

NIH Scientific Management Review Board

Scientific Opportunities and Emerging Public Health Issues at the NIH: A View from NIAID

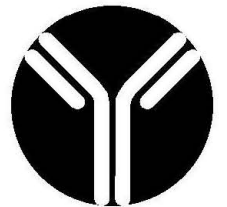
Anthony S. Fauci, M.D.

Director

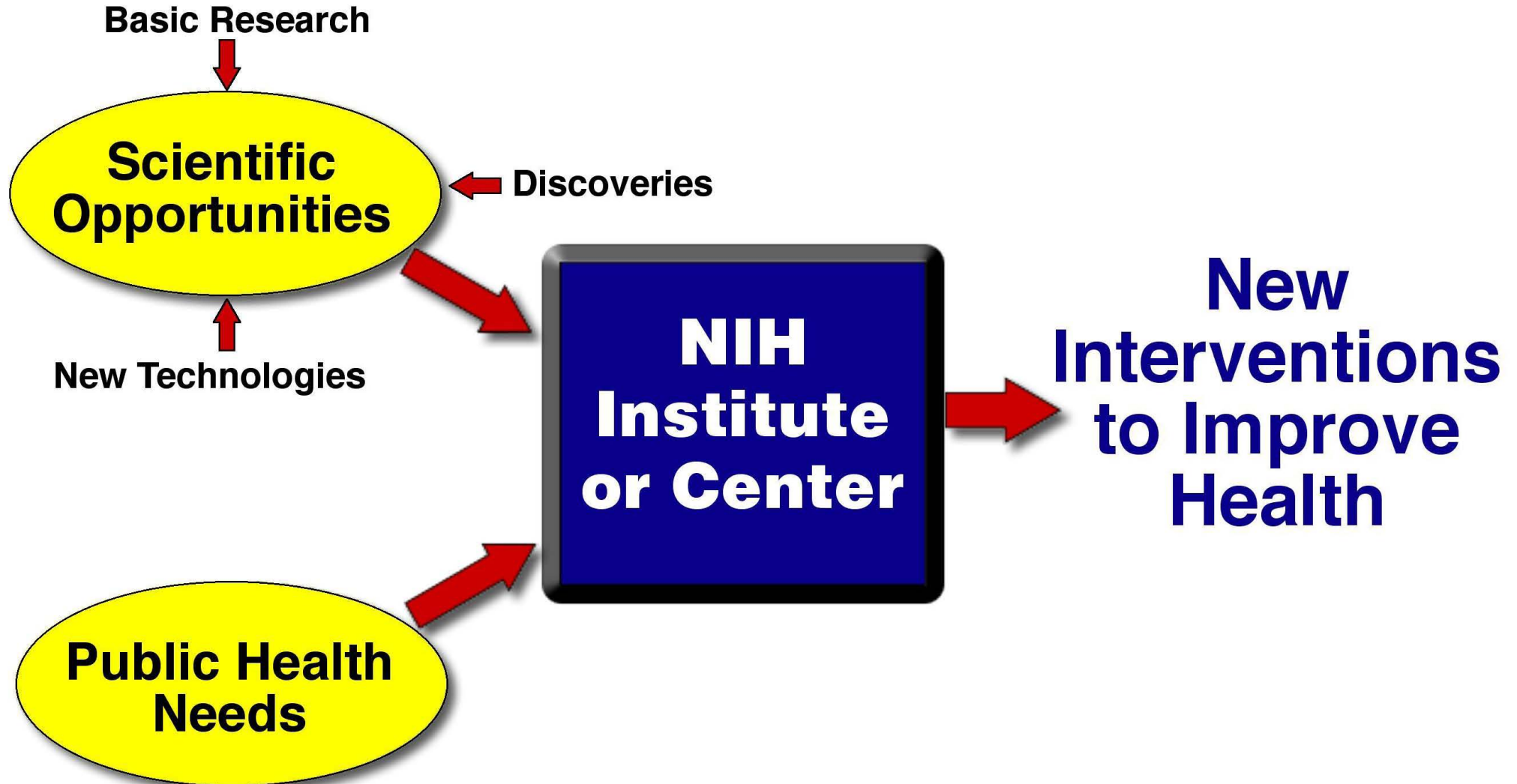
**National Institute of Allergy and Infectious
Diseases**

National Institutes of Health

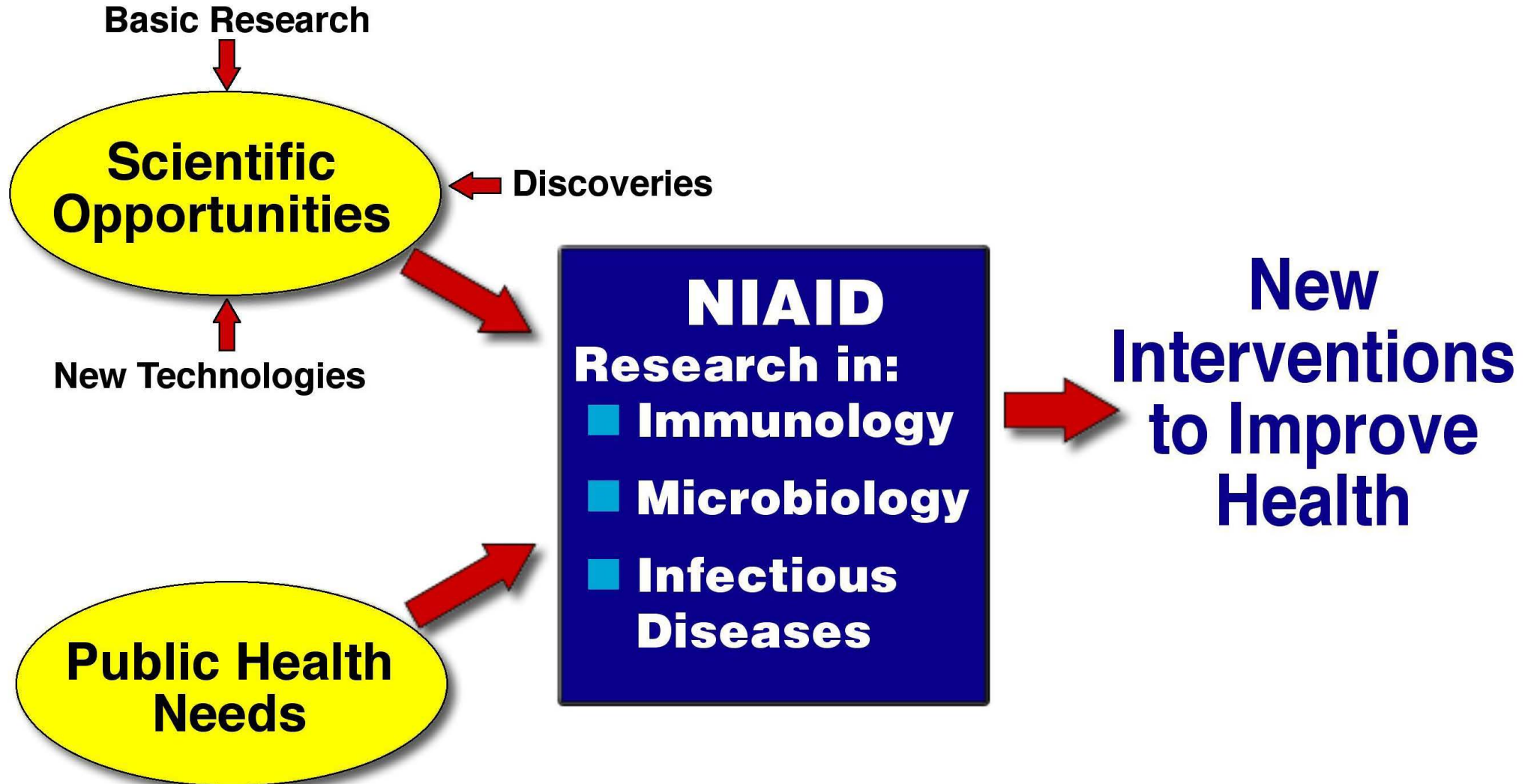
April 27, 2009



Paradigm for NIH Research



Paradigm for NIAID Research



**Scientific
Opportunities**

**Public Health
Needs**

**New
Institutes/Centers**

**Expanded Mandate
and/or Resources
for Existing
Institutes/Centers**

Evolving Public Health Challenges



Shift from Acute to Chronic Conditions



Aging Population



Health Disparities



Emerging and Re-emerging Infectious Diseases



Emerging Non-communicable Diseases - Obesity

Examples of Key Issues that Have Shaped Individual ICs

- **NIDDK** **Obesity epidemic**
- **NHLBI** **Discovery of modifiable risk factors for heart disease**
- **NCI** **Genomics to understand molecular basis of cancer**
- **NIAMS** **Arthritis in an aging population**
- **NIA** **Alzheimer's disease**
- **NINR** **Increase in chronic diseases and need for improved symptom management**
- **NICHD** **Understanding early developmental processes**
- **NIBIB** **Convergence between engineering and life sciences**
- **FIC** **Global Health**
- **NIDCR** **Relationship of oral health to overall health and well-being**
- **NCRR** **Clinical and Translational Science Award program to move research results rapidly from discovery to practice**
- **NINDS** **Identification of disease genes and their role in pathology**
- **NIDA** **Drug abuse treatment in criminal justice settings to improve public health/safety**

