Introduction to Biological WMDs

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www.biosecurity.sandia.gov

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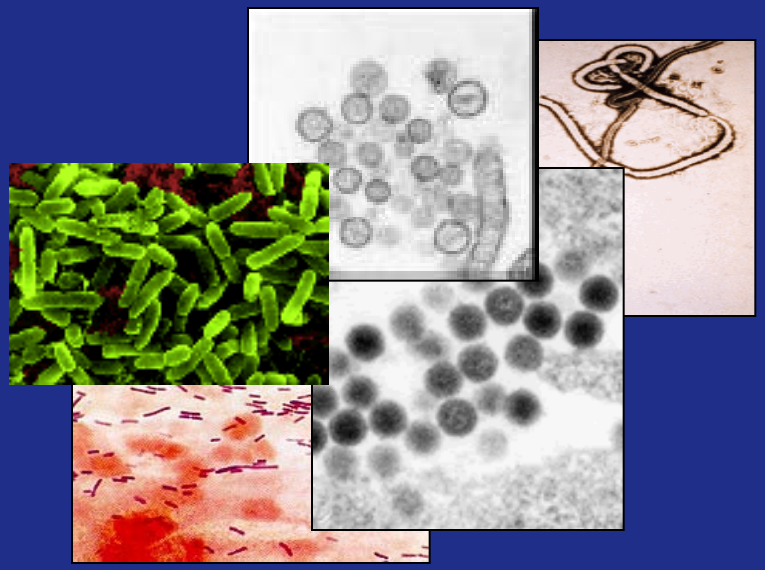
Biological Weapons

“Microbial or other biological agents, or toxins whatever their origin or method of production, of types and in quantities that have no justification for prophylactic, protective or other peaceful purposes.”

“Weapons, equipment or means of delivery designed to use such agents or toxins for hostile purposes or in armed conflict.”



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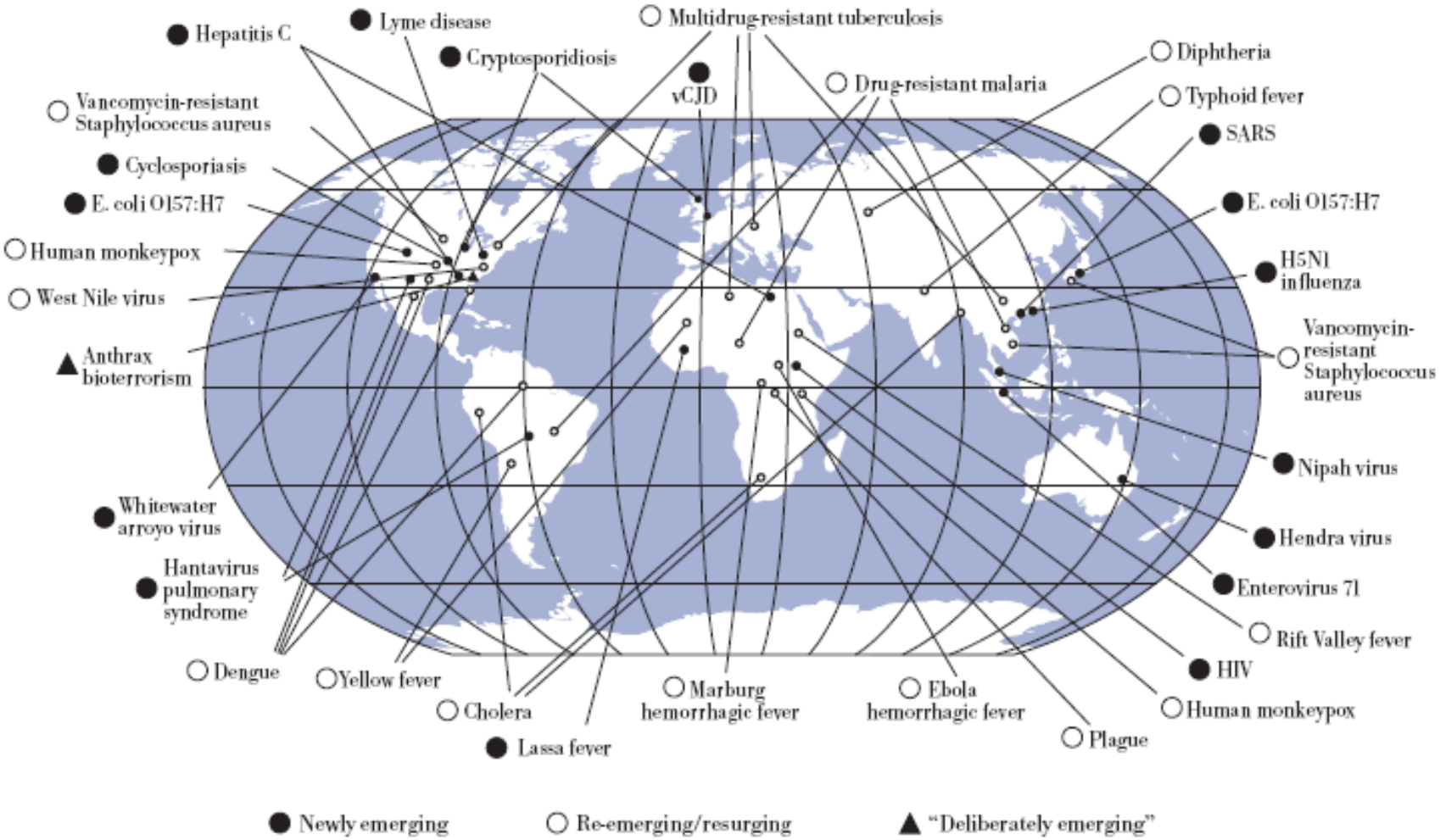
BW is Different Than Other WMD

