Managing
Dual Use Research of Concern

Stanley M. Lemon, M.D.
The University of North Carolina at Chapel Hill

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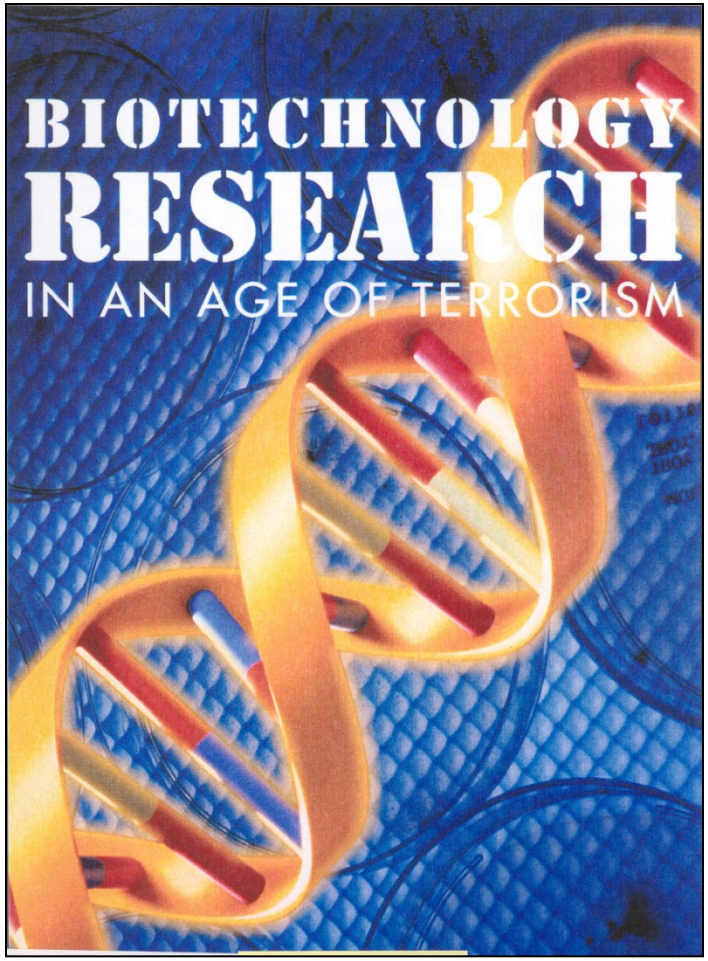
The “Dual Use Research” Issue

How to prevent good science being put to bad use….

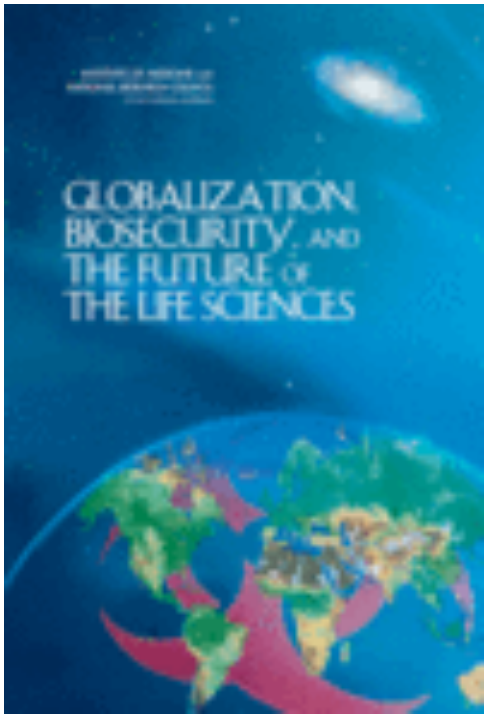
Long recognized to be an issue in nuclear physics and computer sciences, but life sciences research has not figured prominently previously in considerations of national security.

