



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

Dr. George Poste

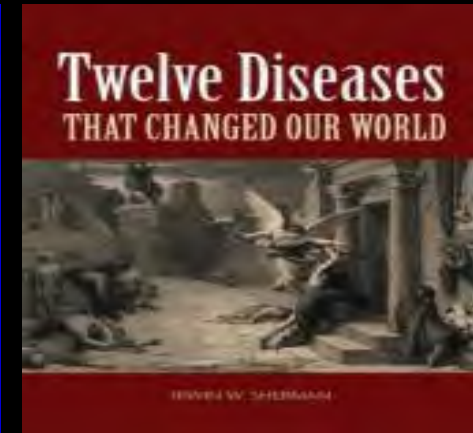
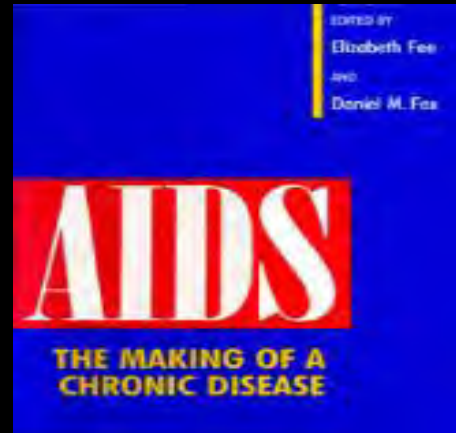
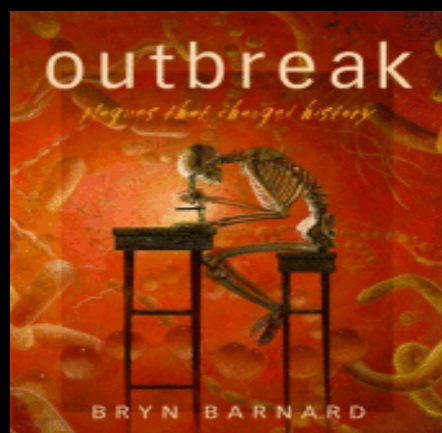
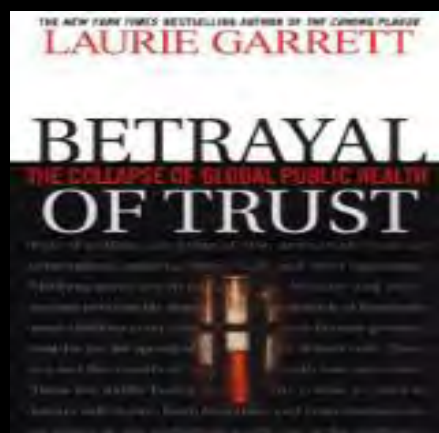
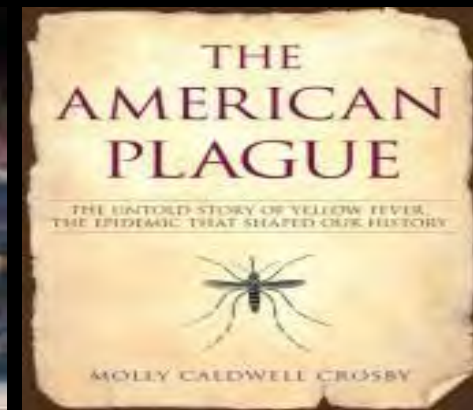
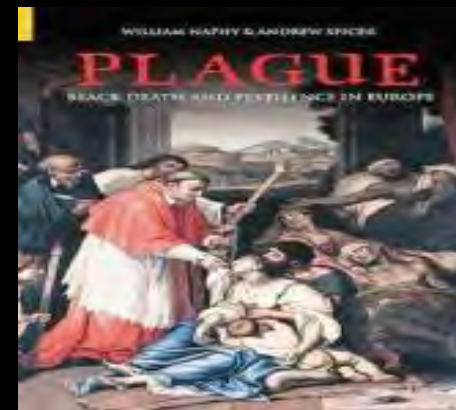
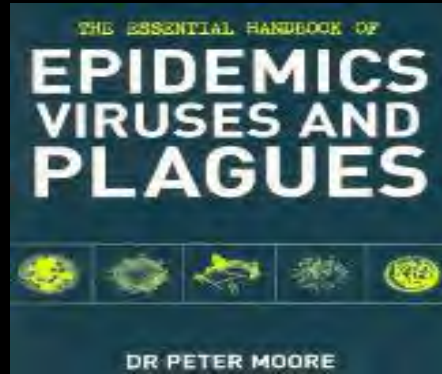
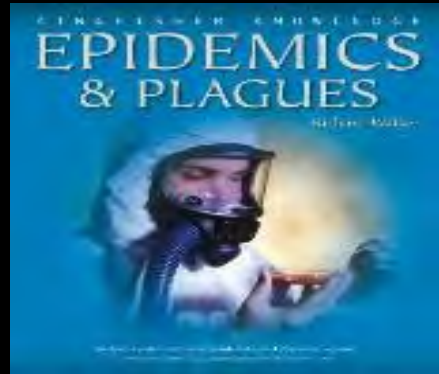
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BioSecurity and Pandemic Resilience: Winter 2022
BIOE 122, EMED 122/222, PUBLPOL 122/222
Stanford University School of Medicine
Virtual Lecture
12 January 2022

Biosecurity

- **escalating complexity imposes new challenges for institutions and policy makers**
- **decision-making in the face of accelerating change and accompanying uncertainties**