Growth of the National Institutes of Health

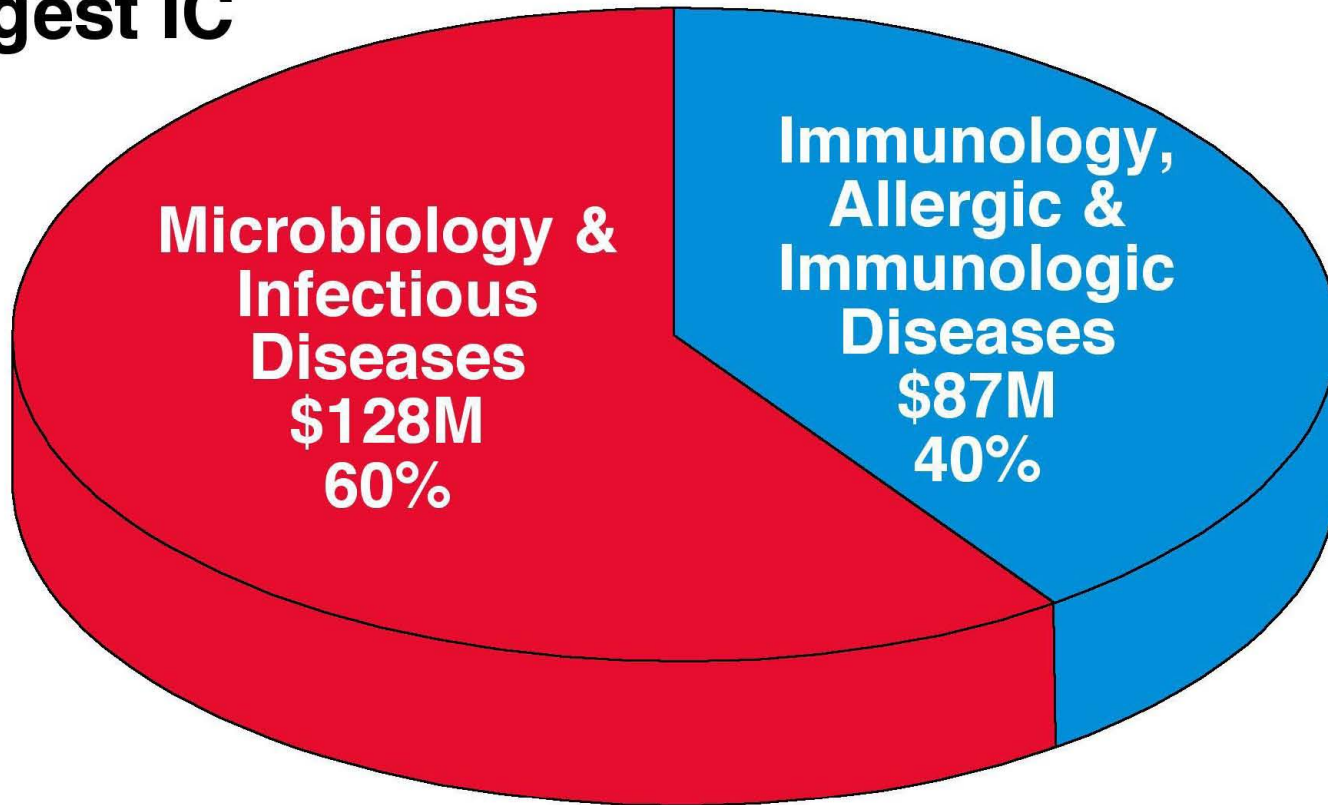
- **1948: 6 Institutes**
- **1950: 8 Institutes & Divisions**
- **1960: 11 Institutes, Centers & Divisions**
- **1965: 14 Institutes, Centers & Divisions**
- **1975: 20 Institutes, Centers & Divisions**
- **1990: 22 Institutes, Centers & Divisions**
- **2009: 27 Institutes & Centers**

National Institute of Allergy and Infectious Diseases



NIAID in 1980

- Budget: ~\$215 million
- Sixth largest IC



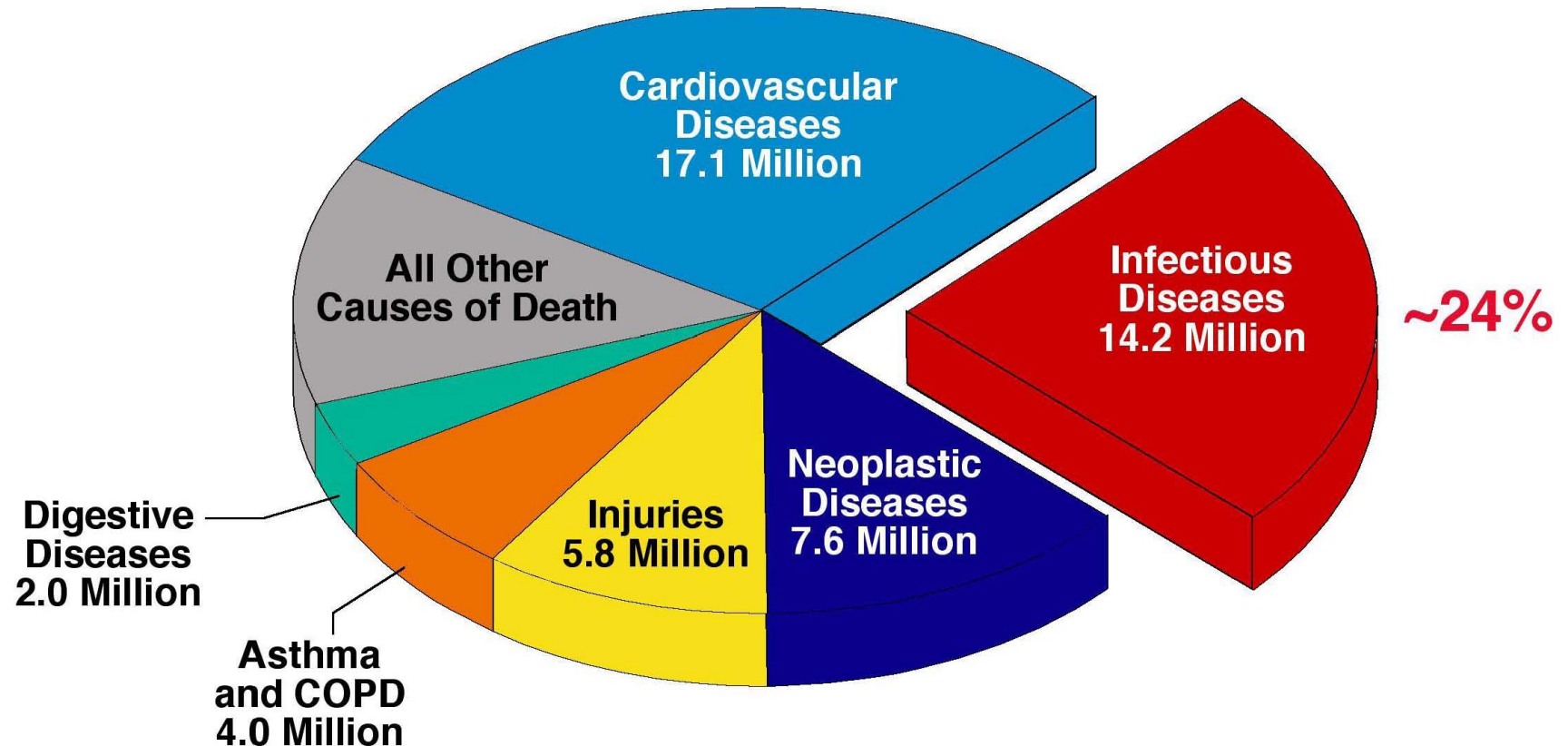
Total Budget: \$215M

A Premature Declaration of Victory Over Infectious Diseases

"We can look forward with confidence to a considerable degree of freedom from infectious diseases at a time not too far in the future. Indeed... it seems reasonable to anticipate that within some measurable time... all the major infections will have disappeared."

- Aidan Cockburn, *The Evolution and Eradication of Infectious Diseases*, 1963.

Infectious Diseases Cause ~24% of All Deaths Worldwide



Total Deaths: ~58.8 Million

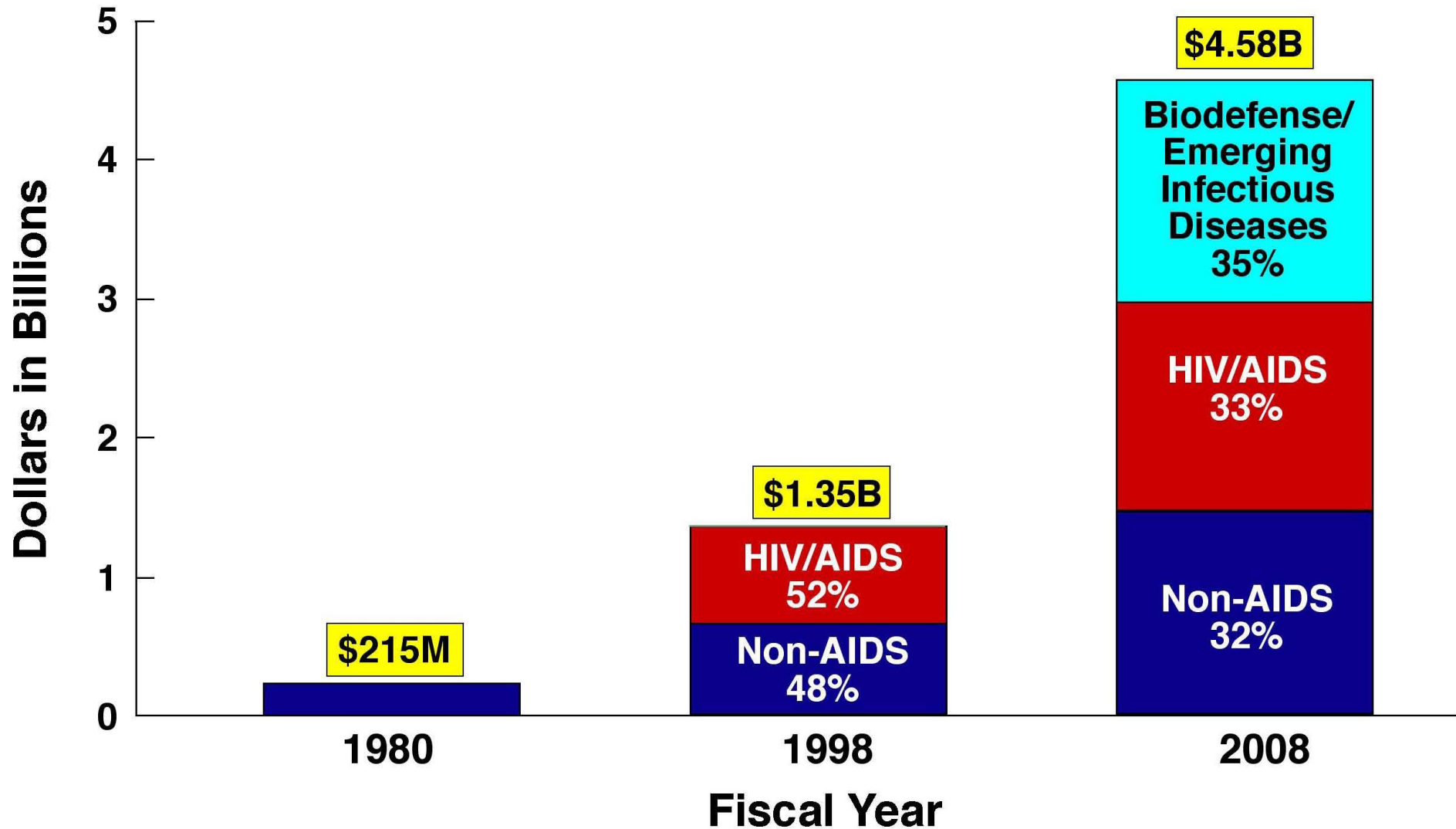
NIAID: Transforming Issues Since 1980

- **HIV/AIDS**
- **Global Health**
- **Biodefense**
- **Other emerging/re-emerging
infectious disease issues**

