New Epidemic Threats –
A challenge for the 21st Century

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- *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

The competitors are increasing

- The increasing challenges of infectious agents in the 21st century are only beginning to be appreciated
- Sources of the threat:
  - Natural mutation of microbes
  - Emergence of organisms from remote areas
  - Biological terrorism
- The threats are international

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

- Dramatic changes post WW II
  - Vaccines
  - Antibiotics
  - Nutrition
  - Housing
  - Sanitation
- Decline or elimination of many diseases
  - Smallpox, diphtheria, whooping cough, tetanus, polio, measles, others

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- *"One can think of the middle of the 20th 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--1962
Nobel Laureate, Australia

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
  - 4th leading cause of death world-wide
  - No vaccine
  - No curative drug

HIV is not the only surprise

- 1989 Conference on Emerging Infections
- An illustrative partial new inventory
  - SARS – from Asia
  - Monkeypox – from Africa
  - Anthrax – from ?
  - TSE – "mad cow" disease
  - *H5N1 influenza* – from Asia
- More than 30 new agents in 25 years

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

Why now?

- Growth in urban populations
- International travel
  - Volume
    - 18 million commercial air flights (2000)
    - 1.1 billion air passengers
  - Remote area destinations
  - All cities now within 36 hours from others

Why now?

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

Why now?

- Growth in urban populations
- Travel
- Growth of hospitals in endemic areas
- Food supply
  - Internationalized -- 70% of many U.S.fruits and vegetables come from developing countries
  - Industrialized – Feed lots

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

What has Changed?

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

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

Watershed events
USSR Bioweapons Program

- A secret program – unknown until 1989
- 1992 – Ken Alibek, Deputy Director of USSR bioweapons program, deserts
- 1995 – Full scope of program apparent
  - 60,000+ persons in 50 different labs.
- Concern: Expertise and specimens now dispersed world-wide. Program still secret

"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

Bioweapons of Greatest Concern

- Smallpox
- Anthrax
- Plague
- Tularemia
- Botulinum Toxin
- Hemorrhagic fevers
  Ebola, Marburg, etc.

Agents that, if used, could threaten the integrity of civil government

A recurrent menace -- influenza

- Influenza – 1918 – H1N1
  - Case-fatality rate - about 1 %
  - Deaths -- U.S. 550,000
    World >20,000,000
- Influenza – 2004-2005 – H5N1
  - 88 cases/ 51 deaths

As of 5 April

The Agenda for the Future

- Public health emergency preparedness
  - Detection and diagnosis
  - Response
    - Epidemiological capability
    - National strategic stockpile
    - Research and development
  - Clinical care
    - Hospital surge capacity
    - Emergency medical services
  - Communication and education

The Agenda for the Future

- Greatly strengthened network of international cooperation and communication
  - Cooperative international centers for epidemiology and laboratory diagnosis in most countries
  - A far more generously supported WHO effort to orchestrate the many national initiatives
- Planned program for international response
  - Lessons from "Atlantic Storm"

- "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

- "No responsible assessment of microbial threats to health in the 21st century could end without a call to action. The magnitude and urgency of the problem demand renewed concern and commitment. We have not done enough – in our own defense or in the defense of others."

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

International coop. and collaboration is not an option. It is a necessity if mankind is to survive.