The Concept of "Dual Use" Research

- The "Fink Report" of the National Research Council of the National Academies (2004)
- "*…the same technologies can be used legitimately for human betterment and misused for bioterrorism.*"



"Globalization, Biosecurity, and the Future of the Life Sciences"



- 2006 report of the National Research Council of the National Academies
- *Advances in the life sciences will inevitably create new opportunities for misuse, both purposeful and unintended. The technologies are widely dispersed, readily accessed, and increasingly global.*

US Government Response

- New biosecurity measures are warranted
- Established the “National Science Advisory Board for Biosecurity” (NSABB) reporting to the Secretary DHHS in 2005.
- NSABB charged with recommending a framework for efficient and effective oversight of federally-funded dual use life sciences research.
- Directed to consider both national security concerns and needs of the life sciences research community

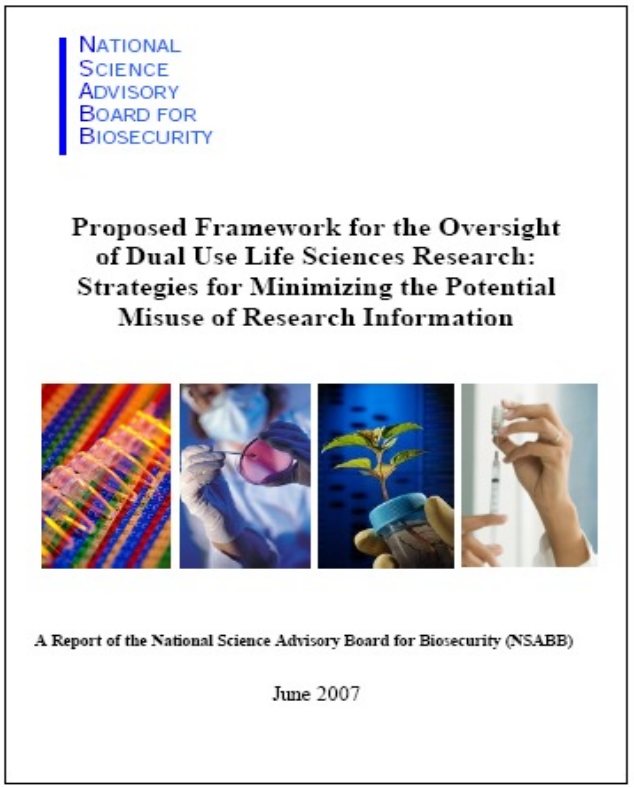
NSABB *Ex officios*

- *Executive Office of the President*
- *Dept. of Health and Human Services*
- *Dept. of Energy*
- *Dept. of Homeland Security*
- *Dept. of Veteran's Affairs*
- *Dept. of Defense*
- *Environmental Protection Agency*
- *U.S. Dept. of Agriculture*
- *Dept. of Interior*
- *National Sciences Foundation*
- *Dept. of Justice*
- *Dept. of State*
- *Dept. of Commerce*
- *National Aeronautics and Space Administration*
- *Intelligence community*

Initial NSABB Charges

- Criteria for identifying dual use research of concern
- Framework for oversight of dual use research
- Guidance on responsible communication and dissemination of dual use research results
- Guidance on a code of conduct for scientists and laboratory workers in life sciences research
- Recommendations on education and training in biosecurity issues for all scientists and laboratory workers at federally funded institutions
- Strategies for promoting international dialogue on dual use research issue
- Other issues as assigned (e.g., biosecurity concerns related to synthetic genomics/biology)

2007 Framework for Oversight of Dual Use Research of Concern



- Steps in the local oversight of DUR
- Criterion and guidance for identifying DUR of particular concern (DURC)
- Tools to assess and manage the dual use risk associated with certain research
- Tools for the responsible communication of research
- Responsibilities of those conducting life sciences research
- Code of conduct for dual use research

DUR vs. DURC

- Dual use research (DUR) = legitimate research that yields information or technologies that could be misused for malevolent purposes
- Goal is to identify the subset that has highest potential for generating information that could be readily misused = DUR *of concern* (DURC)
- A further subset of DURC in the life sciences is the focus of the recently proposed oversight policies that require institutions to assess and manage the risks posed by this research

Dual Use Research of Concern (DURC) Defined[1]

"Life sciences research that, based on current understanding, can be reasonably anticipated to provide knowledge, information, products, or technologies that could be directly misapplied to pose a significant threat with broad potential consequences to public health and safety, agricultural crops and other plants, animals, the environment, materiel, or national security."