- **Naturally-occurring**
  - With only a few notable exceptions:
    - **Variola major virus**
    - **1918 Influenza virus**
- **Dual-use**
  - Materials
  - Technologies
  - Expertise
- **Wide variety of materials**
  - Deadly to incapacitating
  - Human, animal, zoonotic, plant
- **Self-replicating**
  - Minute quantities of concern
- **Not detectable at a distance**
- **Present in many types of facilities**
  - Research laboratories, clinical laboratories, hospitals
  - Private and public sector
- **Present at multiple locations within a facility**
  - In laboratory, in storage, in animals, in waste stream
- **Synthetic biology**
  - De-novo synthesis
  - Turning non-pathogenic material into virulent organism

Source: Jonathan B. Tucker, “Biosecurity: Limiting Terrorist Access to Deadly Pathogens,” Peaceworks No. 52, United States Institute of Peace, November 2003.

The Changing Biological Threat: Examples of Outbreaks



Adapted from Morens, D.M., et al. 2004. The Challenge of Emerging and Re-emerging Infectious Diseases. *Nature* 430:242–49.

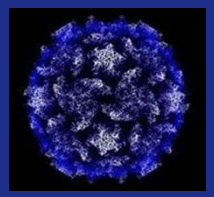
Nature of Biology is Changing

- **Rapid technological advances**
- **Technologies becoming more available**
  - Geographically
  - Individuals

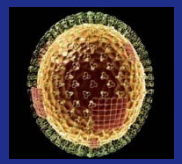
DNA extraction kit for 10 year old kids, sold by
Japanese National Museum of Emerging Science and Innovation

Synthesizing Viable Organisms

2002 Polio virus[1]
7,741 bp

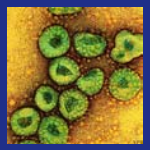


2005 1918 flu virus[2]
13,500 bp

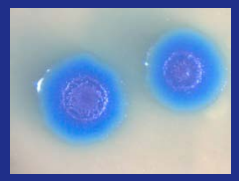


2006 Marburg virus[3]
19,000 bp

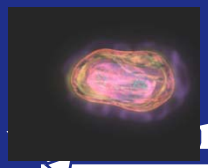
2008 SARS virus[4]
30,000 bp



2008 Mycoplasma[5]
582,970 bp



? Smallpox virus
185,000 bp



"Potentially, we can apply this technology to many other emerging viruses"

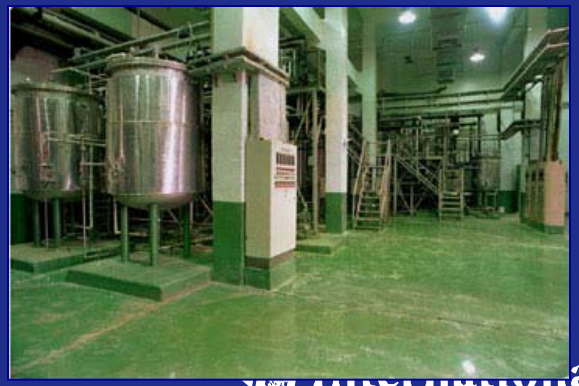
1: Science 2002, 9;297(5583):1016-8, 2: Science 2005 7;310(5745):77-80
3: J Virol 2006 80(2):1038-43, 4: PNAS 25 NOV 2008,
5: Science 2008 29;319(5867):1196-7

national
BIOLOGICAL THREAT REDUCTION

International Obligations

- **Biological Weapons Convention**
  - Prohibits the development, production, and stockpiling of biological weapons agents, toxins, equipment, and means of delivery by State Parties
  - Opened for signature April 1972; entered into force March 1975
  - No provisions for verification of compliance
  - Focus is on confidence building measures
- **UNSCR 1540**
  - "Take and enforce effective measures to establish domestic controls to prevent the proliferation of . . . biological weapons . . .; including by establishing appropriate controls over related materials"
  - Requires States to report efforts to 1540 Committee

Fermentation Vessels



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