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**

The Relentless Ever-Changing Dynamics of Infectious Diseases

**old foes resurgent:
Rx – resistance**



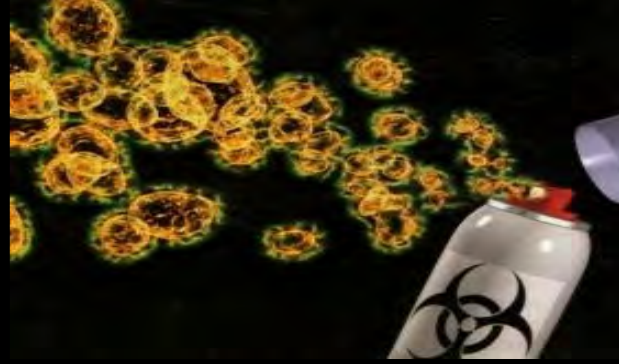
**omnipresent
pandemic threats**



**new foes:
emerging infectious
diseases**



**climate change and
new vector ranges**



**bioterrorism and
bioweapons**

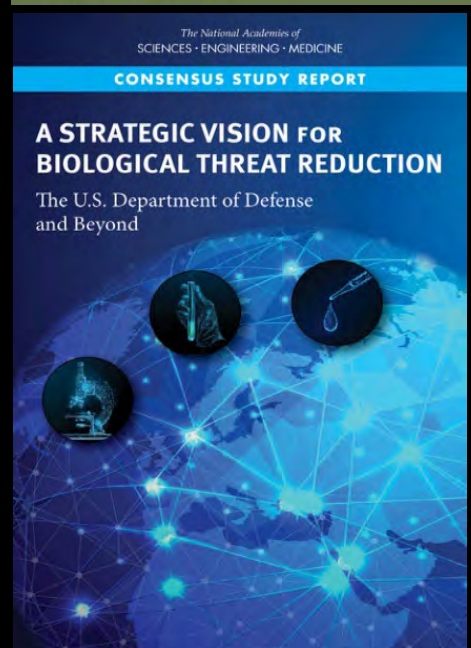
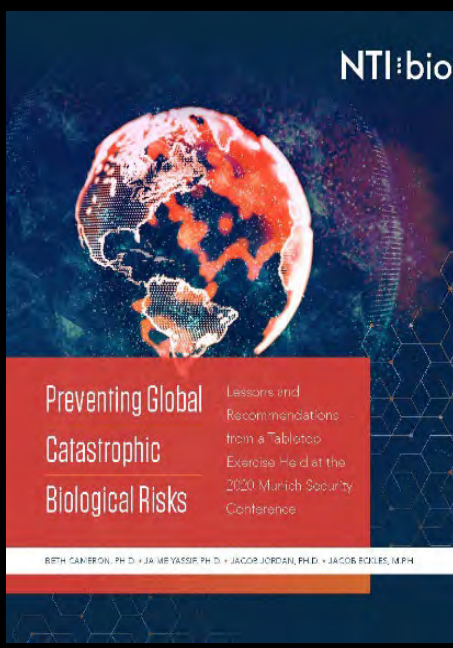
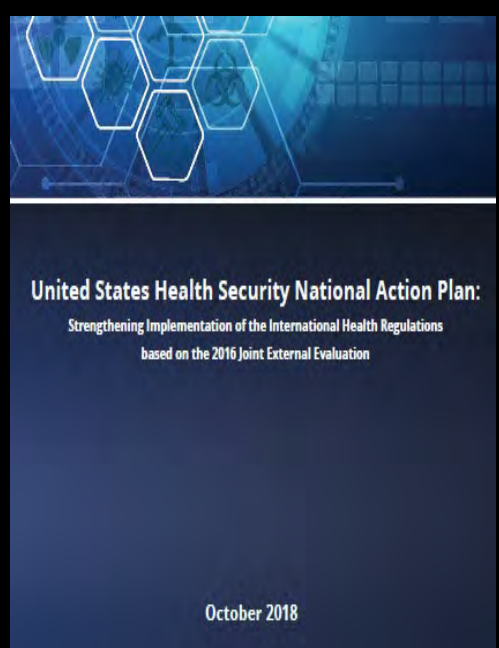
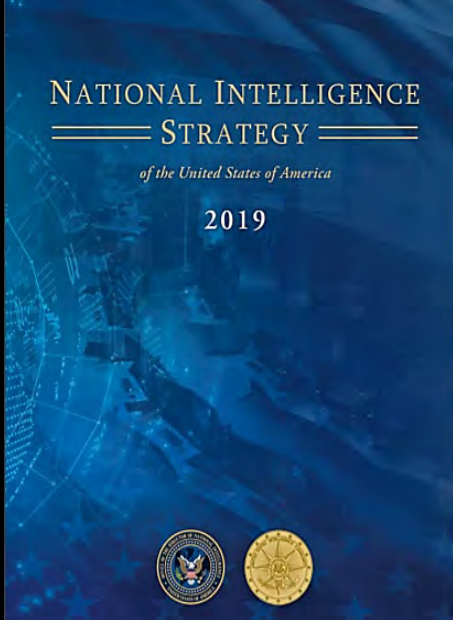
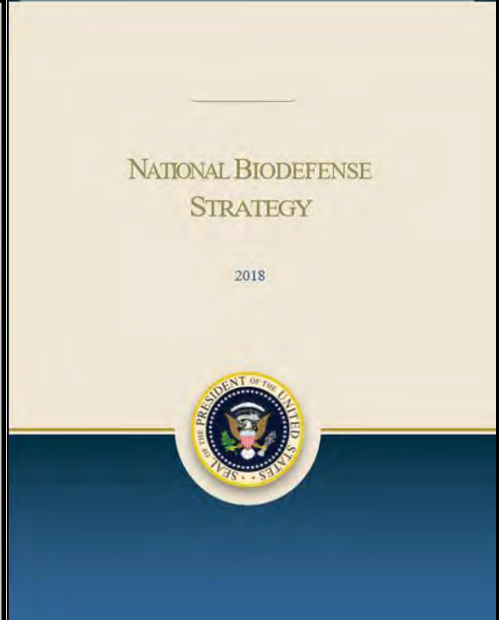
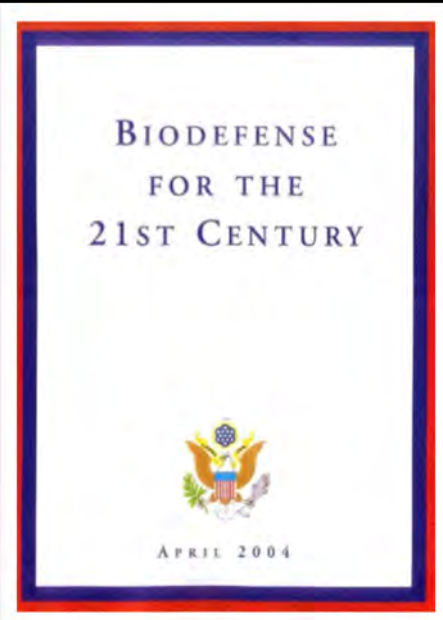


**dual-use
research of concern**

The Evolution of a Bioincident

- **detection of atypical event (speed of alert)**
- **containment (stamp out at the source)**
- **prevent spillover (sparks to ignite a fire)**
- **mitigation (flatten the curve and reduce demand on finite resources)**
 - **large scale testing and contact tracing**
 - **slow the spread and assess herd immunity**
- **maintenance of essential services and public order**
- **surge capacity, supply chain logistics and triage priorities for allocations of finite resources**
- **reliable information and public trust in actions by authorities (managing the worried well)**

