Biosecurity:
A Multi-Dimensional Challenge of Escalating Complexity and Urgency

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History of Biosecurity Threats:
Pandemic and Plagues
The Four Horsemen of the Apocalypse

- pestilence
- war
- famine
- death

Albrecht Dürer, 1498
Infectious Diseases: A Powerful Force in Human Evolution
History of Biosecurity Threats: Pandemics and Plagues

- multi-millennial history of major societal dislocations
- large scale disruptions, often over extended periods
- sadly, a consistent theme of neglect and threats ignored
  - reactive versus proactive preparedness
  - proliferation of public fear, distrust, scapegoating and social divisions
  - triggers for major cultural change
  - economic/shifts in geopolitical power and political and military ascendancy
History of Biosecurity Threats: Pandemics and Plagues

- 7 historical eras (soft boundaries and overlap)
  - before 1800 AD
  - 1800-1900 AD
  - 1900 AD onwards
  - 1950’s onwards
  - 1980’s onwards
  - 2000’s onwards
  - 2020: the COVID-19 reset

- exploration, war and conflict
- industrialization, urbanization
- trade, globalization and new connectivities
- scientific progress, new technologies, new risks
Major Pandemics

- Athens 427 BC
- Justinian Plague 541 AD
- The Black Death 1350-1700
History of Biosecurity Threats: Pandemics and Plagues Before 1800 AD

- omnipresent threat and average human life span limited to 30 years
- pestilence in livestock and crops drove repeated cycles of famine and civil unrest
- lack of understanding of disease causation
- little or no environmental or personal hygiene
- pervasive sense of helplessness against backdrop of illiteracy and misplaced faith in religious institutions for solutions
Global Exploration and the Dissemination of Infectious Diseases

With a new introduction by Gerald N. Grob

Rats, Lice and History
Hans Zinsser

ECOLOGICAL IMPERIALISM
The Biological Expansion of Europe, 900-1900
NEW EDITION
Alfred W. Crosby

Epidemics and Society
FROM THE BLACK DEATH TO THE PRESENT
Frank M. Snowden
History of Biosecurity Threats: Pandemics and Plagues Before 1800 AD

- Global exploration by Western European nations for new land, resources, and trade
- ‘the new world’ encounters the infectious diseases of the ‘old world’
  - Particular devastation in S. and N. America
  - Decimation of Polynesia (measles)
- “payback”: Syphilis comes to Europe from Amerindians
- Expanded encounters of Europeans with insect borne infectious diseases in tropical and semitropical climates
  - Yellow Fever, Dengue, typhus, malaria
Military Medicine: The Toll From Infectious Diseases Frequently Exceeds Combat Casualties

Napoleon's Long March
Military Medicine: The Toll From Infectious Diseases Frequently Exceeds Combat Casualties

Malaria and the Pacific Campaigns WWII

These Men Didn't Take Their Atabrine
long history of military campaigns in spreading disease
expanded imperial military campaigns to capture global resources and markets for industrialization
adverse impact of disease on military capabilities
emergence of military medicine as a powerful intellectual resource in identification and control of infectious and parasitic diseases
- Yellow Fever and construction of the Panama Canal
- Malaria control programs WWII
- WWII and the quest for antibiotics and vaccines
Industrialization and the Agrarian to Urban Migration
1800 Onwards
Urban Slums and Spread of Infectious Disease

Unsanitary and Unsafe Food

Unregulated Quack Therapies
History of Biosecurity Threats: Pandemics and Plagues 1800 Onwards

- rapid industrialization, urbanization and urban slums
  - epicenters for infectious diseases
- birth of large-scale public health programs and sanitation engineering
  - workforce health to sustain the industrial economic engine
- creation of International Sanitary Conventions (1851-1938) as precursors to WHO/FAO
- validation of the ‘germ theory’ of disease (1850-1885)
  - R. Koch, L. Pasteur
The Foundation of Epidemiological Testing and Contact Tracing

Dr. John Snow, 1855

- cholera deaths 1,000 population
Evolution of Public Health as a Key Element of National Policy and Comprehensive Legal Controls
Quarantine and Lockdowns: the Cordon Sanitaire: The Most Used Tool in Infection Control

London 1665

Wuhan 2020

RULES and ORDERS
To be observed by all Justices of Peace, Mayors, Bayliffs, and other Officers, for prevention of the spreading of the Infection of the PLAGUE.

Published by His Majesties special Command.

6. That fires in moveable places, or otherwise, be made in all necessary publice Meetings in Churches, &c. and convenient houses to correct the Air be kept threene.

7. That no person be taken that runne about Streets, fishing fish, fowls, etc., or any other unwholesome food be sold in any Shops or Markets.

8. That no Cows, Dogs, Cats, or any other beasts be permitted to pass up and down in streets, or from house to house, as places infected.

9. That all Dogs and hogs be kept within, and that no man be Licensed, or any other be admitted, but after strict examination, and that no more be admitted who are absolutely necessary in each City or place, especially during the continuance of this present Contagion.

10. That each City and Town (in which there are any infectious persons) do take convenient place remote from the same, where a bell-house, yoke, or other place may be erected, to be in readiness in case any infection should break out, which if it should happen to do, that the able and faithful searchers and examiners be lost which published and summoned to search all suspected bodies, for the usual signs of the plague, etc.

11. That all Houses be searched, the back part of persons be left with the left part of the house, and the burnt clothes, with all spoiles, either on the body or in the house, commonly called tokens.

12. That at the opening of each infected house, after the evacuation of the said fourteen days, a White Coal be afforded.
Epidemics Amplify Social Divisions

Fear and Scapegoating

Ethnic Tensions

Political Tensions
History of Biosecurity Threats: Pandemics and Plagues
1900’s Onwards

- continued national and international investment in public health programs
  - infection control, sanitation, housing, nutrition and education
- 1917-1919 global influenza pandemic
- use of chemical and biological weapons in World Wars I and II (later lecture)
Post-World War II: A New Era of ‘Wonder Drugs’
Success of global vaccination campaign to eradicate smallpox

Major progress in prevention of poliovirus and multiple childhood infectious diseases (G20 countries)

Emergence of HIV/AIDS - extensive mortality in Africa and Asia
Amerithrax: October 2001
Assessing New Risks From Bioterrorism
History of Biosecurity Threats: Pandemics and Plagues 2000 Onwards

- 9/11/2001 attack on USA and formation of US Department of Homeland Security
- Increased concern about potential use of biological agents by terrorist groups, substate actors and nation states
- Expanded ‘homeland security’ strategic requirements added to mission of multiple USG agencies, notably DOD and the Intelligence Community (IC)
Dual-Use Applications of Synthetic Biology and the Expanded Threat Spectrum

- beneficent and maleficent applications of same knowledge
- potential to cause profound societal disruptions based on deliberate misuse, error or accident
Recent Emerging Infection Diseases

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<th>TB</th>
<th>Malaria</th>
<th>HIV/AIDS</th>
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The Big Three Still Undefeated

- prevent, detect and respond to infectious disease
- safeguard economies
- end the cycle of panic and neglect
- need for sustained investment commitment
- essential public health capacities represent recurring cost

How Will Decades of Neglect Be Reversed?
2020
SARS-CoV-2: The Great Reset

- lessons learned?
- what will the ‘new normal’ look like?
- what will be the recovery time for different countries/sectors?
- new geopolitical instabilities?
- implications of a new cold war for technological/military dominance (US vs PRC)?
- discussion topics for weeks 4 to 7

SARS-CoV-2: The Great Reset