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From AIDS to Zika: The Perpetual Challenge of
Emerging Infectious Diseases

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National Institutes of Health
April 14, 2017

White House Holds Disaster-Response
Exercise with Trump Officials

The NIH Record
U.S. Department of Health and Human Services
November 22, 1994

Dr. Anthony Fauci, Expert on Immunity and AIDS, Named
Director of NIAID, Institute of Allergy and Infectious Diseases

Five Administrations and Emerging Infectious Diseases

William J. Clinton 1993-2001
George W. Bush 2001-2009
Barack H. Obama 2009-2017

Testimony before the House Appropriations Subcommittee
for NIH – 1980s

Global Examples of Emerging and Re-Emerging Infectious Diseases

- Newly emerging
- Re-emerging/resurging
- "Dullly but steadily emerging"
Global Examples of Emerging and Re-Emerging Infectious Diseases

- Newly emerging
- Re-emerging/resurging
- Deliberately emerging

Global Examples of Emerging and Re-Emerging Infectious Diseases

35 Years of HIV/AIDS

June 5, 1981
Pneumocystis Pneumonia – Los Angeles

July 4, 1981
Kaposi’s Sarcoma and Pneumocystis Pneumonia Among Homosexual Men – New York City and California

HIV/AIDS

Ronald W. Reagan
1981-1989

"...because we do not know the cause of this syndrome, any assumption that the syndrome will remain restricted to a particular segment of our society is truly an assumption without scientific basis."
The Global HIV/AIDS Pandemic: Current Estimates

- 36.7 million people living with HIV (end-2015)
- 1.1 million AIDS deaths in 2015
- 2.1 million new HIV infections in 2015

Source: UNAIDS, 11/2016
**Advances in HIV/AIDS Science, 1981-2017**

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

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**Rounds at NIH Clinical Center, Early 1980s - AIDS Patient**

- Median survival of AIDS patients: ~8-15 months

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**FDA-Approved Antiretroviral Drugs**

- NRTI: Stavudine, Tenofovir (TDF, TAF), Abacavir, Didanosine, Emtricitabine, Lamivudine
- NNRTI: Delavirdine, Nevirapine, Efavirenz, Nelfinavir, Etravirine
- INIs: Darunavir, Ritonavir, Tipranavir
- PI: Atazanavir, Darunavir, Indinavir, Lopinavir/ritonavir, Nelfinavir, Saquinavir, Triumeq
- Multi-Class Combinations: Atripla, Complera, Descovy, Odefsey, Stribild
- Fusion Inhibitor: Enfuvirtide
- Entry Inhibitor: Maraviroc

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**Life Expectancy for 20-Year-Old Newly Diagnosed with HIV, 1980s and Today**

- 1980s (no ART): ~12 years
- Today (on ART): ~53 years

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

GK Folkers and AS Fauci
Meeting at the White House to Discuss AIDS Research, Dec. 3, 1996

- HIV/AIDS
- West Nile Virus
- H5N1 Influenza
- Antimicrobial Resistance

William J. Clinton
1993-2001

NIAID Vaccine Research Center

- Basic Research
- Clinical Trials

VRC Research: From HIV to Zika

- HIV
- West Nile virus
- Chikungunya
- Ebola/Marburg
- Influenza
- Malaria
- MERS-CoV
- RSV
- Tuberculosis
- Venezuelan, Eastern, and Western equine encephalitis viruses
- Zika

Global Examples of Emerging and Re-Emerging Infectious Diseases

- West Nile virus

Global Distribution of West Nile Virus, 1999

Source: CDC
February 5, 2002

President GW Bush: “Tony, what scares you the most among potential microbial threats that a terrorist might use?”

Fauci: “Mr. President, I worry more about the natural occurrence of an influenza pandemic and the ongoing plague of HIV than I do about a bioterror attack.”