U.S. National Security Policy and Biodefense



THE APOLLO PROGRAM FOR BIODEFENSE

WINNING THE RACE AGAINST
BIOLOGICAL THREATS

A RECOMMENDATION BY THE
BIPARTISAN COMMISSION ON BIODEFENSE

January 2021

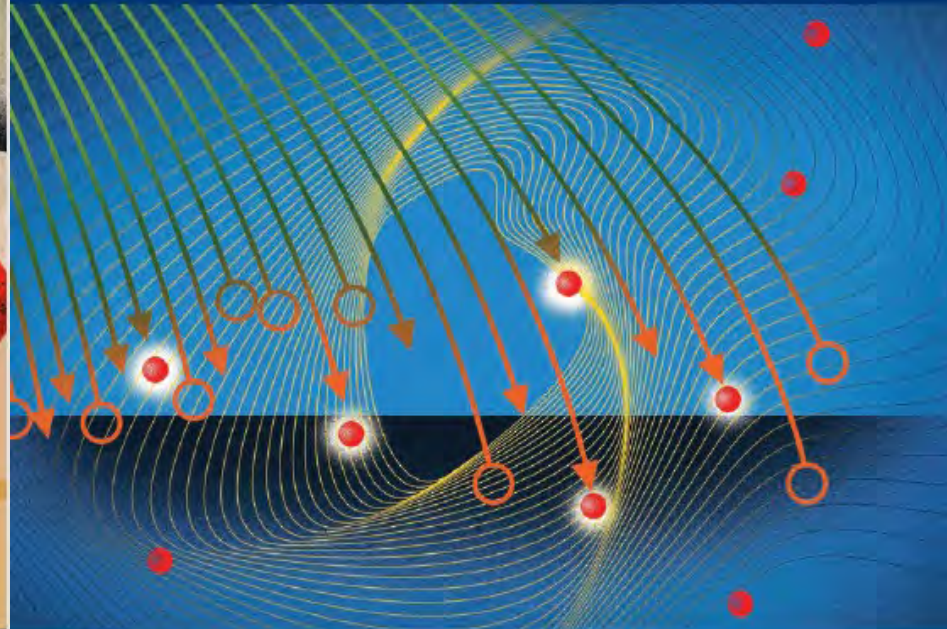


BIODEFENSE IN CRISIS

IMMEDIATE ACTION NEEDED TO
ADDRESS NATIONAL VULNERABILITIES

A REPORT BY THE
BIPARTISAN COMMISSION ON BIODEFENSE

March 2021





ASPR
ASSISTANT SECRETARY FOR
PREPAREDNESS AND RESPONSE

A Coronavirus pandemic was a recognized threat

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
OFFICE OF THE ASSISTANT SECRETARY FOR PREPAREDNESS AND RESPONSE

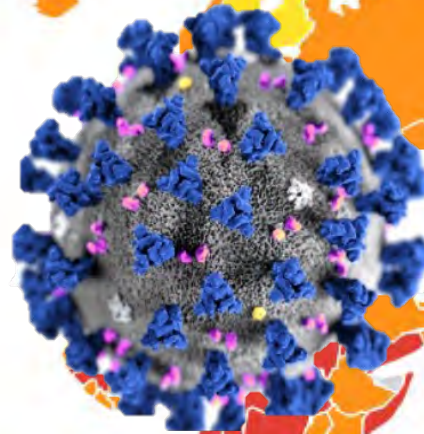
**CRIMSON CONTAGION 2019 FUNCTIONAL EXERCISE
AFTER-ACTION REPORT**

JANUARY 2020



Sars-CoV-2 Revealed Major Shortcomings in US Public Health Capabilities

840,581
US Deaths
(1/11/2022)



**PREPARED ?
NO !**

2019

GHS INDEX
GLOBAL HEALTH
SECURITY INDEX

Building Collective Action and Accountability



Key

● Most Prepared

● More Prepared

● Least Prepared

What Became All Too Familiar Scenes in 2020 and 2021



What Became All Too Familiar Scenes in 2020 and 2021





A330-900neo

Garuda Indonesia



A330-900neo

A Critique of the US Response to COVID-19

Consistent Inconsistency

Politics + Science = Politics

A Report Card on US Response to COVID-19 Across Two Administrations

Function	Grade
biosurveillance	D
rapid mobilization of detection/track/contact	F
supply chain for PPE/support resources	D
national coordination plan	F
fact-based communication and consistent messaging	F
politicization and social tensions	F
trust in government	D
accountability	F

A Report Card on US Response to COVID-19 Across Two Administrations

Function	Grade
biosurveillance	D
rapid mobilization of	F
Operation Warp Speed: “A” Innovation to Develop SARS-CoV-2 Vaccines at Unprecedented Speed	
national coordination plan	F
fact-based communication and consistent messaging	F
politicization and social tensions	F
trust in government	D
accountability	F

The Commitment and Resiliency of Front-Line Personnel: Pre-Vaccine Risk Exposure in Healthcare Delivery

first responders



military services



ICU's



clinical laboratories



waste disposal



burn-out

Civic Volunteerism and Societal Resiliency



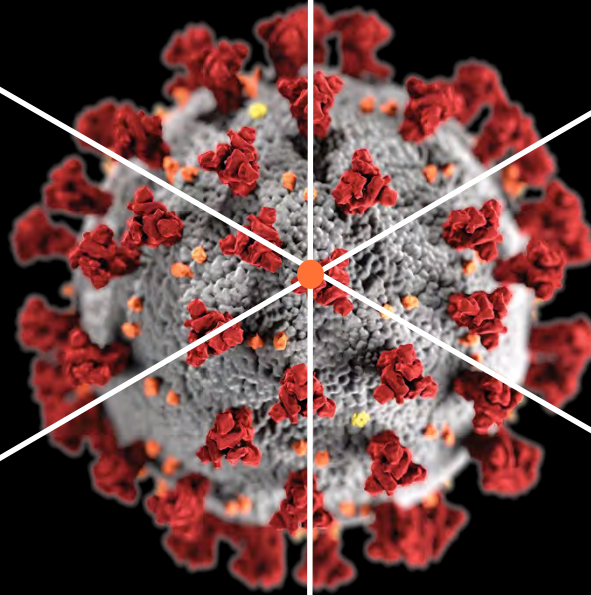
Unprecedented Failure of Governance and Public Health Policy

- **failures of preparation**
- **failures of response**

**multiple warnings of
zoonotic-EID
risks ignored**

**chronic
underinvestment
in preparedness**

**failure of public
institutions and
national leadership**



**conflicting and
confusing messaging**

**disinformation
campaigns and
foreign interference**

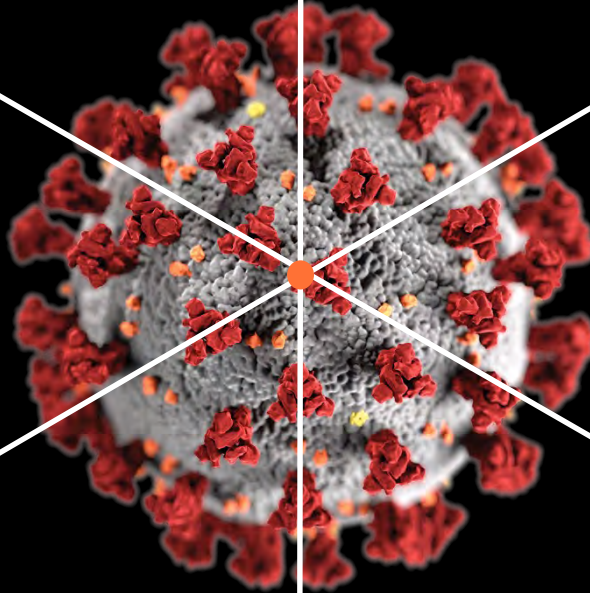
**domestic
political
divisiveness**

A Portrait of the SARS-CoV-2 Pandemic

delayed detection
and political
obfuscation in
emergency declarations

stark deficiencies in scale
of needed diagnostic testing
and slow engagement
of private sector