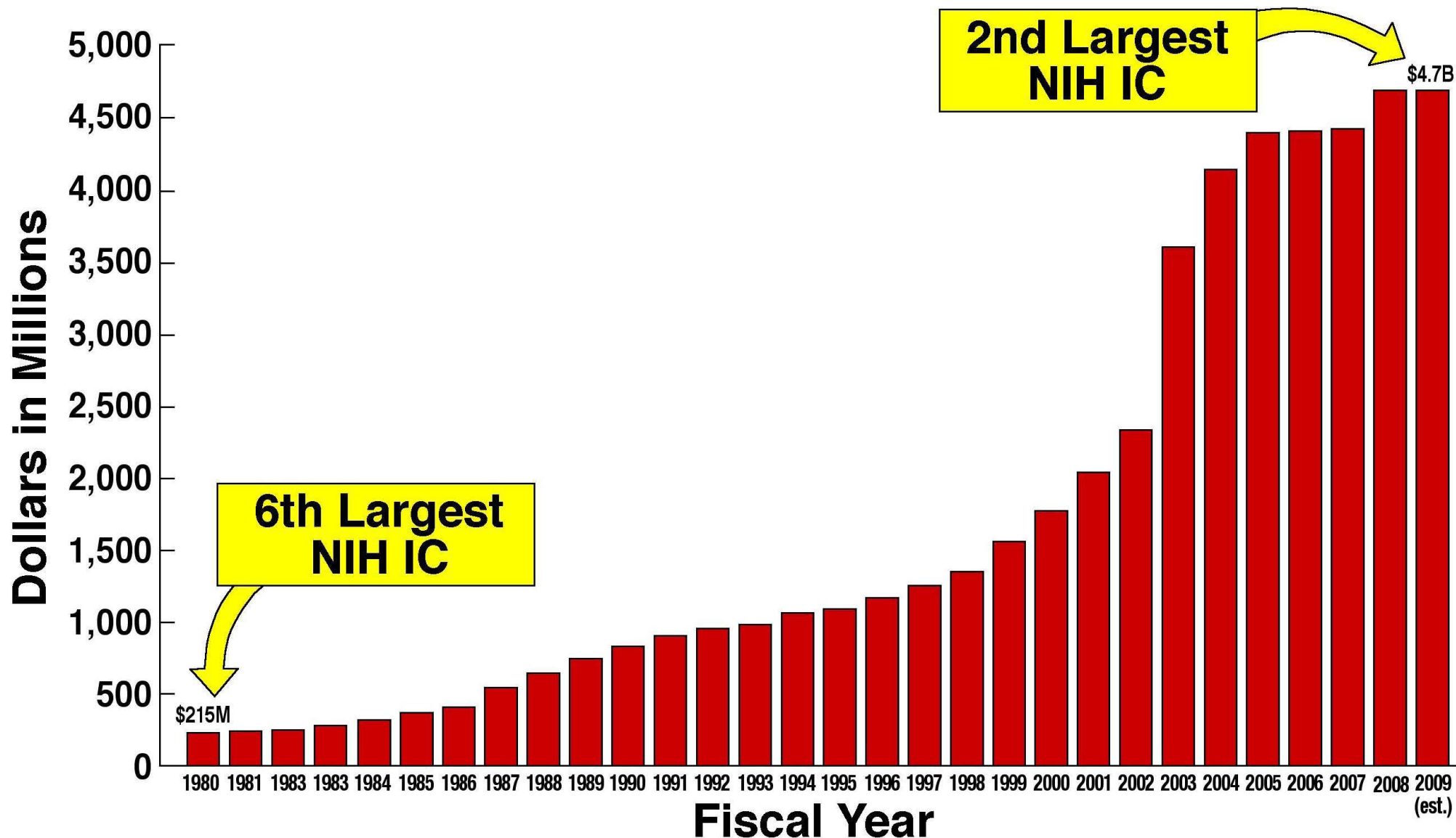
Examples of Technologies and Disciplines that Have Transformed Infectious and Immunological Disease Research

- **Genomics and other “omics”**
- **Array technologies**
- **Nanotechnology**
- **Synthetic chemistry**
- **Robotics**
- **Computer modeling**
- **Imaging**
- **Molecular and genetic epidemiology**
- **Monoclonal antibodies/fusion proteins/recombinant cytokines**
- **MHC tetramers**
- **FACS analysis/cell surface markers/CD antigens**
- **Systems biology**
- **Bioinformatics**

Evolution of the NIAID Budget



NIAID Funding History, 1980-2009 (est.)



Note: FY 2008 includes \$22M Emergency Supplement for NIAID.

MNWR

MORBIDITY AND MORTALITY WEEKLY REPORT

June 5, 1981

***Pneumocystis* Pneumonia - Los Angeles**

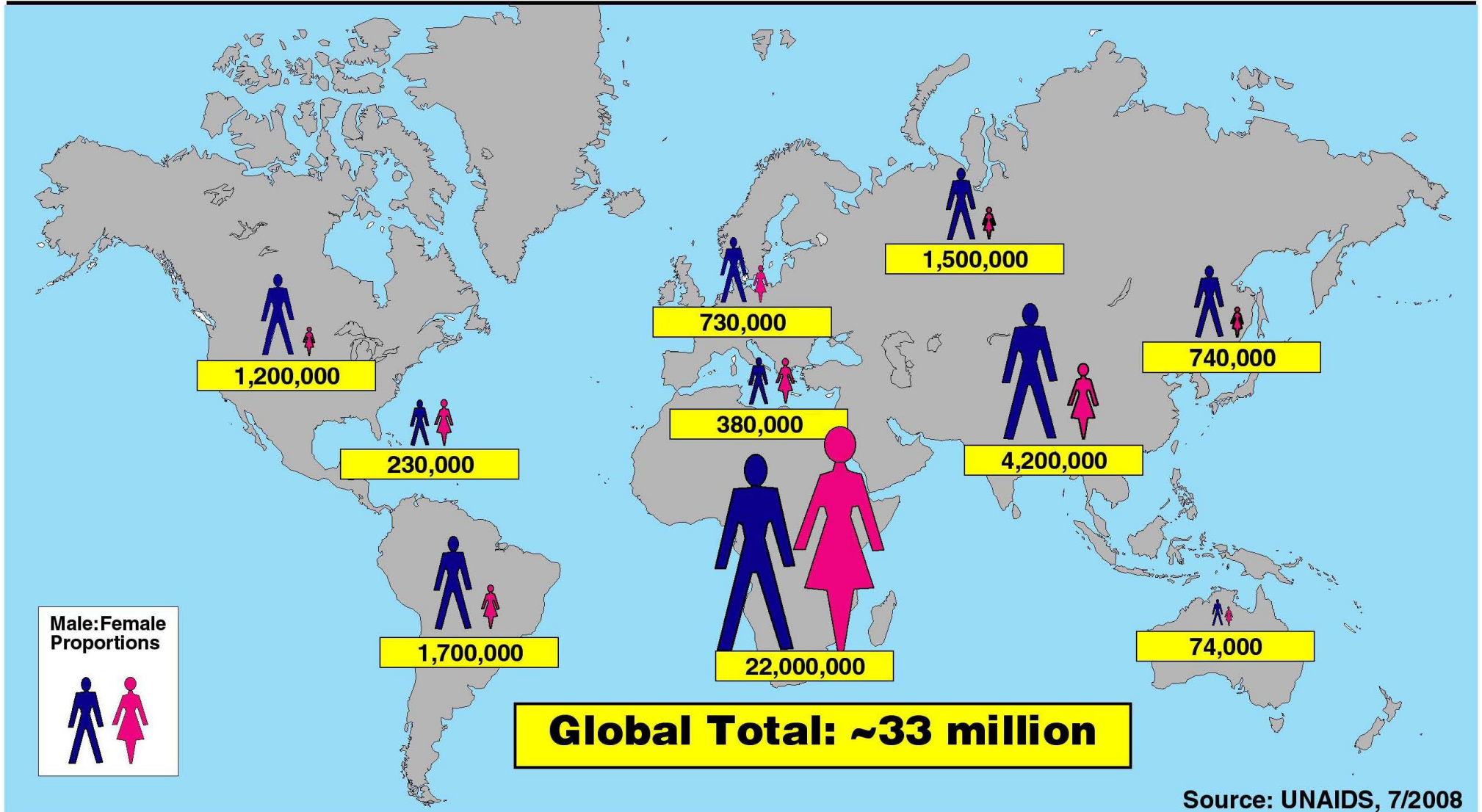
In the period October 1980 - May 1981, 5 young men, all active homosexuals, were treated for biopsy-confirmed *Pneumocystis carinii* pneumonia at 3 different hospitals in Los Angeles, California. Two of the patients died. All 5 patients had laboratory-confirmed previous or current cytomegalovirus (CMV) infection and candidal mucosal infection. Case reports of these patients follow.

July 4, 1981

Kaposi's Sarcoma and *Pneumocystis* Pneumonia Among Homosexual Men - New York City and California

