth)

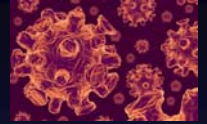
- In late September 2007, the *National Health Security Act 2007 (Cth)* (the Act) was passed, giving effect to the International Health Regulations 2005 (IHR) which came into force on the 15 June 2007.
- Sets out a national system of public health surveillance and establishes mechanisms allowing for Commonwealth, State and Territory cooperation through a National Health Security Agreement (Part 2, Division 2).
- Seeks to enhance Australia's capability to respond to communicable diseases, releases of chemical, biological or radiological agents, public health risks, and the occurrence of overseas mass casualties.



## National Focal Point

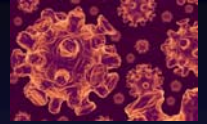
As required by the IHR, a National Focal Point (NFP) is established, serving to liaise with responsible bodies in Australia as well as with the World Health Organisation (WHO) and other countries in the event of public health emergencies. The explanatory memorandum for the Bill proposed that the NFP will be the Secretary of the Federal Department of Health.

- Part 2 of the Act also requires the Minister, upon consultation, to establish (and continue to manage) a National Notifiable Disease List (Division 5) containing diseases likely to result in a public health risk if an outbreak was to occur. In the case of emergency, following provisions allow for a temporary variation of the list by the Commonwealth Chief Medical Officer.



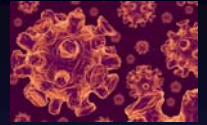
## Notification and Information Sharing Mechanism

- Division 6 goes on to establish notification and information sharing mechanisms between the Commonwealth, States and Territories, as well as with the WHO where the event is determined to be of international concern.
- Division 8 deals with confidentiality of information, and provides that the NFP will be responsible for determining whether the WHO needs to be notified about a potential public health emergency (consistent with articles 6 and 13 of the IHR).



## SSBAs

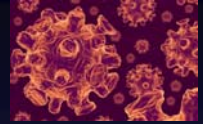
- Part 3 of the Act deals with security-sensitive biological agents (SSBA), requiring the Minister to establish and maintain a list of biological agents which have the potential to be used as weapons.
- It also allows for the Minister to determine standards regarding the storage, handling and transport of the agents (Division 3), which all entities handling SSBA will be required to comply with.



## National Register

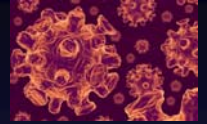
- A National Register of SSBA is also set up under Division 4, to which the Secretary can add entities handling SSBA, while Division 5 sets out requirements for those entities (including ‘legitimate purposes’ for handling SSBA, monitoring reporting requirements and powers of inspection as appointed by the Secretary).





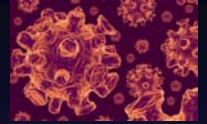
## New IHRs

- These legislative structures were enacted in adherence to the new International Health Regulations (IHR). Revising the old health regulations of 1969, the World Health Assembly adopted the new IHR as an international treaty on May 23, 2005, coming into force on the 15 June 2007. The revision was prompted by a resurgence of infectious diseases such as Ebola, Lassa, meningococcal meningitis W135, severe acute respiratory syndrome (SARS), avian influenza (N5N1) and many more. Previously, the 1969 Regulations covered only the easily quarantined diseases of cholera, plague and yellow fever.



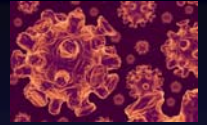
## Surveillance System

The most significant development in the Regulations is the establishment of a comprehensive surveillance system which sets up a public health response framework to deal with international spread of disease, while attempting to retain the balance between security and interference with international trade and travel.



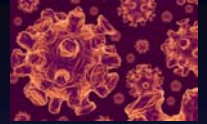
## IHR Reporting

- The IHR sets up specific criteria for countries in relation to their mechanisms of detecting and responding to health threats, as well as comprehensive reporting frameworks to the WHO where threats are detected. Although a short list of diseases is included, countries are still required to assess any health threats according to a flowchart provided in the IHR.
- These developments provide an invaluable opportunity to incorporate nanotechnology research and development into national and global biosecurity policy.



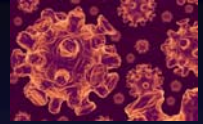
## Public Awareness

- The level of awareness of nanotechnology among Australians is low but increasing, and that, even though there is some fear of the unknown, people are interested in learning more about nanotechnology and attitudes toward it are generally positive.
- These are fairly common findings. Furthermore, there is still considerable debate regarding the impact of nanotechnology on human health and safety, and the environment.
- Some critics are even calling for a moratorium on all nanotechnology research and development until all the risks can be assessed or, at the very least, for a strict regulatory regime to be put in place.