underappreciated role
of asymptomatic infections
in pandemic spread

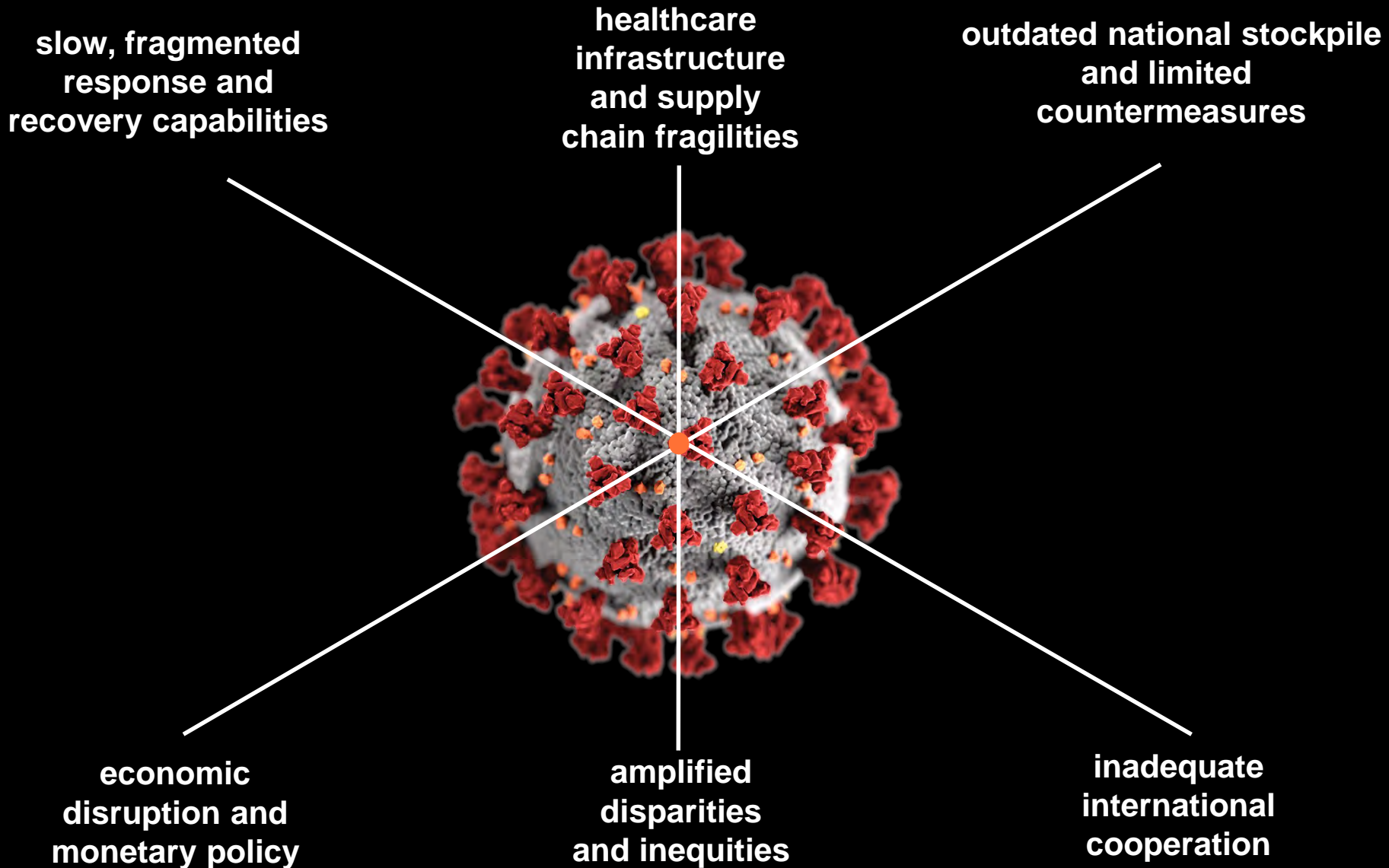


failure of
test and
trace campaigns

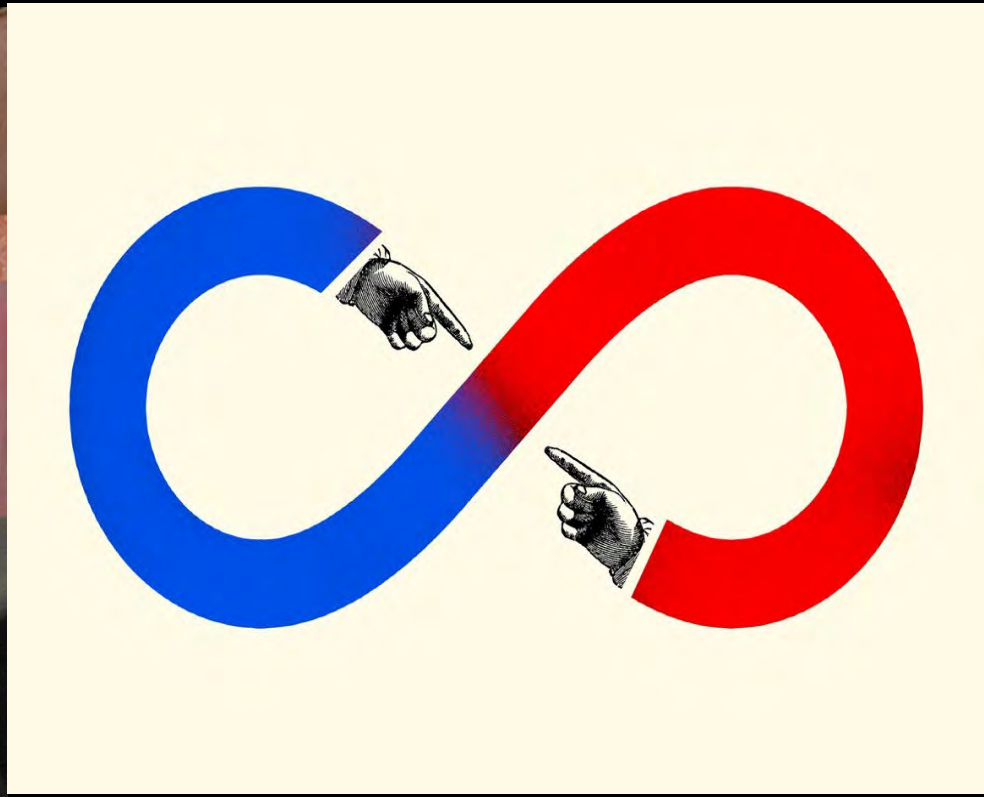
proliferation of
highly variable
epidemiological models

inadequate spread and
scale of US viral sequencing
to map variant
distribution/evolution

A Portrait of the SARS-CoV-2 Pandemic



A Critique of the US Response to COVID-19



- **political stridency**
- **partisan politics**
- **ever changing messaging**
- **media sensationalism**
- **proliferation of disinformation on social media**
 - **public confusion and mistrust**

A Critique of the US Response to COVID-19

- **politics plus science = politics = consistent inconsistency**
- **lack of coherent national policies and assignment to individual states**
 - **variable performance and policies on testing, face masks and level of 'lock down' needed**
 - **states forced to compete for purchase of critical PPE and diagnostic resources**
- **hypocritical failure of some USG and state leaders to follow own recommendations**

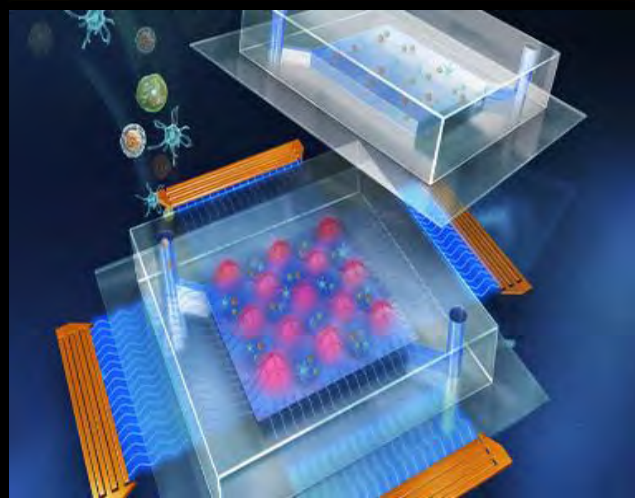
Faster Detection Saves Lives:

The Primacy of Diagnostics in Biosurveillance and Preparedness Mobilization

Profile:
signatures of infectious agents



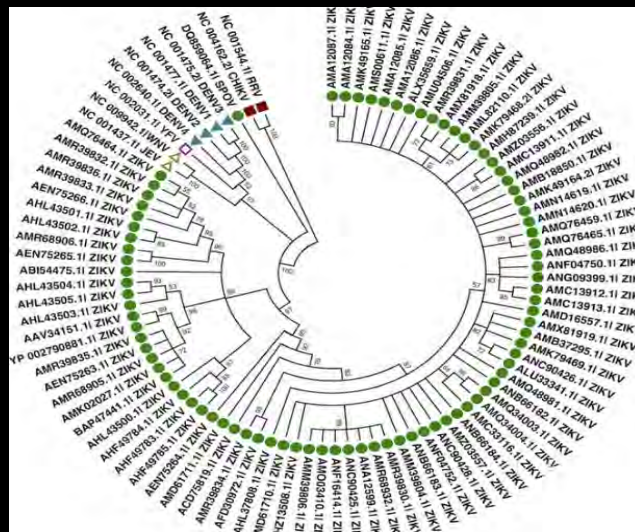
Detect:
rapid automated PON/POC diagnostics



Act:
real-time situation awareness, decisions



**surveillance
sans frontières**



**genomics of
pathogen evolution**



**dual-use research and
engineered biotreatments**

The COVID-19 Pandemic and the Primacy of Rapid Detection



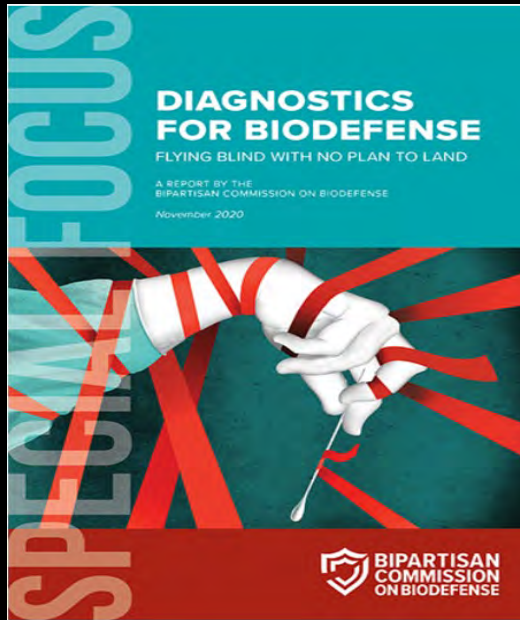
- lack of transparency and IHR compliance reporting (12/19-1/20)
- Wuhan/Hubei lock down (1/23/20) but extensive flights to foreign countries for prior 2 weeks
- constraints on export of PPE while US still exporting
- launch of aggressive global disinformation campaign



- reluctance to demand data from PRC (early 1/20)
- misplaced praise for PRC “extraordinary control measures”
- slow declaration of Public Health Emergency of International Concern (PHEIC) (1/30/20)



Test, Test, Test and Trace, Trace, Trace!

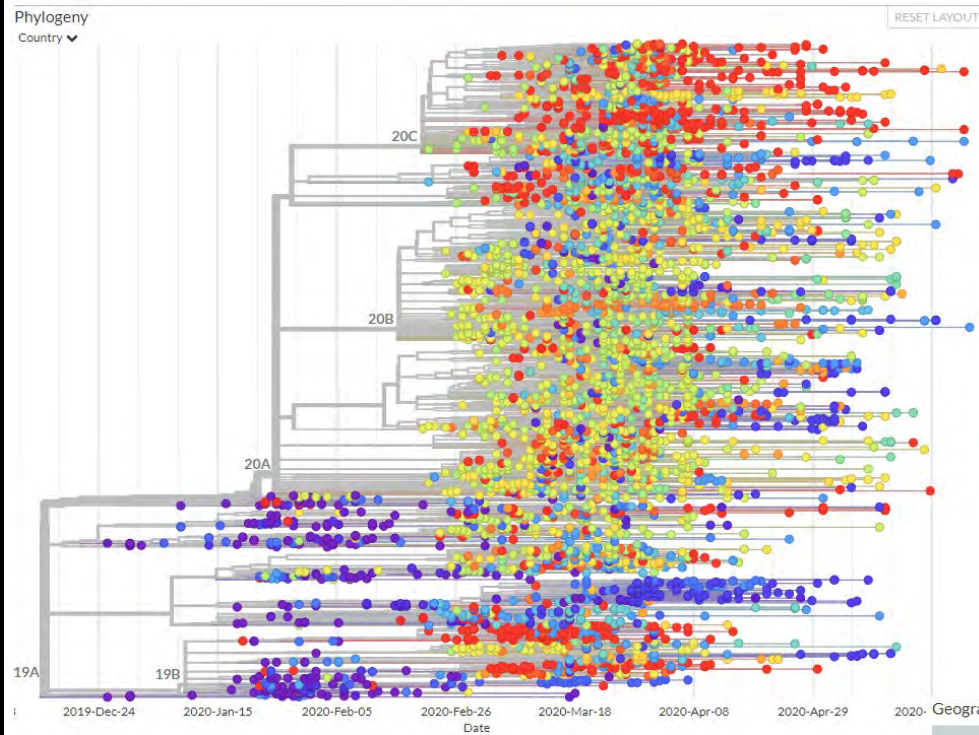


- the critical 'tandem': without BOTH the system is blinded
 - true prevalence (MDx) and herd immunity (serological)
 - control of super-spreader events and suppression of new hot spots

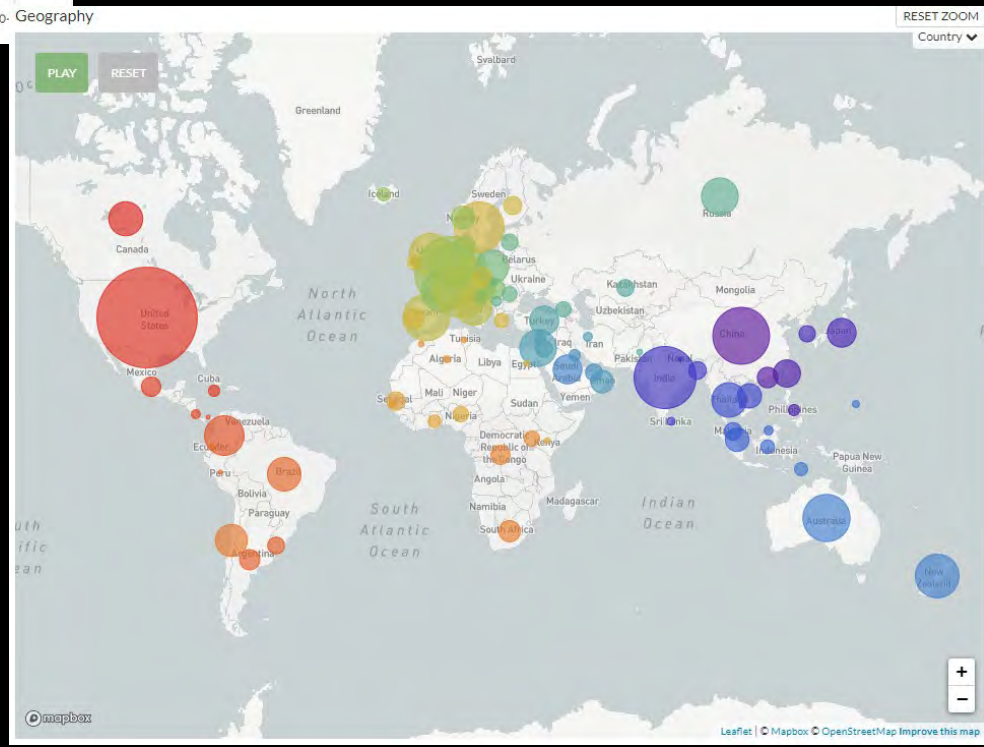


A Case Study in Ineptitude

- **arrogant rejection of WHO PCR test**
- **first tests kits contaminated/inaccurate**
- **six-week delay (March 2020) before distribution to Departments of Health in individual states**
 - **pandemic unchecked and spreading**
 - **contact tracing compromised**
- **tardy outreach to engage private sector for scaled up testing and kit manufacture**