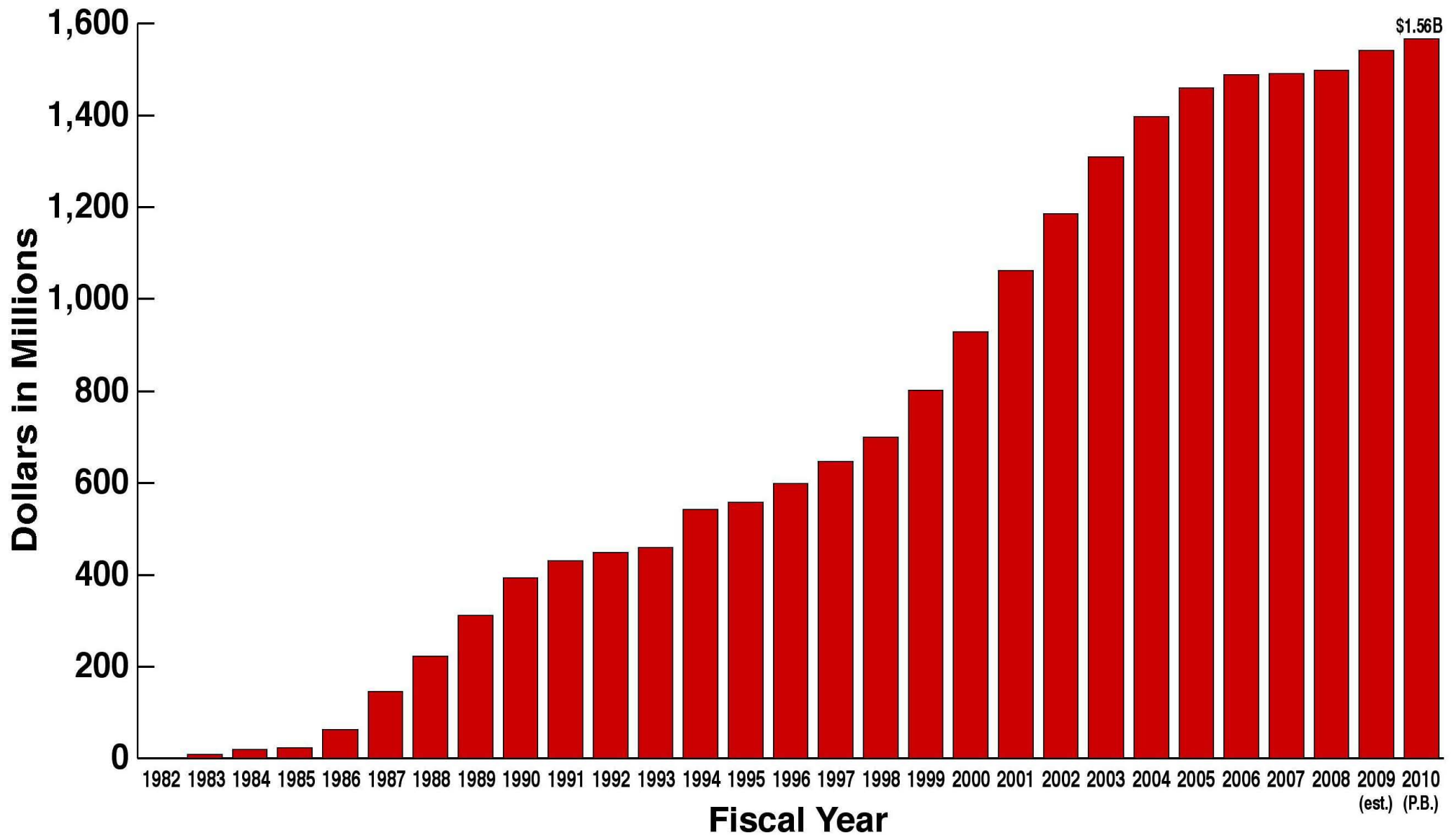
During the past 30 months, Kaposi's sarcoma (KS), an uncommonly reported malignancy in the United States, has been diagnosed in 26 homosexual men (20 in New York City (NYC), 6 in California). The 26 patients range in age from 26-51 years (mean 39 years). Eight of these patients died (7 in NYC, 1 in California) - all 8 within 24 months after KS was diagnosed.

Adults and Children Estimated to be Living with HIV, 2007



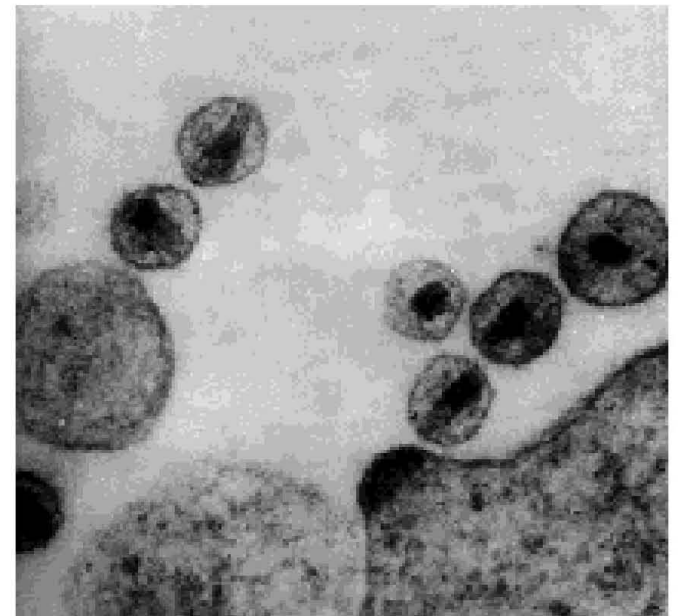
Source: UNAIDS, 7/2008

NIAID HIV/AIDS Research Funding



Advances in AIDS Research, 1981-2009

- Etiology
- Diagnosis
- Molecular Virology and Epidemiology
- Pathogenesis
- Natural History
- Treatment
- Prevention
- Vaccine Development



FDA-Approved Antiretroviral Drugs

NRTI

- Zidovudine
- Didanosine
- Zalcitabine
- Stavudine
- Lamivudine
- Abacavir
- Tenofovir
- Emtricitabine

NNRTI

- Nevirapine
- Delavirdine
- Efavirenz
- Etravirine

PI

- Saquinavir
- Ritonavir
- Indinavir
- Nelfinavir
- Amprenavir
- Lopinavir
- Atazanavir
- Fosamprenavir
- Tipranavir
- Darunavir

Fusion Inhibitor

- Enfuvirtide (T-20)

Entry Inhibitor

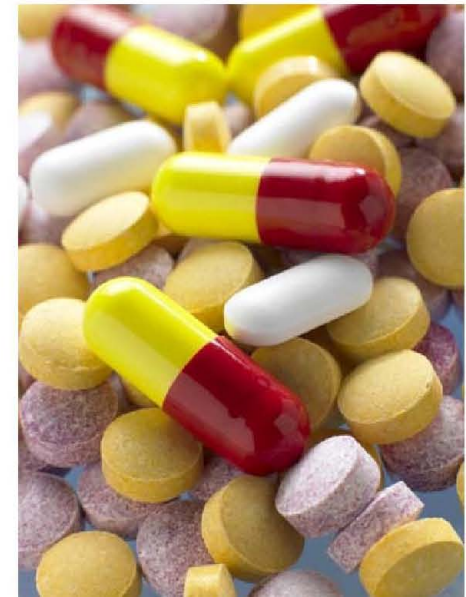
- Maraviroc

Integrase Inhibitor

- Raltegravir

Combinations

- 6 available, combining 2 or 3 drugs



Antiretroviral Therapy Dramatically Increases Life Expectancy for HIV-Infected Individuals

THE LANCET

Volume 372

Number 9635 Founded 1823 Published weekly

July 26, 2008

Life Expectancy of Individuals on Combination Antiretroviral Therapy in High-Income Countries: a Collaborative Analysis of 14 Cohort Studies

Antiretroviral Therapy Cohort Collaboration

- **An HIV-infected 20-year-old appropriately treated with ART can expect to live to >69 years in high-income countries**

Number of Antiviral Drugs Approved by FDA

1960s	3
1970s	1
1980s	5
1990s	30
2000s	24
Total	63

JAMA[®]

The Journal of the American Medical Association

July 25, 2001



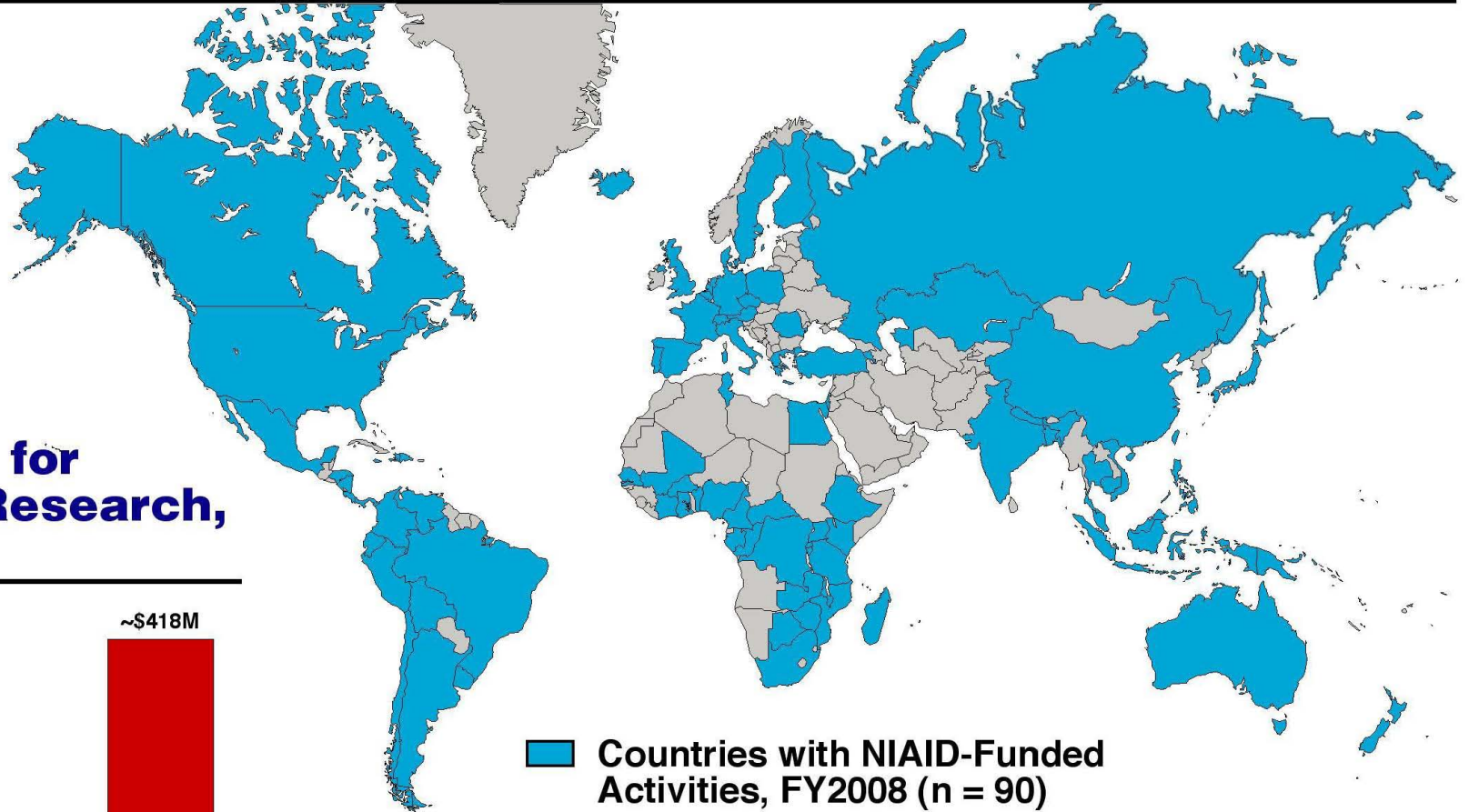
The AIDS Research Model Implications for Other Infectious Diseases of Global Health Importance

