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Breakthroughs.

Partnerships.

Leadership.

Managing Global Challenges in an Evolving Threat Environment

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Global Security Programs

Sandia National Laboratories

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Bio International Convention

The Global Event for Biotechnology

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Revolution in Biotechnology

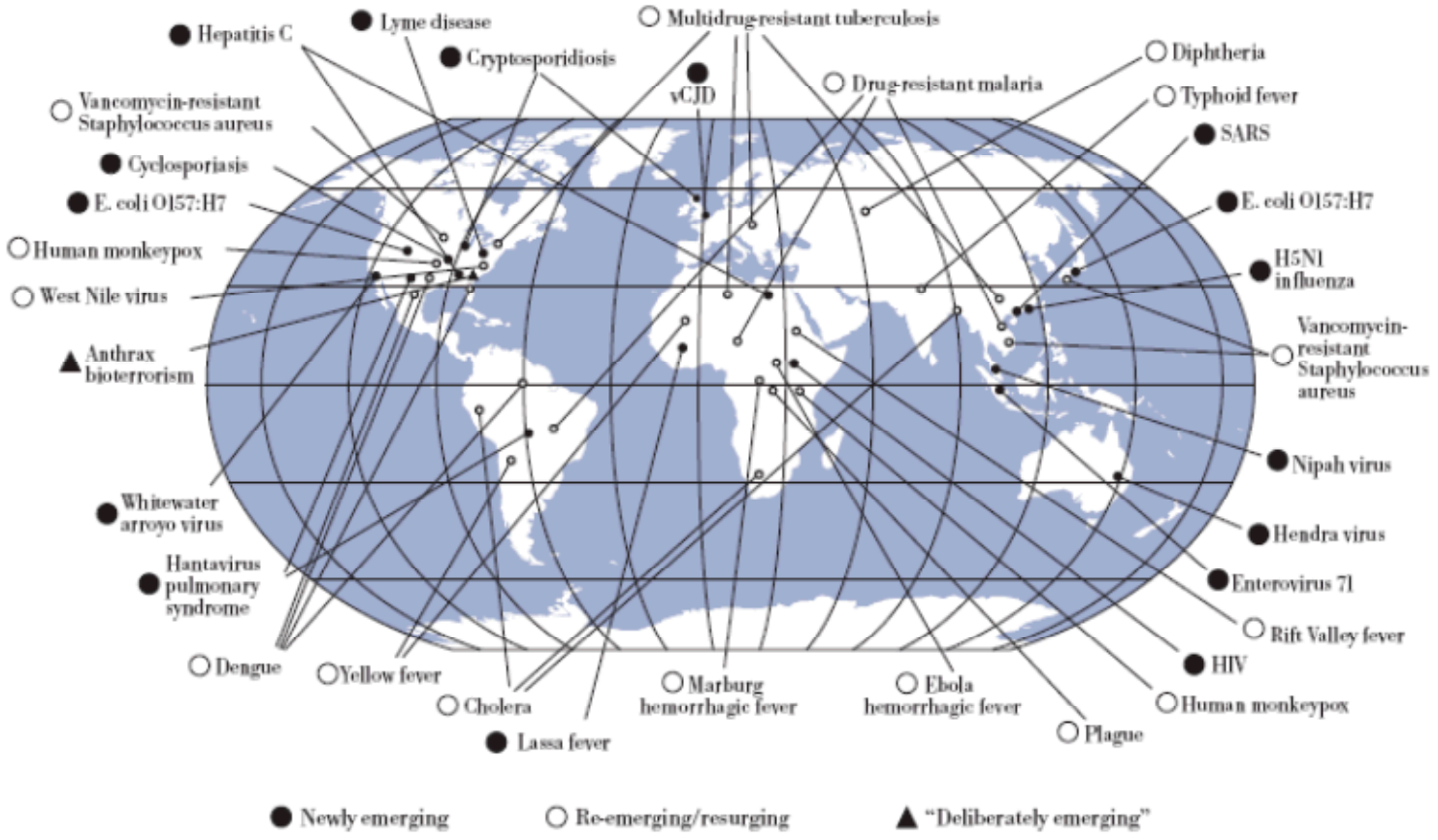
- Genetic sequencing
  - 2003 – Human genome
- Genetic modification
  - 2001 – IL-4 and mousepox (Australia)
  - 2003 – IL-4 and mousepox (St. Louis)
- Chemical synthesis
  - 2002 – polio virus (7,741 bp)
  - 2005 – 1918 influenza virus (13,500 bp)
  - 2006 – Marburg virus (19,000 bp)
  - 2008 – SARS virus (30,000 bp)
  - ??? – Smallpox virus (185,000 bp)