[1] *United States Government Policy for Oversight of Life Sciences Dual Use Research of Concern*, March 29, 2012. Also, *Proposed USG Policy for Institutional Oversight of Life Sciences Dual Use Research of Concern*, February 22, 2013.

Dual Use Research vs. *Dual Use Research of Concern* (DURC)

- But, who should make this assessment?
- How will background and experience influence the outcome of any risk assessment?
- Relatively few life scientists believe that DURC is a real issue, at least not as related to *their* science.
- The public's perceptions can be very different….

Reconstruction of the 1918 Influenza Virus - 2005

nature

LETTERS

Vol 437|6 October 2005|doi:10.1038/nature04230

Characterization of the 1918 influenza virus polymerase genes

Jeffery K. Taubenberger[1], Ann H. Reid[1]†, Raina M. Lourens[1]†, Ruixue Wang[1], Guozhong Jin[1] & Thomas G. Fanning[1]

RESEARCH ARTICLE

Characterization of the Reconstructed 1918 Spanish Influenza Pandemic Virus

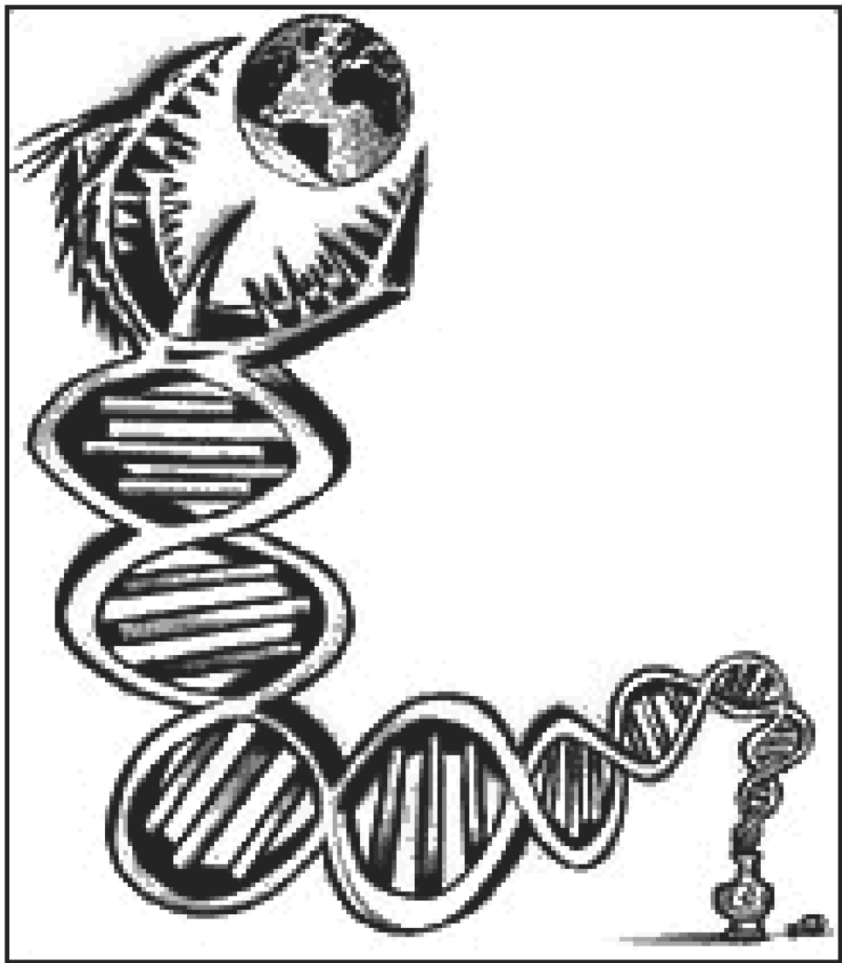
Terrence M. Tumpey,[1]* Christopher F. Basler,[2] Patricia V. Aguilar,[2] Hui Zeng,[1] Alicia Solórzano,[2] David E. Swayne,[4] Nancy J. Cox,[1] Jacqueline M. Katz,[1] Jeffery K. Taubenberger,[3] Peter Palese,[2] Adolfo García-Sastre[2]