Global Tracking of Mutational Changes in SARS-COV-2 Samples





US Epidemiological Data and SARS-CoV-2 Variant Genome Sequencing Lack Scale, Speed and Accuracy

- **fragmented reporting systems as major barrier to timely data capture of actionable data**
- **different reporting formats from different states and inadequate systems inter-operabilities**
- **reliance on international data from countries with centralized data frameworks and biosurveillance systems (UK, EU, Israel, S. Africa)**
- **predictable outcome of long-term neglect and investment at national and state levels**

The US Public Health System: Data Backwaters

- **massive gaps in timely capture, analysis and sharing of data**
- **widespread dependence on paper documentation/FAX transmission**
- **over one-third of local health departments cannot access electronic data from local emergency departments**
- **fragmented and tardy capture and limited interoperability of data feeds at Federal level**

M. Wallace and J.M. Sharfstein (2022) NEJM 386, 1

Individual Rights Versus Public Good



Countering Disinformation: A Growing Challenge in Public Health Communications and Sustaining Public Trust



- purposeful dissemination of inaccurate information on social media
- manipulate public opinion, increase socio-political tensions and erode trust in authorities/decisions
- active role of PRC and Russia in COVID-19 pandemic

The COVID-19 Debacle: The Scientific and Political Failures Reflect Larger Legislative and Societal Pathologies

- **Dysfunctional National Governance, Lack of Bipartisanship and Legislative Paralysis**
- **Technical Illiteracy and the Retreat from Complexity**
- **Dangerous Societal Divisions on Multiple issues**
- **A Threat to National Security and Technological Competitiveness ?**



The Shadow Pandemic

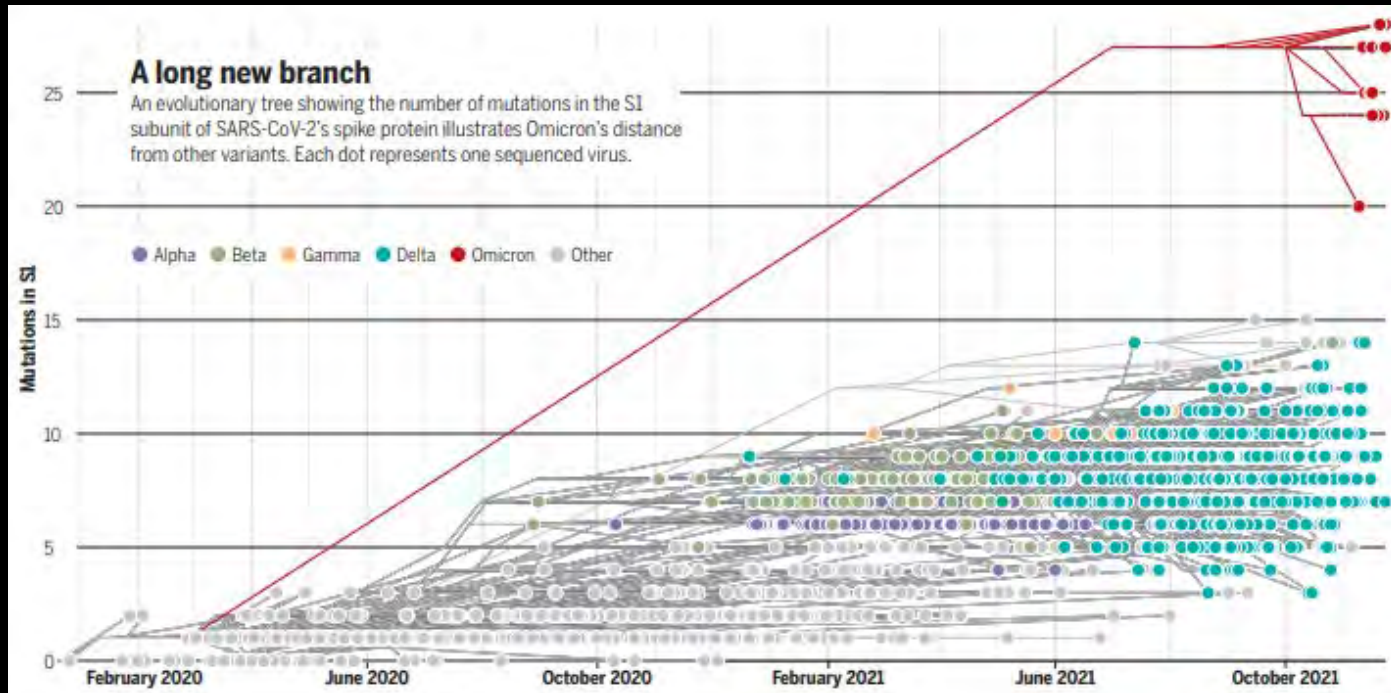
- **“long-Covid” - unknown incidence and clinical outcomes**
- **delays and disruption in disease screening, diagnosis and optimum treatment for non-COVID diseases**
- **medication non-adherence and reduced Rx refills**
- **increased incidence of mental health, SUD and suicide**
- **uncertain long-term implications for educational and socialization for K-12 populations during lock down**
- **disproportionate impact on underrepresented minorities**
- **‘burn out’ in health care personnel**

The Longer-Term Economic Consequences of COVID-19



- **government and central bank policies**
 - \$17 trillion debt expansion
 - future for inflation and taxation?
- **business sector recovery**
 - HIC vs LIC
- **catalyst for PRC economic ascendancy ?**

The Rapid Spread of Omicron: An Opportunity to Shift to a New Equilibrium?