Gregory K. Folkers, MS, MPH and Anthony S. Fauci, MD

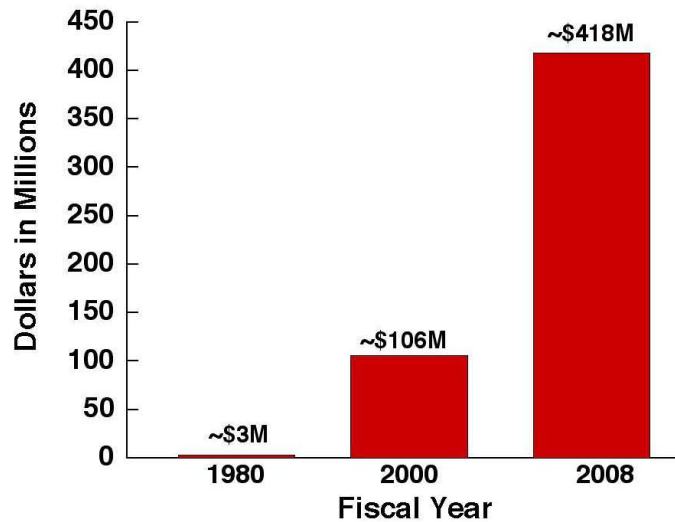
Selected Infectious Diseases of Global Public Health Importance

	<u>Estimated Annual Deaths</u>
Respiratory Infections	4.3 million
Diarrheal Diseases	2.2 million
HIV/AIDS	2.0 million
Tuberculosis	1.7 million
Malaria	881,000
Vaccine Preventable Childhood Diseases (measles, pertussis, tetanus, etc.)	847,000
“Neglected” Tropical Diseases (schistosomiasis, hookworm infection, leishmaniasis, trypanosomiasis, etc.)	530,000

Global Health Research at NIAID



NIAID Funding for International Research, 1980-2008



The Global Community is Faced with Numerous Health Challenges

Infectious Diseases

Heart Disease

Obesity

Mental Health

Accidents/Injuries

Cancer

Diabetes

Aging

Child Health

Many Others

Total annual deaths

Total annual DALYs

>57 million

>1.4 billion

Volume 8, Issue 11

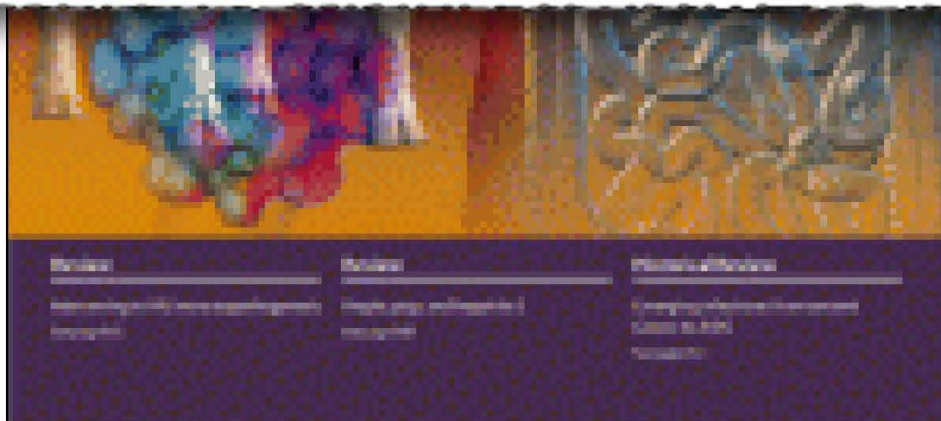
November 2008

THE LANCET Infectious Diseases



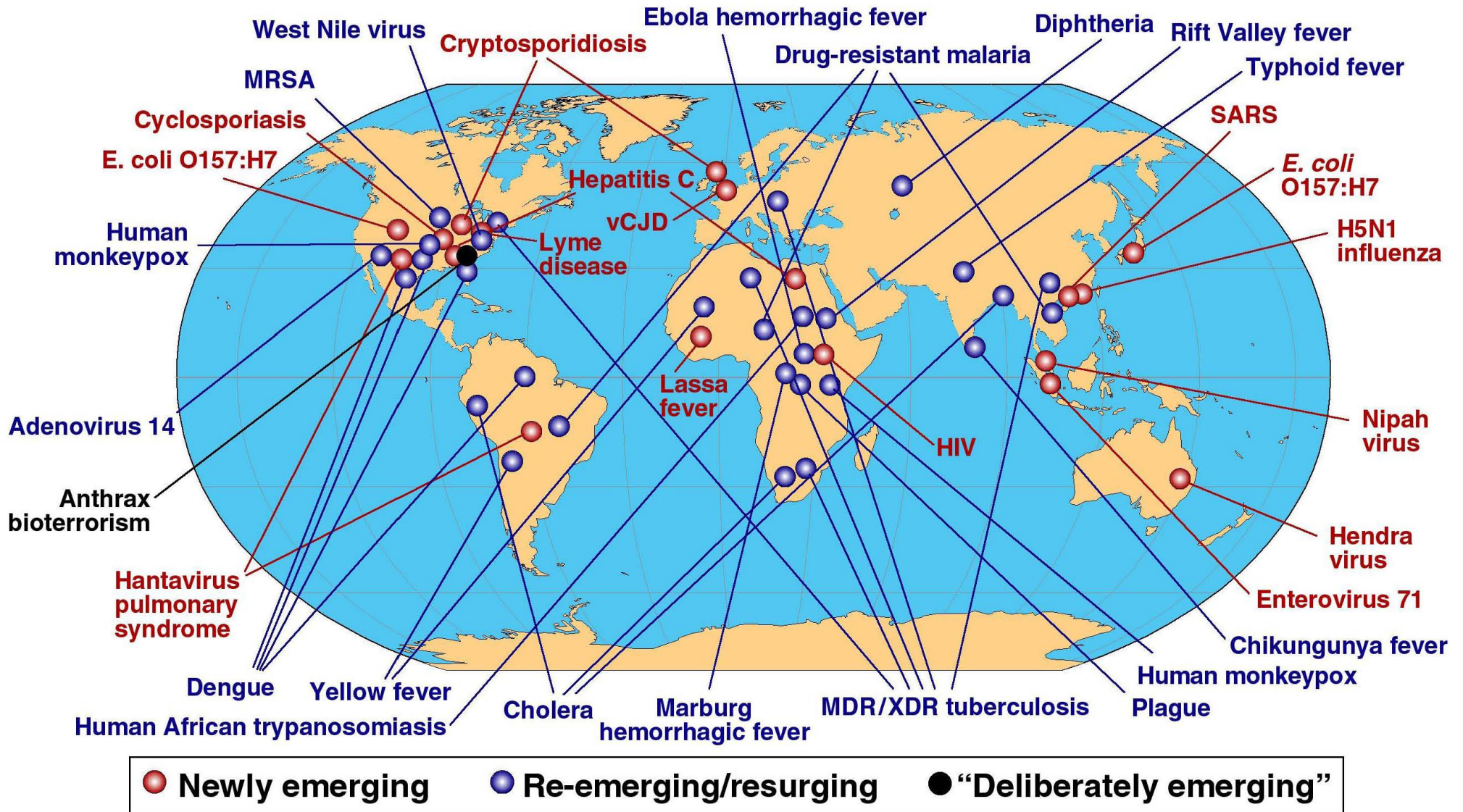
Emerging Infections: A Perpetual Challenge

DM Morens, GK Folkers & AS Fauci

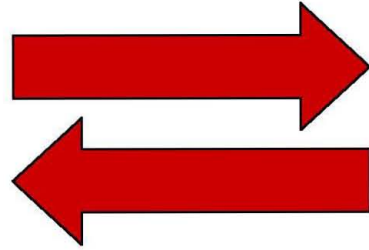


"For centuries a fundamental challenge to the existence and well-being of societies -- as reflected by scientific attention, as well as in art, religion, and culture -- emerging infections remain among the principal challenges to human survival."

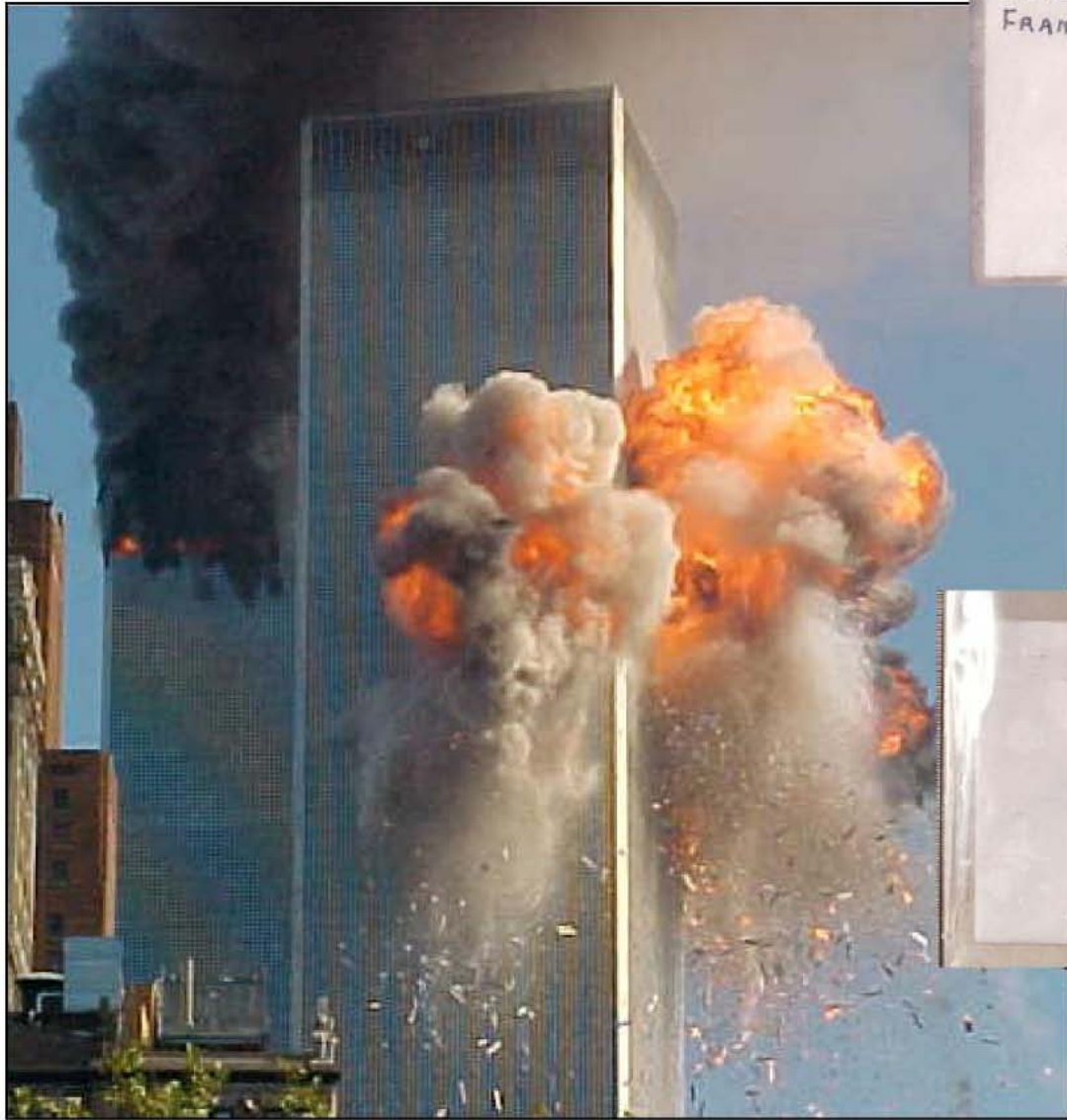
Global Examples of Emerging and Re-Emerging Infectious Diseases