Reconstruction of the 1918 Influenza Virus - 2005

"*I firmly believe that allowing the publication of this information was the correct decision in terms of both national security and public health.*"

Philip A. Sharp
Science
Vol. 310, 7 October 2005

Reconstruction of the 1918 Influenza Virus - 2005



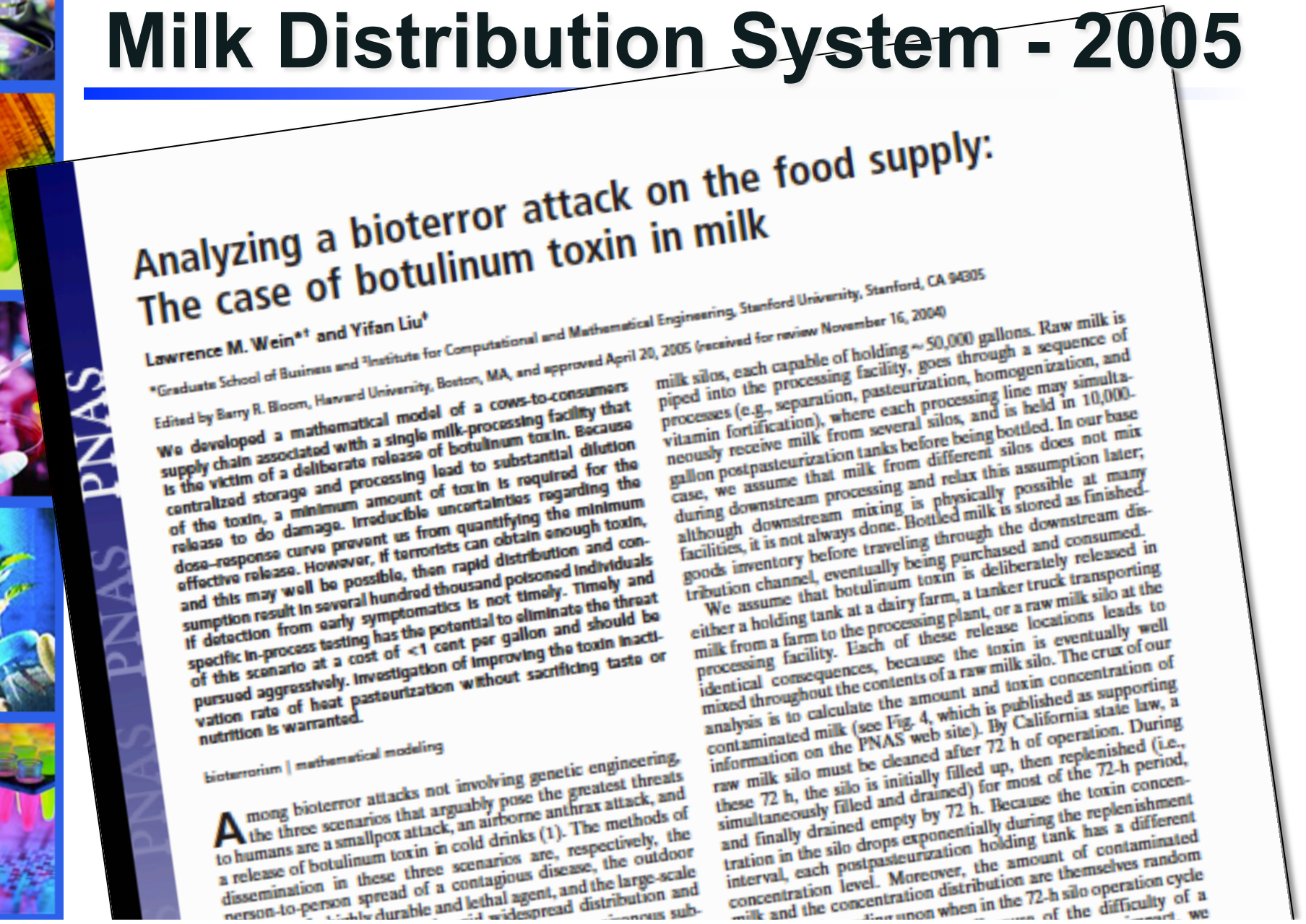
"This is extremely foolish. The genome is essentially the design of a weapon of mass destruction."