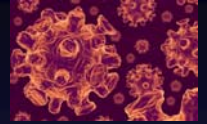
## Human Rights Perspective

- Biosecurity nanotechnologies will potentially be responsible for collecting and reporting upon sensitive information about individuals' health status and this raises all sorts of issues.
- The right to the integrity of the person, to liberty and security, to the respect for private and family life, to the protection of personal data, to equality and non-discrimination, and to informed consent as outlined in documents such as the *International Convention on Civil and Political Rights*, the *International Convention on Economic, Social and Cultural Rights*, and the *Universal Declaration of Human Rights* will have to be given due consideration.



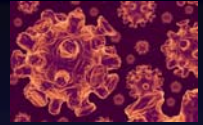
## Nanotechnology and Civil Security

- A recent report sponsored by the European Union, ‘Nanotechnology and Civil Security’ was released in June 2007, and divides applications for civil security into several areas: detection (including imaging, sensors and sensor networks), protection (including decontamination and filtering, personal protective equipment, electromagnetic shielding) and identification (including authentication and counterfeiting, forensics, quantum cryptography).
- Most relevant to biosecurity are the detection nanotechnologies, particularly sensors, which aim to detect biological and chemical agents.



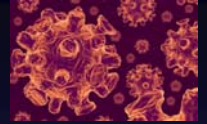
## Nanotech and Biotech

- The key to developing biosecurity surveillance is in the merging of nanotechnology with biotechnology. Current methods for identifying a detected pathogen in the laboratory include PCR, colony count, ELISA, electrophoresis and others, all of which have good sensitivity but require considerable time and human resources to produce a result.
- More recently, biosensors have become more widely used, for example in food, water and medical analysis, as well as in environmental monitoring and agriculture.



## Advantages of Nanotech

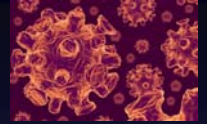
- Other ideal characteristics of Nanotech in biosecurity include low power consumption, the ability to recognise many different biological and chemical agents over a wide range of concentrations, high sensitivity and specificity, speed, and integrated systems for remote or embedded monitoring.
- This could enable the use of ambient sensors in airports or embedded sensors in clothing of military personnel to recognise biological and chemical threats.



## Biosensor Network

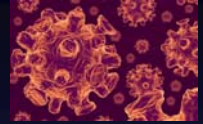
- According to the comprehensive ‘Nanotechnology and Civil Security’ report, the real goal is a biosensor network, which would function autonomously to avoid human exposure (for example at contaminated sites), and where continuous detection is needed (for example, airports). In the US, a technology system known as ‘smart dust’, initially conceived by researchers at the University of California, is being developed to address this need, while another group, Nano-Propriety Inc., has just recently received funding from the Homeland Security Advanced Research Project Agency to develop a ‘sensor network design tool’.

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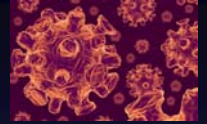
## Nanobiosecurity in the US

- A workshop report from the AVS Science and Technology Society in California entitled ‘Nanotechnology Innovation for Chemical, Biological, Radiological and Explosive (CBRE): Detection and Protection’ emphasised improved sensitivity, selectivity and expense of sensors in a wide range of applications including transportation systems, to the military, protection for Federal buildings, customs and schools. It also considered the enormous potential of nanotechnology applications in the emergency response actions taken by hospitals or decontamination teams in the event of chemical or biological incidents.