**Naturally
Occurring
Infectious
Disease
Threats**



**Bioterror
Threats**



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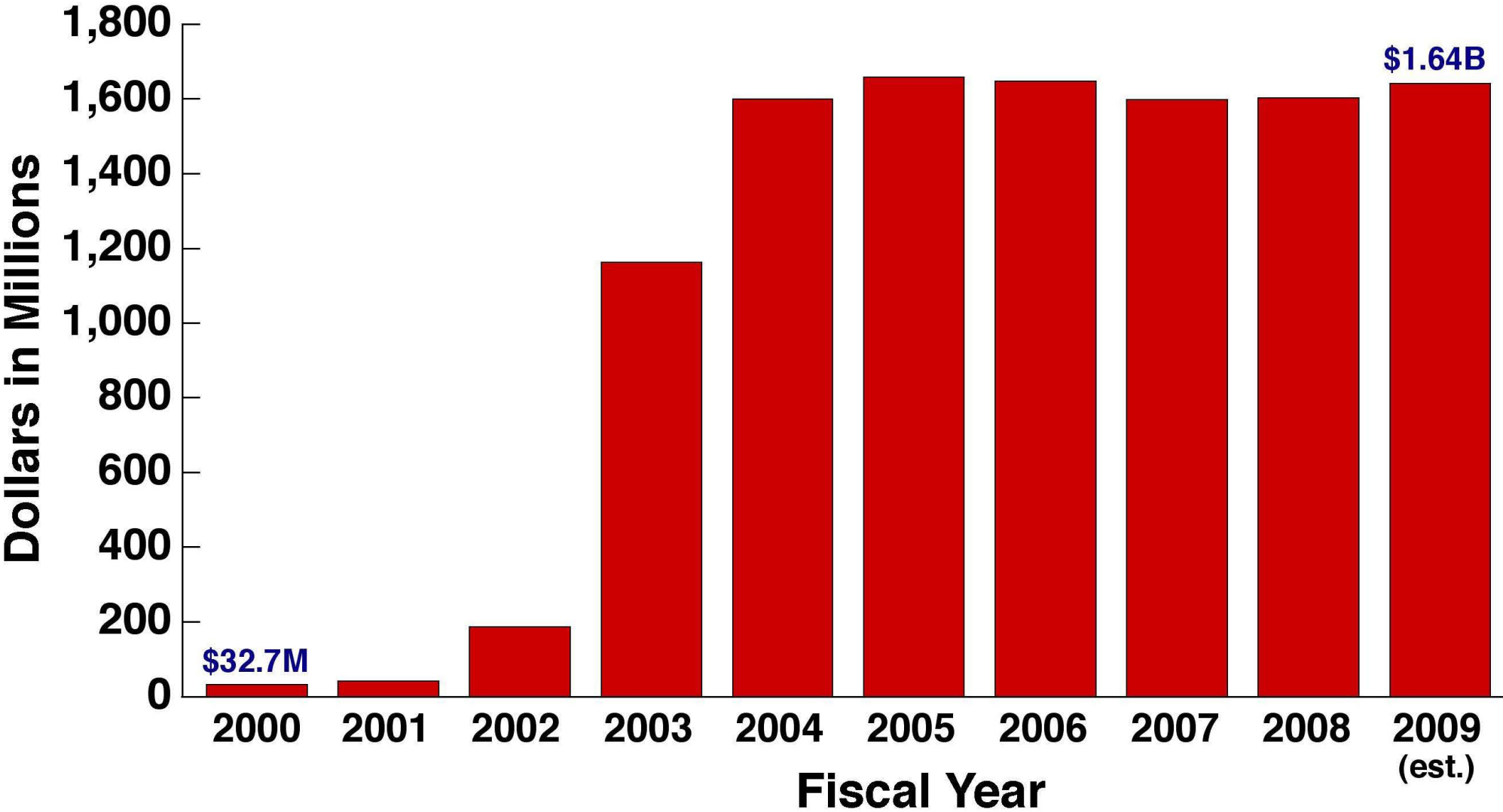
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Dr. Julie L. Gerberding

Dr. Anthony S. Fauci

NIAID Funding for Biodefense and Emerging Infectious Diseases Research, 2000-2009




 **NIAID Biodefense**
Preparing Through Research

**NIAID Biodefense Research Agenda
for CDC Category A Agents**

Progress Report




August 2003


 **NIAID Biodefense**
Preparing Through Research


**NIAID Biodefense Research Agenda
for Category B and C Priority Pathogens**

Progress Report




June 2004

 **NIAID Biodefense**
Preparing Through Research




**NIAID Biodefense
Research Agenda
for CDC Category A
Agents**

2006 Progress Report


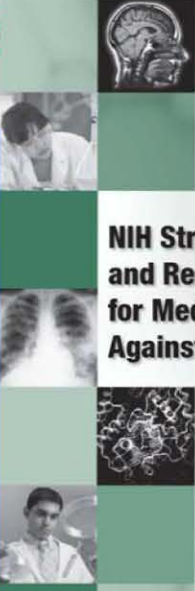


06.2005


**NIH Strategic Plan and Research Agenda
for Medical Countermeasures Against
Radiological and Nuclear Threats**




U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
National Institutes of Health
National Institute of Allergy and Infectious Diseases





**NIH Strategic Plan
and Research Agenda
for Medical Countermeasures
Against Chemical Threats**




U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
National Institutes of Health

 **NIAID Biodefense**
Preparing Through Research



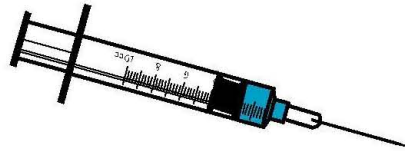
**NIAID Strategic Plan for
Biodefense Research**

2007 Update



U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
National Institutes of Health
National Institute of Allergy and Infectious Diseases

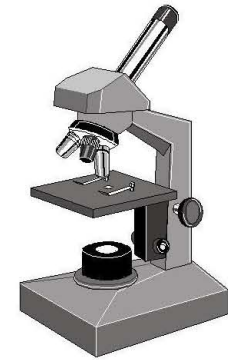
<http://www.niaid.nih.gov/biodefense>



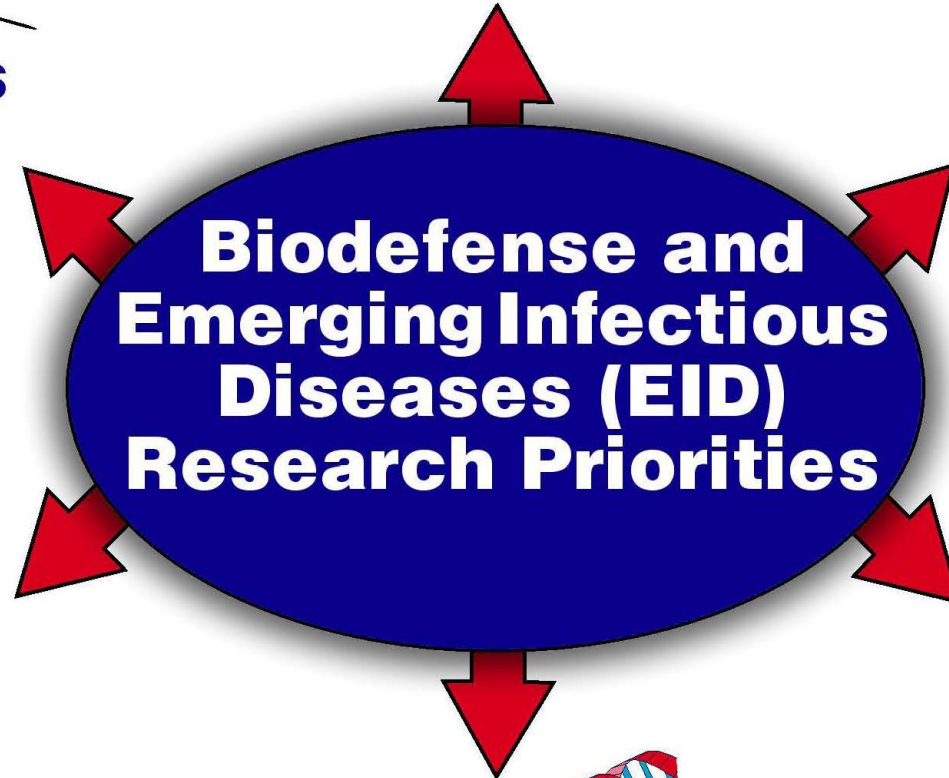
Vaccines



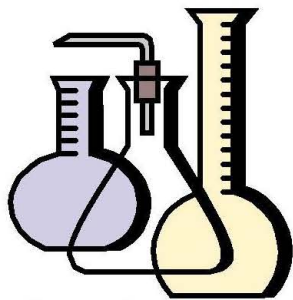
Therapeutics



Diagnostics



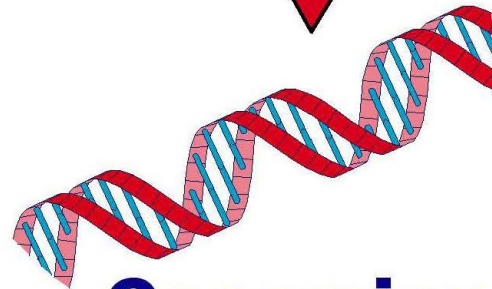
**Biodefense and
Emerging Infectious
Diseases (EID)
Research Priorities**



Basic Research



**Expansion of
Research
Capacity**

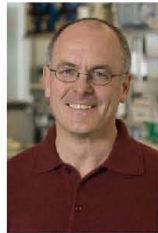


Genomics

NIAID Regional Centers of Excellence for Biodefense and Emerging Infectious Diseases