Ray Kurzweil and Bill Joy

New York Times

October 17, 2005

Modeling an attack on the U.S. Milk Distribution System - 2005



PNAS PNAS PNAS

Analyzing a bioterror attack on the food supply: The case of botulinum toxin in milk

Lawrence M. Wein*† and Yifan Liu‡

*Graduate School of Business and ‡Institute for Computational and Mathematical Engineering, Stanford University, Stanford, CA 94305

Edited by Barry R. Bloom, Harvard University, Boston, MA, and approved April 20, 2005 (received for review November 16, 2004)

We developed a mathematical model of a cows-to-consumers supply chain associated with a single milk-processing facility that is the victim of a deliberate release of botulinum toxin. Because centralized storage and processing lead to substantial dilution of the toxin, a minimum amount of toxin is required for the release to do damage. Irreducible uncertainties regarding the dose–response curve prevent us from quantifying the minimum effective release. However, if terrorists can obtain enough toxin, and this may well be possible, then rapid distribution and consumption result in several hundred thousand poisoned individuals. If detection from early symptomatics is not timely. Timely and specific in-process testing has the potential to eliminate the threat of this scenario at a cost of <1 cent per gallon and should be pursued aggressively. Investigation of improving the toxin inactivation rate of heat pasteurization without sacrificing taste or nutrition is warranted.