## Biosensors

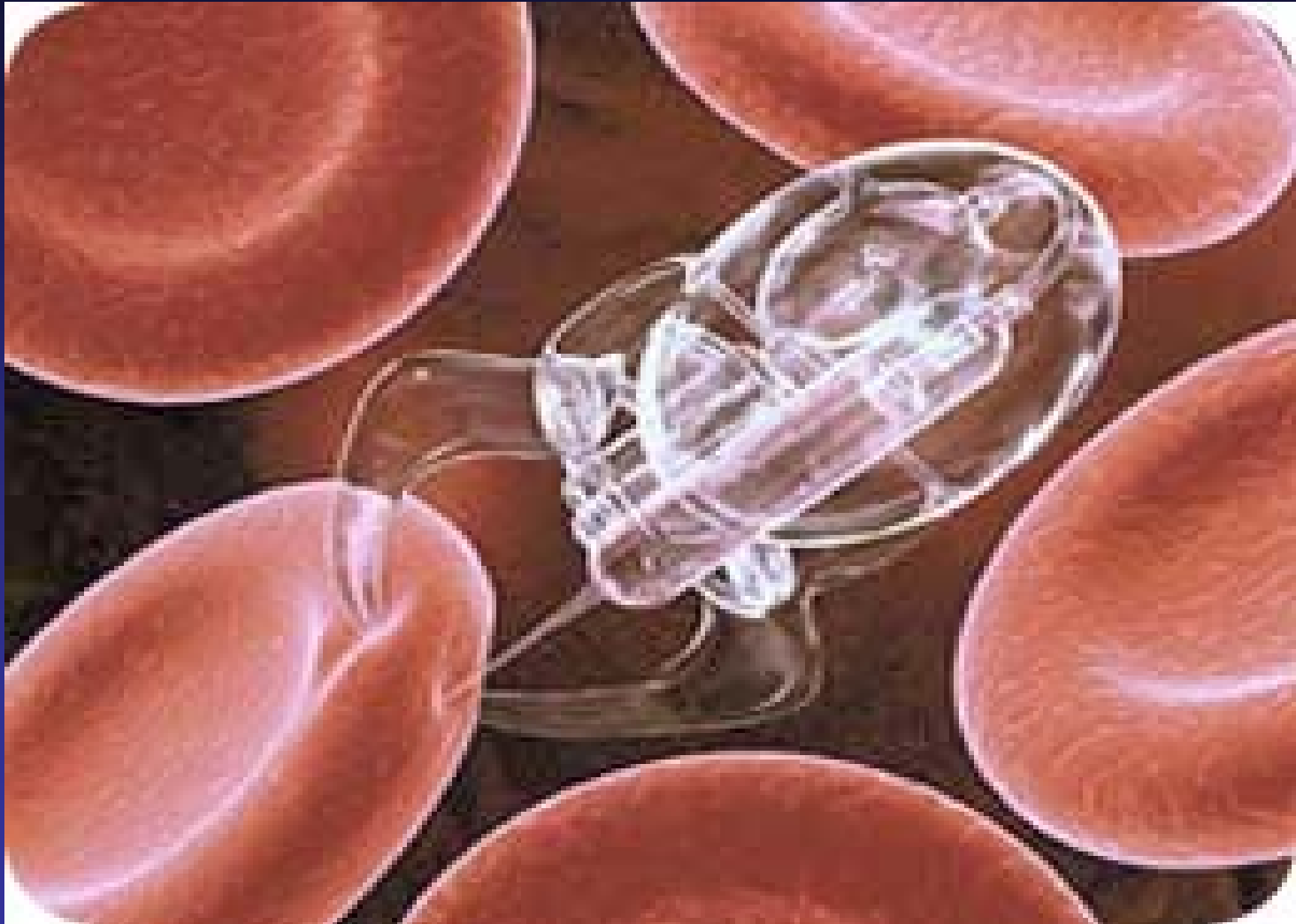
- The ability to produce near instantaneous results from nanobiosensors in hand-held devices or in the form of ambient detectors will be a vast improvement on symptom or syndromic based reporting systems.
- The potential for a virulent pathogen is real, and as such investment into nanotechnology applications for biosecurity cannot be put off. However, in the absence of a specific policy statement or legislation indicating a need and a market for the development of nanotechnology applications for biosecurity, it will be difficult to encourage both public and private research institutions to steer their endeavours towards this end.

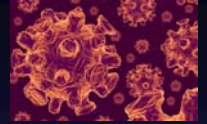


## Cooperation

- The issue of state and Federal government cooperation is relevant to both the new *National Health Security Act 2007* (section 7) and the National Nanotechnology Strategy (as evidenced by proposal 5 in the options paper). As discussed, the Act allows for the Minister to enter into agreements with the states and territories for the purposes of, among other things, ‘enhancing the ability within Australia to identify and respond quickly to public health events of national significance’ (section 7(1)(c)) and ‘facilitating the monitoring of public health events of national significance within Australia’ (section 7(1)(d)).

# Nanotech. in Biosecurity





## Funding Priorities

- Focusing on the overall goal of the IHR in establishing a global health surveillance network, funding incentives could be provided for the development of nanotechnology-based monitoring and detection devices tailored to particular aims of the biosecurity framework.
- For example, one of the major focuses of the Act is public health observation, including travellers and monitoring of airports. This is in line with the IHR in terms of each country establishing a timely and effective response system to public health events. The funding priorities could be determined by consultation with biosecurity experts based on threat assessment, and in the longer term, on practical biosecurity outcomes.