PI – Dr. Samuel Miller
University of Washington
Seattle, WA



PI – Dr. John Belisle
Colorado State University
Fort Collins, CO



PI – Dr. Olaf Schneewind
University of Chicago
Chicago, IL



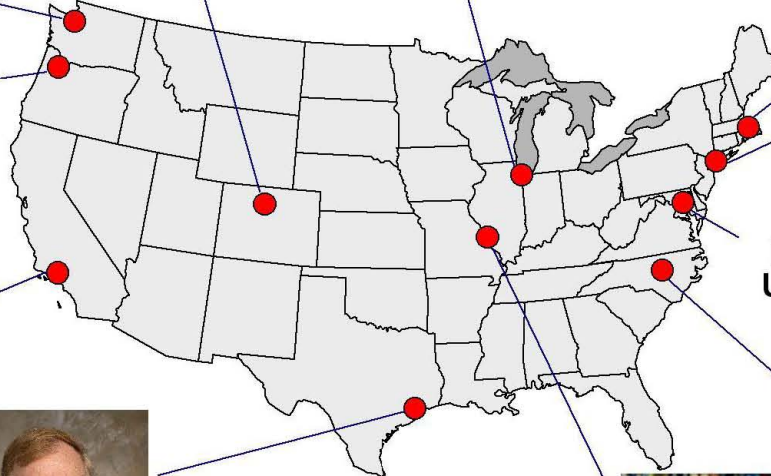
PI – Dr. Dennis Kasper
Harvard Medical School
Boston, MA



PI – Dr. W. Ian Lipkin
Columbia University
New York, NY



PI – Dr. Jay A. Nelson
Oregon Health & Science
University
Portland, Oregon



PI – Dr. Myron Levine
University of Maryland
Baltimore, MD



PI – Dr. Alan G. Barbour
University of California
Irvine, CA



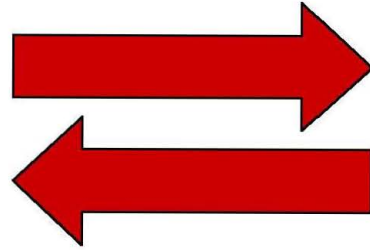
PI – Dr. David Walker
University of Texas Medical Branch
Galveston, TX

PI – Dr. Samuel Stanley
Washington University
St. Louis, MO



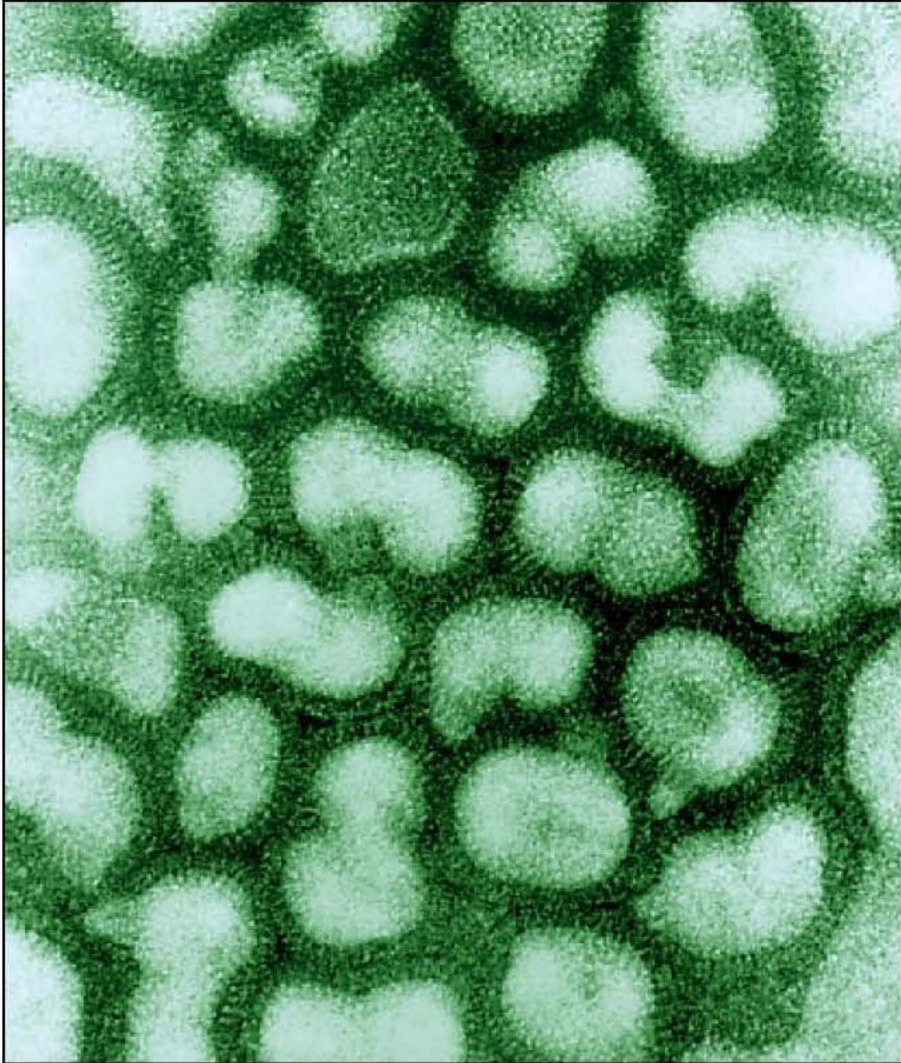
PI - Dr. Fred Sparling
University of North Carolina
Chapel Hill, NC

**Bioterror
Threats**



**Naturally
Occurring
Infectious
Disease
Threats**

Influenza

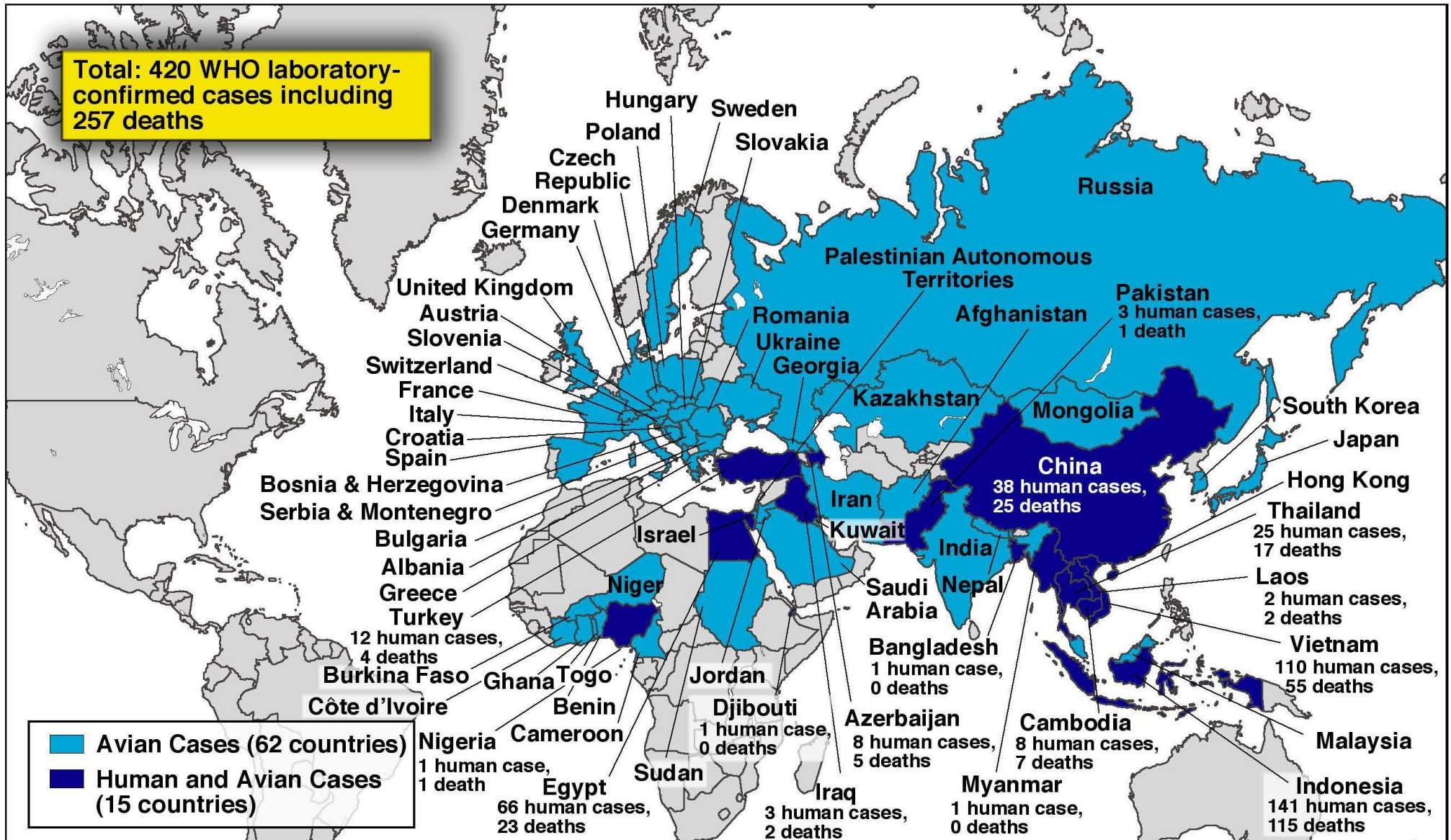


- **Re-emerging disease (seasonal flu)**
- **Newly emerging disease (potential pandemic flu)**

The Burden of Seasonal Influenza

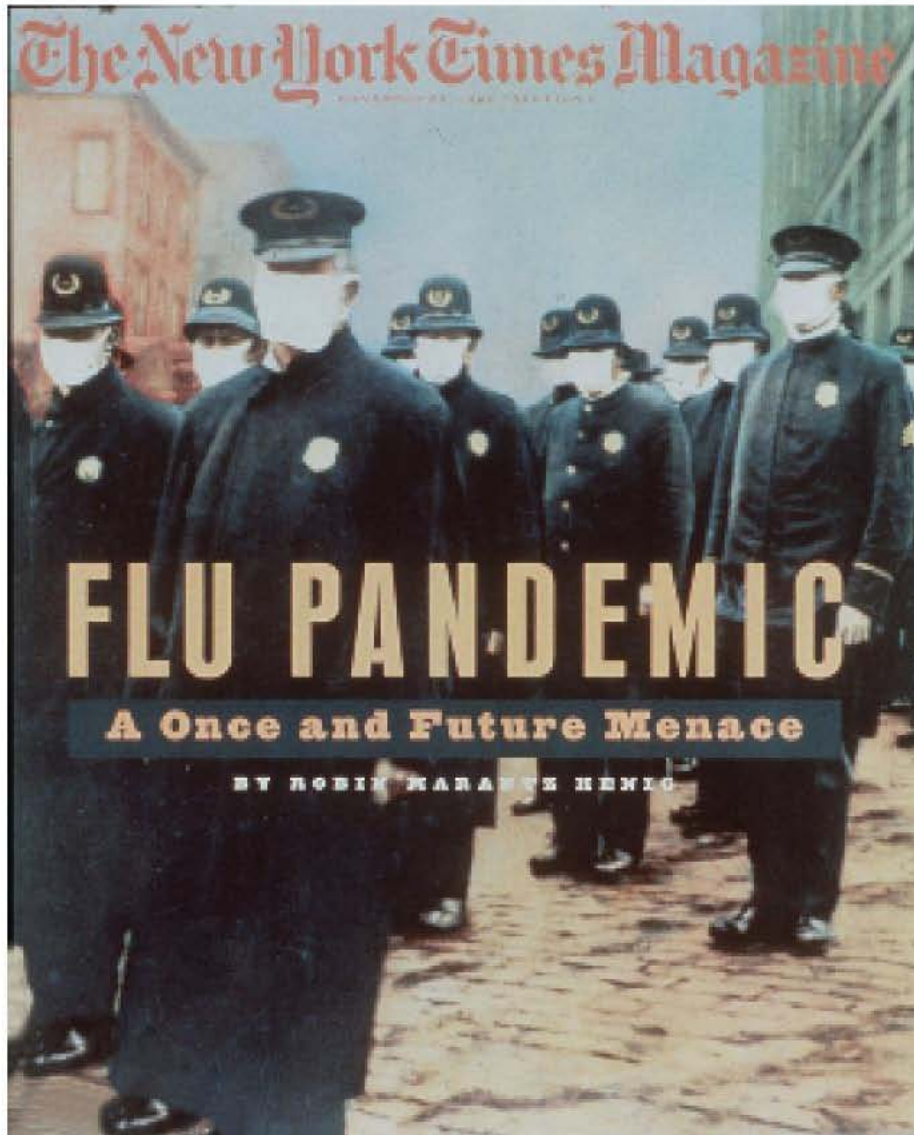
- **250,000 to 500,000 deaths globally/yr**
- **36,000 deaths and >200,000 hospitalizations/yr in U.S.**
- **\$37.5 billion in economic costs/yr in U.S. related to influenza and pneumonia**