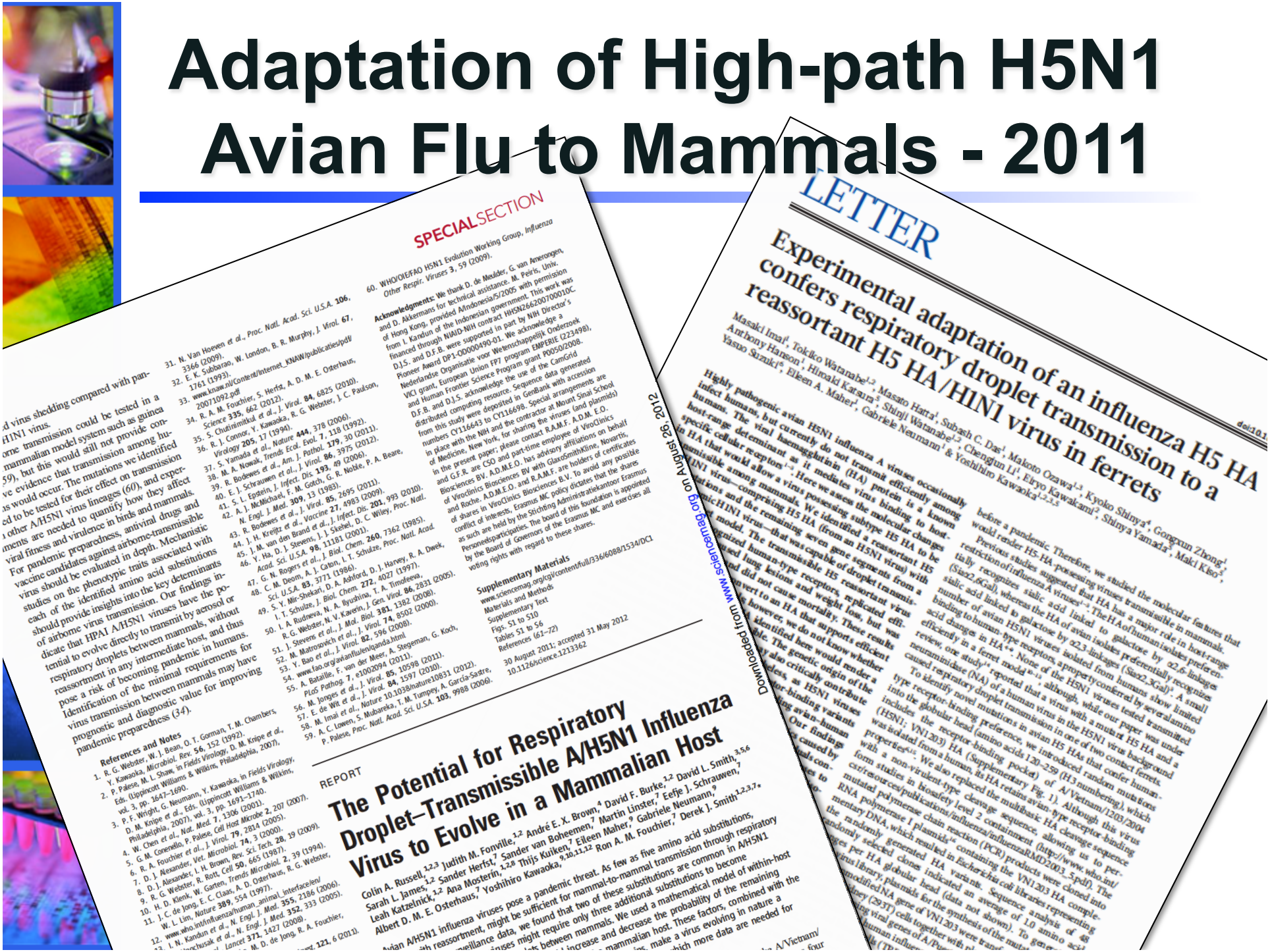
bioterrorism | mathematical modeling

Among bioterror attacks not involving genetic engineering, the three scenarios that arguably pose the greatest threats to humans are a smallpox attack, an airborne anthrax attack, and a release of botulinum toxin in cold drinks (1). The methods of dissemination in these three scenarios are, respectively, the person-to-person spread of a contagious disease, the outdoor highly durable and lethal agent, and the large-scale rapid widespread distribution and

milk silos, each capable of holding ≈50,000 gallons. Raw milk is piped into the processing facility, goes through a sequence of processes (e.g., separation, pasteurization, homogenization, and vitamin fortification), where each processing line may simultaneously receive milk from several silos, and is held in 10,000-gallon postpasteurization tanks before being bottled. In our base case, we assume that milk from different silos does not mix during downstream processing and relax this assumption later; although downstream mixing is physically possible at many facilities, it is not always done. Bottled milk is stored as finished-goods inventory before traveling through the downstream distribution channel, eventually being purchased and consumed.

We assume that botulinum toxin is deliberately released in either a holding tank at a dairy farm, a tanker truck transporting milk from a farm to the processing plant, or a raw milk silo at the processing facility. Each of these release locations leads to identical consequences, because the toxin is eventually well mixed throughout the contents of a raw milk silo. The crux of our analysis is to calculate the amount and toxin concentration of contaminated milk (see Fig. 4, which is published as supporting information on the PNAS web site). By California state law, a raw milk silo must be cleaned after 72 h of operation. During these 72 h, the silo is initially filled up, then replenished (i.e., simultaneously filled and drained) for most of the 72-h period, and finally drained empty by 72 h. Because the toxin concentration in the silo drops exponentially during the replenishment interval, each postpasteurization holding tank has a different concentration level. Moreover, the amount of contaminated milk and the concentration distribution are themselves random depending upon when in the 72-h silo operation cycle of the difficulty of a