Global Expansion of Biotech Facilities

- Construction of large bio-parks in Asia and the Middle East
  - Singapore invested over $5 billion to develop a preeminent biomedical R&D cluster
- Rapid expansion of high- and maximum-containment laboratories
  - India in the process of tripling its BSL4 capacity
- Dramatic growth in genome sequencing centers
  - More than 75 genome centers involved with sequencing at one of the 183 microbial genomes in the GenBank database

Biopolis, Singapore

Emerging and Reemerging Infectious Diseases



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

At least one newly identified infectious disease is reported annually

33 completely new pathogens identified in the past 30 years

Infectious diseases cause:
25% of all deaths
45% of deaths in developing countries
63% of deaths in children worldwide

Complex Spectrum of Biological Risks

Naturally occurring diseases | Re-emerging infectious diseases | Unintended consequences of research | Laboratory accident | Lack of awareness | Negligence | Deliberate misuse

Wilton Park, September 2009

Evolving Threat Environment

- More life scientists are now working in more locations worldwide with more deadly, and potentially dangerous, pathogens and toxins that are now simpler to manipulate with today's basic equipment

> "Advances within the life sciences hold extraordinary potential for beneficial progress, but they also can empower those who would use biological agents for ill purpose."
>
> *National Strategy for Countering Biological Threats*, November 2009

- Risk of accidental or intentional misuse of dual-use pathogens is expanding, but the resources to mitigate those risks are shrinking

New Challenges Call for New Paradigm

Global Disease Surveillance

- Failure to rapidly detect and control outbreaks of disease compromises national and international security
  - Jeopardizes public and animal health
  - Damages trade and national economies
  - Endangers international relations and stability of governments
  - Potentially facilitates those with malicious intent
- Recent outbreaks have demonstrated the weakness of our international system for disease detection and control
  - WHO, OIE, FAO depend on governments to report disease
  - Regional systems lack continuity
  - Reporting systems vary in efficiency and effectiveness
  - Areas of the world most affected by outbreaks often lack adequate technical and financial resources

Current Investment Approach

- Recent Center for Biosecurity UPMC report* indicated that US Government spending on disease surveillance is approximately $300-350 million annually – much of it going overseas
  - Many other advanced countries are also making similarly substantial investments
- Significant efforts by the Gates Foundation, Google.org, the Foundation for Innovative New Diagnostics, and many other NGOs attempting to introduce new models
- But, we typically promote technologies and methods developed and used in the West, or we focus on diseases that most concern us
  - Often, this approach is neither the most effective nor sustainable

*"International Disease Surveillance: United States Government Goals and Paths Forward" (2010)

New Paradigm?

- Can we persuade other nations to take responsibility for recognizing and addressing this problem (disease surveillance and, more generally, mitigating dual-use risks in the life sciences)?
- Can we move from a model of US funding and US solutions to cooperative funding and cooperative solutions based on indigenous understanding of risks and commitment to reducing them for their own benefit?

Imperative for Cooperative Engagement

- Need to focus on intellectual and technical capacity building by engaging local scientists and decision makers, and jointly developing sustainable solutions

- Tools, technologies, and methods that are
  - Low tech
  - Low cost
  - Easy to acquire
  - Easy to use
  - Easy to maintain
  - Easy to transfer, and
  - Whose use clearly advances international security interests

Opportunities for Collaboration

- Point of care diagnostics that are less dependent on reagents
- Technologies to simplify biomarker isolation and improve sample preparation
- Bioinformatics methods to quickly compare biomarkers isolated from samples and public data banks
- Mapping and analysis of current disease situations to facilitate diagnostic strategies
- Decision support and risk assessment tools to support disease control strategies

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