H5N1 Influenza Cases, 2003-2009



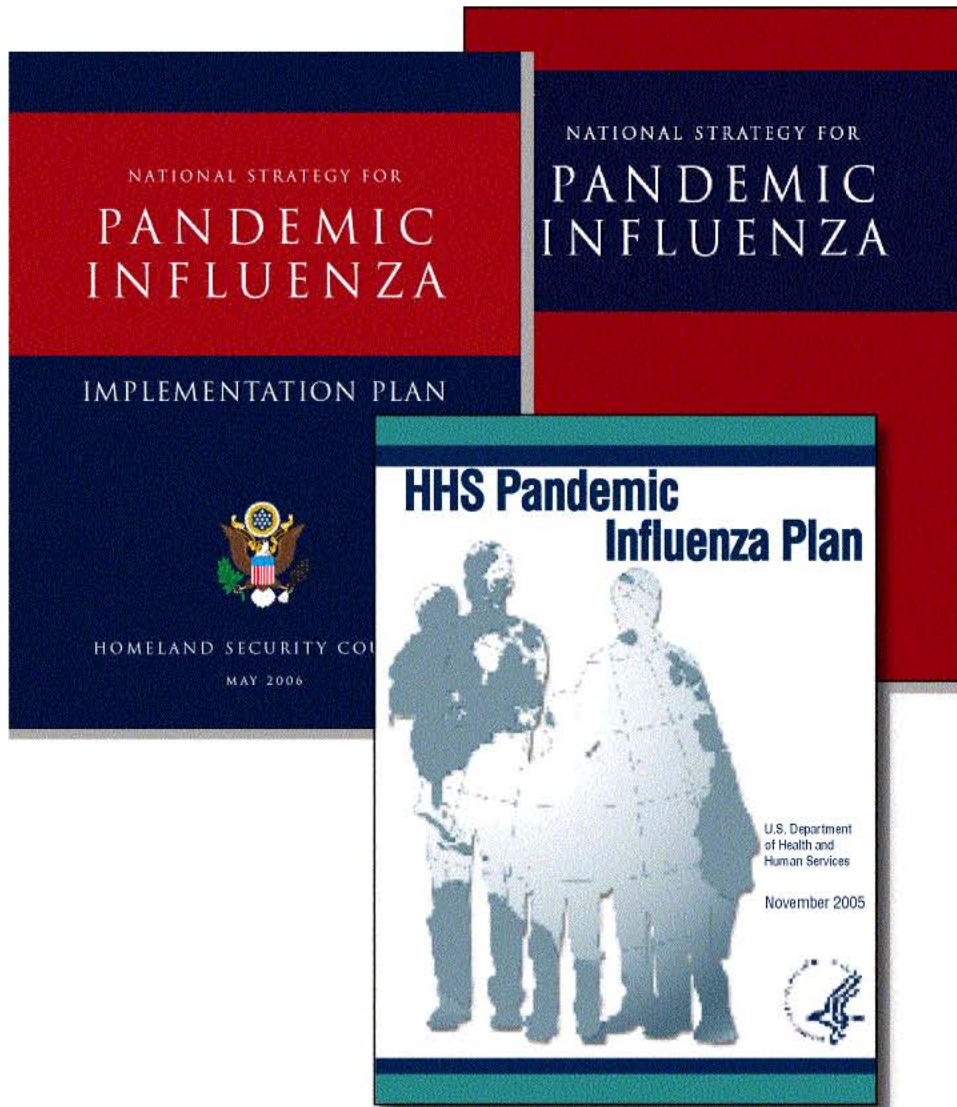
Source: WHO and OIE (World Organization for Animal Health), 4/21/2009

The Influenza Pandemic of 1918-1919



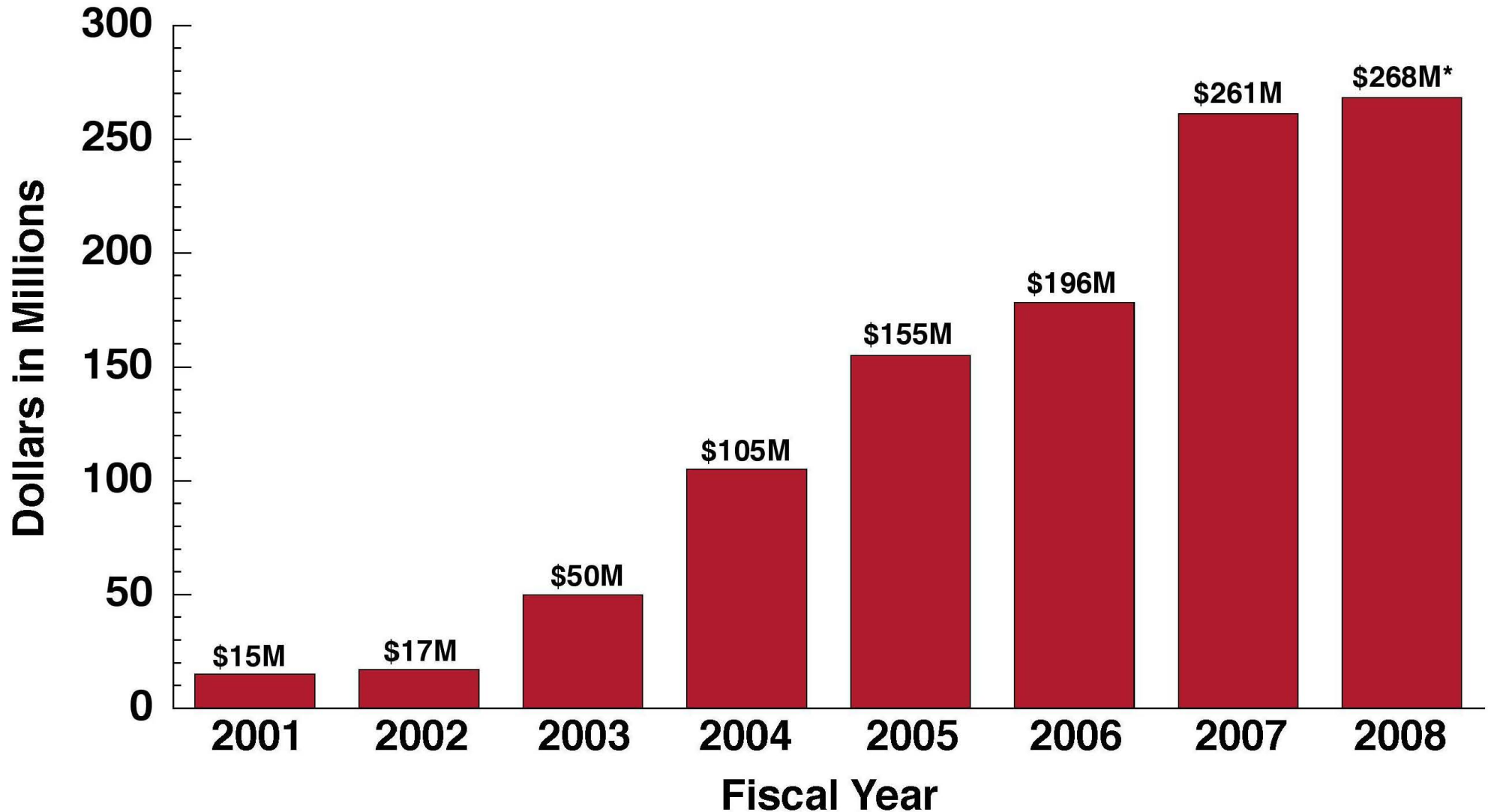
- 25-30% of world's population (~500 million people) fell ill
- >50 million deaths worldwide; ~60 percent in people ages 20-45
- >500,000 deaths in United States; 196,000 in October, 1918 alone

Pandemic Influenza Preparedness Strategy and Implementation



- **International Surveillance**
- **Domestic Surveillance**
- **Vaccines**
- **Antivirals**
- **Communications**
- **State and Local Preparedness**

NIAID Influenza Research Funding



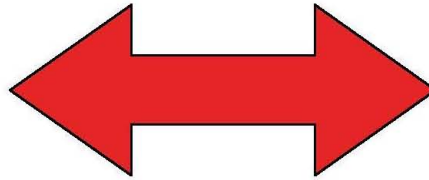
*Estimate; figure using new RCDC methodology is \$186M.

**Seasonal
Influenza
Preparedness**

**Pandemic
Influenza
Preparedness**

NIAID Research: A Dual Mandate

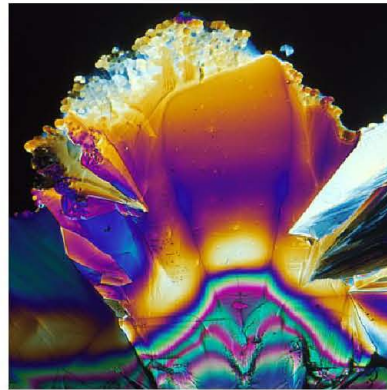
Maintain and “grow” a robust basic and applied research portfolio in microbiology, infectious diseases, immunology and immune-mediated diseases



Respond rapidly to new and emerging disease threats



New/Improved Interventions



NIH *Transforming medicine and health through discovery*