Adaptation of High-path H5N1 Avian Flu to Mammals - 2011



SPECIAL SECTION

REPORT

The Potential for Respiratory Droplet–Transmissible A/H5N1 Influenza Virus to Evolve in a Mammalian Host

LETTER

Experimental adaptation of an influenza H5 HA confers respiratory droplet transmission to a reassortant H5 HA/H1N1 virus in ferrets

Downloaded from www.sciencemag.org on August 26, 2012

Key Elements of NSABB's Approach to Oversight of DURC

- The potential for DURC exists throughout life sciences research.
- Primary responsibility for recognizing dual use potential rests with the PI.
- Recognition that research is DURC does NOT mean it should be stopped, but there must be a plan to manage it responsibly and communicate results appropriately.
- To the maximum extent possible, there should be no restrictions on the free flow of information from life sciences research.

Key Elements of NSABB's Approach to Oversight of DURC

- DURC is an international issue that demands an international approach.
- Scientists must cultivate and sustain a culture of responsibility, accountability and safety!
- Institutions (esp. institutional leadership) must promote this culture of responsibility and awareness of the dual use issue.
- Personnel reliability is best managed at the local institutional and not the national level.

PI Responsibilities: Dual Use Research of Concern

- Assess his/her own research for dual use potential and report as appropriate;
- Stay abreast of literature, guidance, and requirements related to dual use research, and particularly *Dual Use Research of Concern* (DURC);
- Ensure that his/her lab personnel are able to identify DURC and manage it properly;
- Conduct research responsibly, especially research that may meet the criteria for DURC;
- Give thought as to how the results of such research should be communicated to others, including the public;
- Be alert to potential misuse of research.

UNC's Approach to Managing Dual Use Research of Concern

- Educate its workforce regarding DURC. An online training module has been developed.
- PI and UNC's Institutional Biosafety Committee (IBC) and EHS Biological Safety Section identify research proposals submitted to UNC's IBC that meet the NSABB definition of DURC.
- If a protocol meets the criteria for DURC, a risk assessment is done and a mitigation plan is developed. Further safety measures may be taken or if necessary the protocol may be revised or retracted.

USG Policies on Oversight of DURC

- Federal oversight policy issued March 29, 2012
  - Establishes periodic review of USG funded or conducted research with certain high-consequence pathogens and toxins for its potential to be DURC in order to mitigate risks where appropriate
- Proposed policy for institutional oversight of DURC issued February 22, 2013
  - Formally delineates the roles of institutions and investigators in identifying DURC at the local/ institutional level
  - Public comment being sought before the proposal is finalized

Proposed USG Policy for DURC Oversight by Institutions

- Institutional Contact for DUR (ICDUR)
- Institutional DUR Review Board (? IBC)
  - Verifies that research is within the scope of the policy: 15 select agents and toxins…
  - Applies DURC definition: 7 types of "experiments of concern"…
- For research falling within the scope and judged to be DURC:
  - Assess the risks and benefits of the research
  - Develop and implement a risk mitigation plan for the DURC
  - Report to NIH

Challenges for Institutions in Meeting the Proposed Policy

- Building awareness and educating faculty and staff about DUR and DURC.
- Establishing local policy and schedules for DUR reviews (more frequent than IBC review?)
- Ensuring sufficient expertise available to ICDUR and institutional DUR review entity.
- Increased faculty time and effort devoted to research compliance.
- Regulatory issues: additional institutional reporting requirements.

Managing DURC: NSABB Tools

- Considerations in Identifying DURC
- Points to Consider in Risk Assessment and Management of DURC
- Points to Consider in Assessing the Risks and Benefits of Communicating DURC
- Considerations in the Development of a Communication Plan
- **http://1.usa.gov/13qbsIX**

Questions?