**Flatten
the
Curve
(2020)**



**Control
Pandemic
Spread
(2020-2021)**

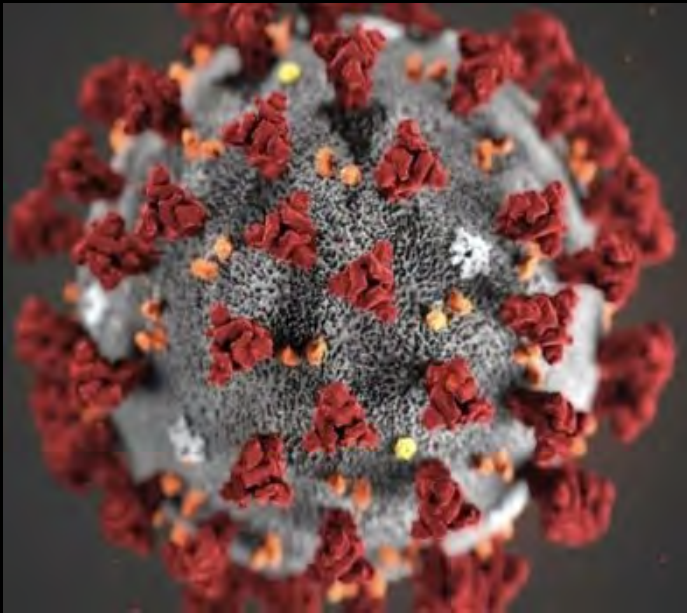


**Widespread
Exposure and
Herd Immunity
(1Q/2022)?**



**Endemic Pathogen
Joining the Four Prior
Circulating Human
Coronaviruses?**

SARS-CoV-2: The Great Reset



- lessons learned?
- what will the 'new normal' look like?
- what will be the recovery time for different countries and business sectors?
- new geopolitical instabilities?
- a US-PRC cold war for economic, technological and military dominance?



**PREPARE FOR
TOMORROW'S
THREAT TODAY**

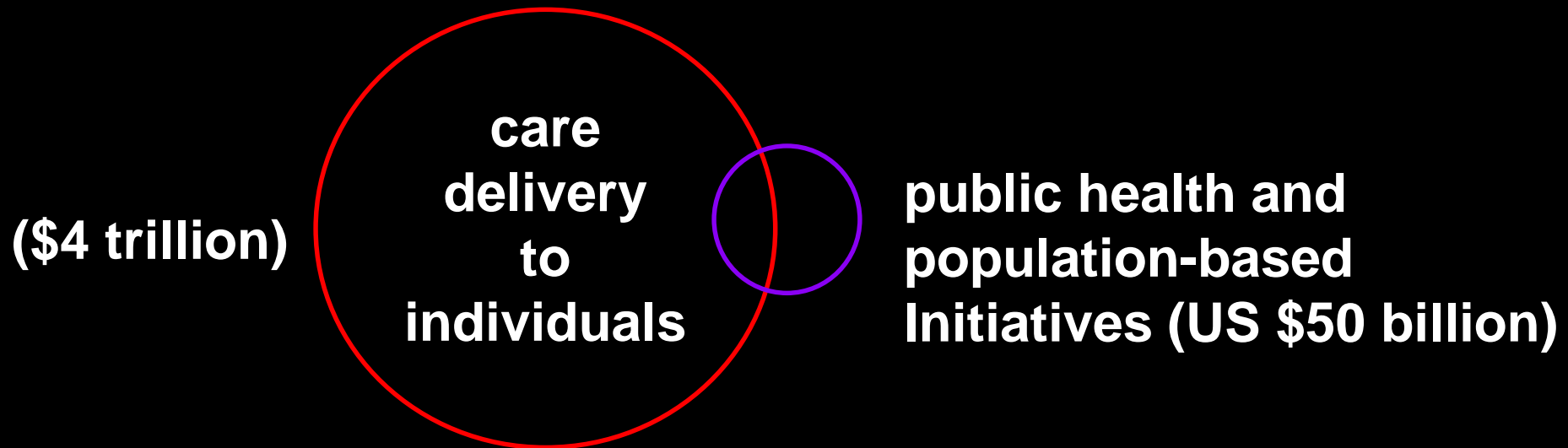
The Risk Hierarchy



**Hon. D. Rumsfeld
US Secretary
of Defense**

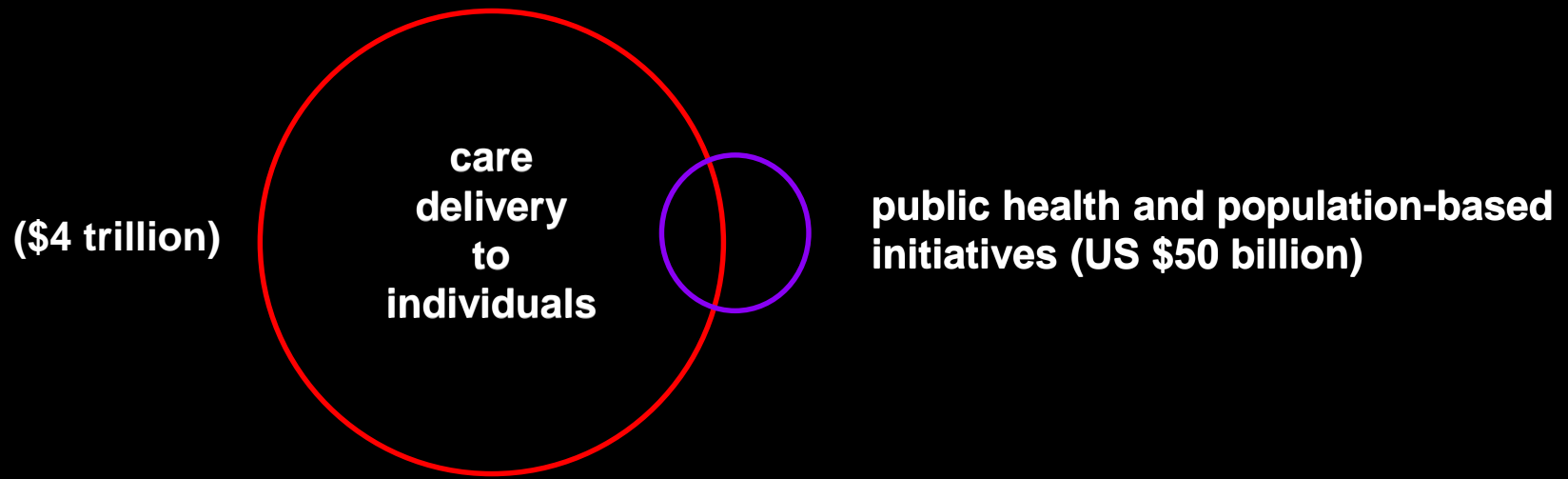
- **known knowns (even if ignored)**
- **known unknowns (intelligence, surveillance for prompt detection)**
- **unknown unknowns (adaptive survival and resilience)**

Public Health and Healthcare Delivery: Two Largely Separate Domains With Different Priorities and Economics



- **different outcomes and value propositions**
- **different organizations and infrastructure**
- **different skills/competencies**
- **different investment patterns: public vs private sector**

Underinvestment in Public Health Capabilities to Address Pandemic Threats



- cascading effect of public health failure as threat to stability of conventional healthcare delivery systems
- major disruptions in supply chains, commerce, employment and education

Real Time Data: The Foundation of Situational Awareness for Timely and Rational Decisions



COVID-19 Dashboard by the Center for Systems Science and Engineering (CSSE) at Johns Hopkins University (JHU)

Last Updated at (M/D/YYYY)

1/12/2022, 10:21 AM

Total Cases

314,493,734

Total Deaths

5,508,836

Total Vaccine Doses Administered

9,515,677,215

28-Day Cases

42,009,625

28-Day Deaths

181,933

28-Day Vaccine Doses Administered

943,125,492

Cases | Deaths by
Country/Region/Sovereignty

US

28-Day: 12,058,225 | 40,229
Totals: 62,545,851 | 843,165

France

28-Day: 4,242,420 | 5,231
Totals: 12,680,836 | 127,048

United Kingdom

28-Day: 3,831,025 | 4,008
Totals: 14,956,860 | 151,493

Italy

28-Day: 2,515,977 | 4,510
Totals: 7,774,863 | 139,559

Spain

28-Day: 2,226,114 | 1,841
Totals: 7,592,242 | 90,383

Argentina

28-Day: 1,167,113 | 769
Totals: 6,533,635 | 117,595

India



Esri, FAO, NOAA

Powered by Esri

CDC and the Data Gap



“Breakthrough cases are tracked by passive reporting (voluntary reporting) but this does not provide the full picture.” (Doh!)

