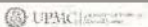


**New Infectious Disease Challenges  
for the 21<sup>st</sup> Century**

D.A. Henderson, MD, MPH  
Professor of Medicine and Public Health, University of Pittsburgh  
Johns Hopkins University Distinguished Service Professor

Malcolm Adcock Lecture  
Cincinnati, Ohio  
March 23, 2006

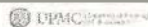
---

Center for Biosecurity 

- *Man's only competitors for the dominion of the planet are the viruses – and the ultimate outcome is not foreordained.*

*Joshua Lederberg*  
Nobel Laureate, USA

---

Center for Biosecurity 

**These competitors are increasing**

- New and *emerging* infections have been increasing in number
- The sources of the threat
  - Natural mutation of microbes
  - Emergence of organisms from remote areas
  - Biological terrorism
- The threats are international


---

Center for Biosecurity 

**"Conquest" of the infectious diseases  
1950s-70s**

- Dramatic changes post WW II
  - Vaccines
  - Antibiotics
  - Nutrition
  - Housing
  - Sanitation
- Decline or elimination of many diseases in the industrialized world
  - Smallpox, diphtheria, whooping cough, tetanus, polio, measles, *et alia*


---

Center for Biosecurity 

- *"One can think of the middle of the 20<sup>th</sup> century as the end of one of the most important social revolutions in history, the virtual elimination of the Infectious diseases as a significant factor in social life"*

*Sir Macfarland Burnet*  
Nobel Laureate, Australia, 1962


---

Center for Biosecurity 

**A cloud on the horizon**

- June, 1981 – first cases of AIDS diagnosed
- April, 1984 – HIV is identified
  - "the triumph of science over a dread disease"
  - "a vaccine will be available in 2 years"
- 2005 -a world-wide pandemic in progress
  - 4<sup>th</sup> leading cause of death world-wide
  - No vaccine
  - No curative drug

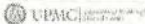
---

Center for Biosecurity 

## HIV is not the only surprise

- 1989 Conference on Emerging Infections
- An illustrative additional inventory
  - SARS – from Asia
  - Monkeypox – from Africa
  - TSE – “mad cow” disease – from UK
  - *H5N1 influenza* – from Asia
- More than 30 new agents in 25 years

Center for Biosecurity



## Why now?

- Growth in urban populations
  - Population of cities
    - 1975 – 5 with more than 10,000,000
    - 2004 – 20 with more than 10,000,000  
6 with more than 15,000,000
  - By 2015
    - 5 cities with more than 20,000,000 persons
    - 55% of world's population in urban areas

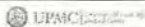
Center for Biosecurity



## Why now?

- Growth in urban populations
- International travel
  - Volume
    - 18 million commercial air flights yearly
    - 1.6 billion air passengers per year
  - Remote area destinations
  - All cities less than 36 hours from others

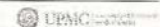
Center for Biosecurity



## Why now?

- Growth in urban populations
- Travel
- Growth of hospitals in endemic areas
  - Major sites for disease distribution
  - Problem of blood borne diseases
  - Development of antibiotic resistance

Center for Biosecurity



## Why now?

- Growth in urban populations
- Travel
- Growth of hospitals in endemic areas
- Food supply
  - Internationalized
  - Industrialized
    - Animal husbandry
    - Food processors

Center for Biosecurity



## Intentional release of biological agents

- A threat, largely ignored until 1995
  - Too difficult to grow organisms
  - Technologically difficult to disseminate
  - Not used because of a moral barrier

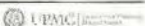
Center for Biosecurity



## What has changed?

- Advances in biotechnology
  - Numbers and sophistication of laboratories
  - Information access – internet
  - Trained microbiologists
  - Aerosolization devices
- Growth of independent terrorist groups

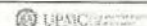
Center for Biosecurity



## Watershed events Aum Shinrikyo -- Japan

- Religious cult released Sarin gas in Tokyo subway (1995)
  - Cult - previously unknown to intelligence
  - Thousands of members, well-funded
  - Tried to aerosolize anthrax and botulinum toxin throughout Tokyo at least 8 times
- *Concern – unknown, non-state sponsored organization, acting without concern for moral deterrents*

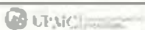
Center for Biosecurity



## Watershed events USSR Bioweapons Program

- A secret program – unknown until 1989
- 1992 – Ken Alibek, Deputy Director of bioweapons program, defects
- 1995 – Full scope of program apparent
  - 60,000+ persons in 50 different labs
- *Concern – Expertise and possibly specimens now dispersed world-wide. Still a secret program*

Center for Biosecurity



"On May 8, 1980, WHO announced that smallpox had been eradicated. Soon after, smallpox was included in a list of biological weapons targeted for improvement in the 1981-85 Five-Year Plan..."

Where other governments saw a medical victory, the Kremlin perceived a military opportunity...the military command issued an order to maintain an annual stockpile of 20 tons (of smallpox virus)."

*Alibek, 1998*

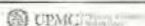
Center for Biosecurity



## A recurrent menace – influenza today – the greatest threat of all

- Influenza – 1918 – H1N1
  - Case-fatality rate - about 2 %
  - Deaths -- U.S. 675,000  
World >50,000,000
- Influenza – 2004/2006 – H5N1
  - ~180 cases/ 100 deaths
  - *More lethal than any epidemic pathogen*

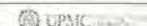
Center for Biosecurity



## Status – ~~at risk~~ <sup>MAR 24</sup>

- Infected wild fowl, chickens, ducks, turkeys
  - Asia
  - Most of Europe
  - Africa
- Human cases – contacts of birds and patients
- Massive slaughter of fowl in infected areas
- Embargo on fowl from infected areas
- Autumn – the beginning of the flu season

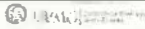
Center for Biosecurity



## Prospects for the U.S.

- Avian – a virtual certainty
  - Migratory birds
  - Bird smugglers
- Pet animals – probable but limited
  - Cats
- Humans – the question
  - Can it be slowed or stopped?