The Worst Bioterrorist May Be Nature Itself

Pandemic Influenza Preparedness
Strategy and Implementation

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

Global Examples of Emerging and Re-Emerging Infectious Diseases

Early Cases of SARS: Guangdong Province, China

Feb 11, 2003: China reports 205 cases of acute respiratory syndrome in Guangdong Province
2003 Spread of SARS from Hotel Metropole in Hong Kong

Sources: MMWR, March 29, 2003; WHO, 2003

Cumulative Reported Cases of SARS
November 1, 2002 to July 31, 2003

Source: WHO

The New York Times
May 21, 2003

Fear of SARS,
Fear of Strangers
Iris Chang

Earlier this month, the University of California at Berkeley banned from its summer programs all students from mainland China, Hong Kong, Taiwan and Singapore, out of fear that some might be infected by the SARS virus... After facing sharp criticism for its decision, Berkeley modified its policy....

SARS: A New Challenge to Global Health

Near-Empty Flight from Hong Kong to Beijing, May 2003

Source: AP

State of the Union Address,
January 28, 2003

President Bush announces the President’s Emergency Plan for AIDS Relief (PEPFAR)
The President’s Emergency Plan for AIDS Relief – $15B Over 5 Years

Goals:
- Prevent 7 million new infections
- Treat 2 million HIV-infected people
- Care for 10 million HIV-infected people, orphans and other vulnerable children

Barack H. Obama
2009-2017

H1N1
Pandemic Influenza
MERS
Chikungunya
Ebola
Zika
Antimicrobial Resistance

Global Examples of Emerging and Re-Emerging Infectious Diseases

The New York Times
Apr 24, 2009
Unusual Strain of Swine Flu Is Found in People in 2 States
Associated Press
Apr 26, 2009
Swine Flu Empties Mexico City’s Churches, Streets

Seasonal Influenza Preparedness
Pandemic Influenza Preparedness

Induction of Unnatural Immunity: Prospects for a Broadly Protective Universal Influenza Vaccine
GJ Nabel and AS Fauci
Zika Virus Spread, 1947-2017

Source: Lancaster University

Symptoms of Zika Virus Infection

4 in 5 individuals asymptomatic
Incubation: 3-12 days
Mild symptoms: 2-7 days

Rash
Headache/Malaise
Non-purulent conjunctivitis/Conjunctival hyperemia
Elevated body temperature (Above 99°F)
Arthralgia/Myalgia
Peripheral edema/gastrointestinal disturbance have also been observed

Source: BMJ. Jan. 29, 2016

Marked Increase in Microcephaly Cases in Brazil

Microcephaly cases in Brazil 2016-14: suspected/confirmed cases 2015-2016

Source: Brazilian MHC, data as of Dec. 31, 2016

Baby Born With Microcephaly

Source: Associated Press

Reported Cases of Zika Virus Disease in the United States, 2015–2017

- U.S. States / District of Columbia
  - 5,234 cases
    - 4,935 travel-associated
    - 223 locally acquired mosquito-borne
    - 46 sexually transmitted, 28 congenital
    - 1 laboratory-acquired, 1 unknown

- U.S. Territories
  - 36,526 cases
    - 36,383 locally acquired
    - 143 travel-associated

Source: CDC, data as of April 12, 2017

Characterizing the Pattern of Anomalies in Congenital Zika Syndrome for Pediatric Clinicians

CA Moore, SA Rasmussen et al.

"Congenital Zika syndrome is a recognizable pattern of structural anomalies and functional disabilities secondary to central and, perhaps, peripheral nervous system damage."

Source: JAMA Pediatrics, Published online November 03, 2016

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Lessons Learned from Previous Pandemics

- Global surveillance
- Transparency and communication
- Infrastructure and capacity building
- Coordinated and collaborative basic and clinical research
- Adaptable platform technologies for vaccines, diagnostics and therapeutics
- Stable funding mechanism – “Public Health Emergency Fund”