Center for Biosecurity

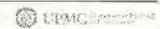


Influenza Outbreaks



July 1957

Center for Biosecurity

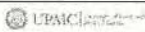


Influenza Outbreaks



August 1957

Center for Biosecurity

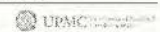


Influenza Outbreaks

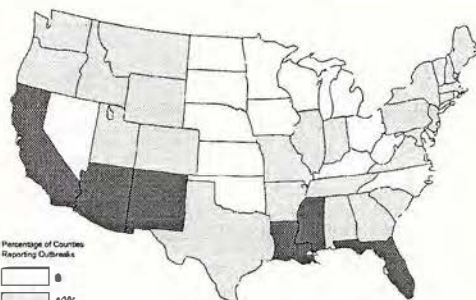


September 14, 1957

Center for Biosecurity

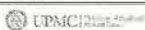


Influenza Outbreaks

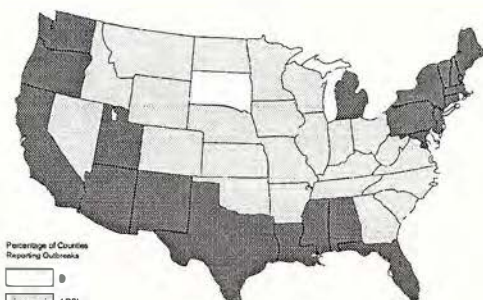


September 28, 1957

Center for Biosecurity

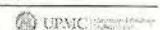


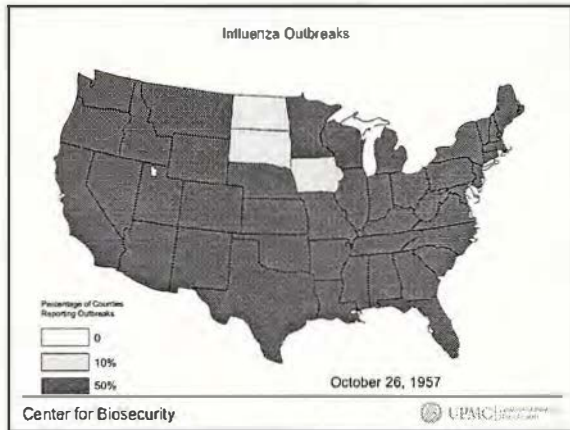
Influenza Outbreaks



October 12, 1957

Center for Biosecurity





### U.S. Measures to cope

- Vaccine the most important
  - H3N2 vaccine – 90 million+ doses available
  - H5N1 vaccine - 0 doses for 05/06 season
    - Studies to produce larger quantities for 06/07
    - Need vaccine strain after human spread begins
- Tamiflu, other antivirals
  - Limited supplies available
  - No certainty they will work in treatment

Center for Biosecurity UPAC

### Active steps this year

- Plans for medical care involving tens of thousands
  - Who is responsible?
  - Monitoring of bed availability
  - Policies re: elective surgery
  - How to staff hospital
  - Who is to pay
- Role of federal government
- Role of isolation and quarantine

Center for Biosecurity UPAC

### Civilian initiatives in national security 1995-99

- Presidential Decision Directive #39 –1995
- 1997 Defense Against Weapons of Mass Destruction Act
  - DoD responsible for organizing domestic preparedness
  - To train teams of first responders in 120 major cities
  - National Guard Rapid Assessment teams (RAID) for States
  - Marine Corps Incident Response Force
  - Army Technical Escort Unit
- Dept. of Justice and FBI given special funds

Center for Biosecurity UPAC

### Initial Assumptions not yet fully corrected

- For terrorist threats, the solution is emergency response measures
  - Police, fire, emergency staff for rescue and to deal with chemical leaks, spills, etc. – “lights and sirens”
  - DoD to do the training
  - FBI to find the bad guys
  - FEMA to deal with recovery
  - Public health and medical problems – all but ignored
- Chemical and biologic weapons require the same response– hence, a new word “CHEMBIO”

Center for Biosecurity UPAC

### A reassessment of strategies – 1998-2001

- Center for Civilian Biodefense Strategies
  - Working group on priority (Class A) agents
  - First national symposia for medicine and public health
  - Meaningful funding of HHS – FY 2000
  - The Dark Winter exercise (June 2001)
  - The anthrax attacks (October 2001)

Center for Biosecurity UPAC

## 2001—Public Health Emergency Preparedness

- A new office
  - A new budget
  - Funds to states and cities
  - 24/7 communication and response
  - Laboratory response network
  - Strategic National Stockpile
  - Smallpox vaccine; antibiotics
  - A research agenda

Center for Biosecurity



## The agenda for the future

- Greatly strengthened network of international cooperation and communication
  - Cooperative international centers for epidemiology and laboratory diagnosis in all countries
  - A far more generously supported WHO effort to orchestrate the many national initiatives
- A focused research and development program

Center for Biosecurity



- “Today’s world is truly a global village, characterized by growing concentrations of people in huge cities, increasing global commerce and travel...One can safely predict that infectious diseases will continue to emerge...Depending on present policies and actions, this situation could lead to a catastrophic storm of microbial threats.”

*Institute of Medicine/ National Academy of Sciences  
Microbial Threats to Health, 2003*

Center for Biosecurity