**Dr. Rochelle Walensky
Director, CDC**

Press Conference 10 December 2021

The US Public Health System: Neglected Investment, Decentralized Fragmentation and Stark Deficits in Real Time Data Tracking

Federal

- **21 different agencies (e.g. CDC, FDA, NIH, EPA, USDA)**

State

- **29 independent, 21 are part of larger agency**
- **state health controls all local health in only 7 states**

Local

- **2459 health departments, only 404 as units of State health**
- **1887 locally governed**



COVID Data Tracker (as of 28 December 2021)

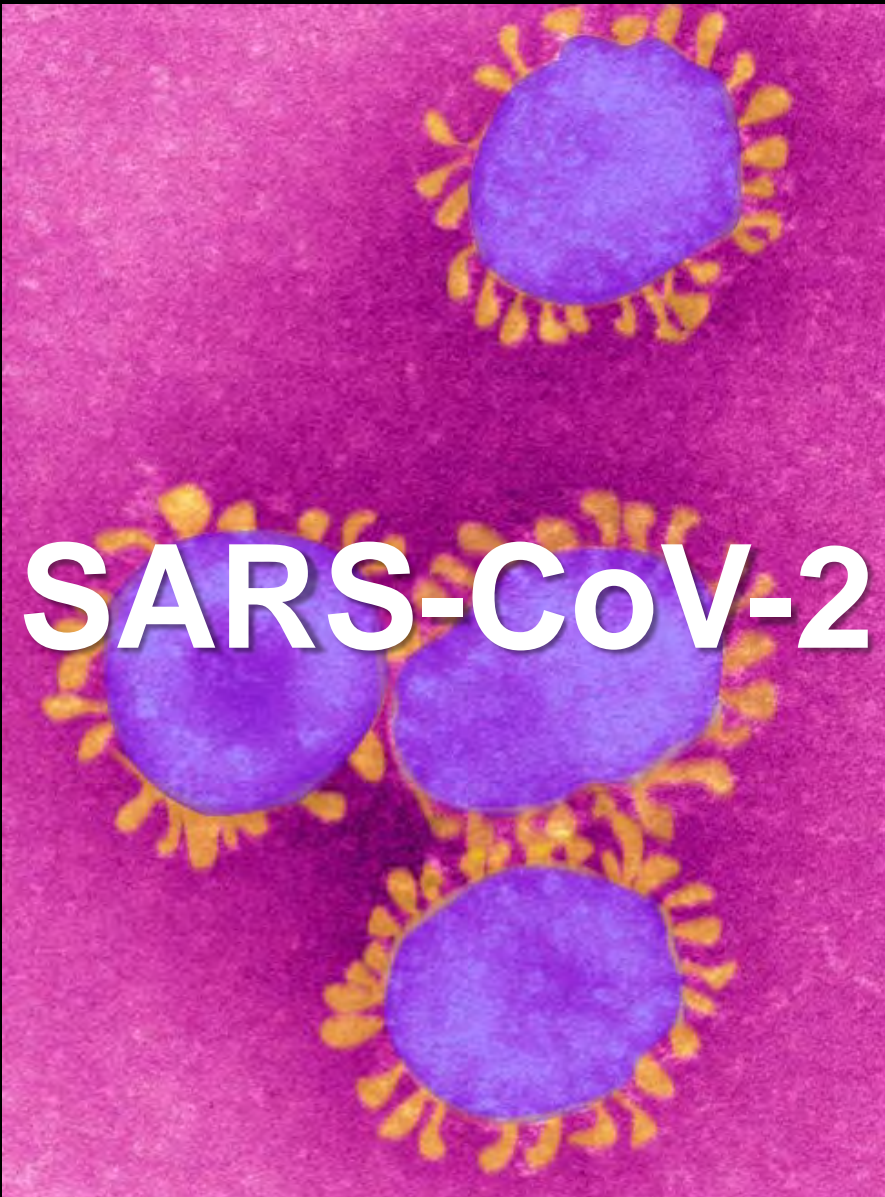
- **cases and deaths by vaccination status (current only to Sept. 2021)**
- **breakthrough hospitalizations by vaccination status (current only to August 2021)**
- **no data provided on gender, race for breakthrough cases**
- **CDC allows at least 4 weeks lag time to link surveillance data to Immunization, Information System (ISS)**
- **data derived from only 27 jurisdictions**

Networked Wearables/Sensors/Devices (IoMT) for Remote Health Status Monitoring and Real-Time Situational Awareness

- **distributed POC/PON networks**
- **low cost, miniaturized, automated**
- **microfluidic systems and multiplex analysis of multiple pathogens**
- **immediate electronic upload to centralized data bases**
- **new power sources for extended sensor lifetimes**
- **biocontainment safety for POC/PON/in-home platforms**

What's Out There?

Comprehensive Global Biosurveillance and Preparedness
for the Next Epidemic/Pandemic Threat

A transmission electron micrograph (TEM) showing several SARS-CoV-2 virus particles. The particles are roughly spherical with a distinct outer layer of yellow, spike-like projections (glycoprotein spikes) and a darker, denser inner core. The background is a light, grainy grey.

SARS-CoV-2



Agent-X

What's Out There?

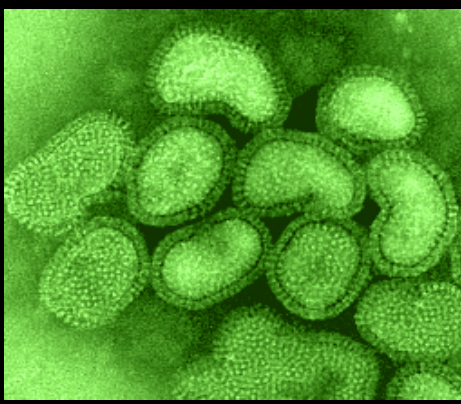
A Global Inventory of Natural Microbial Threats to Humans and Vital Agricultural/Ecological Resources

The Predominance of Zoonoses as Emerging Infectious Disease Threats: The “One Health” Perspective

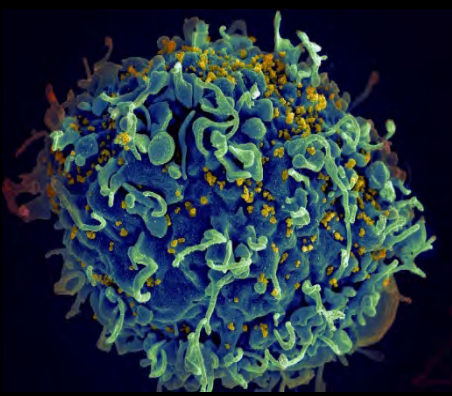
Natural Pathogens as Attractive Substrates for Engineering New Bioterrorism and Biowarfare Threats

“One Health”- The Importance of Zoonotic Diseases as Human Health Threats: A Rich Reservoir for EIDs and Genetic Manipulation

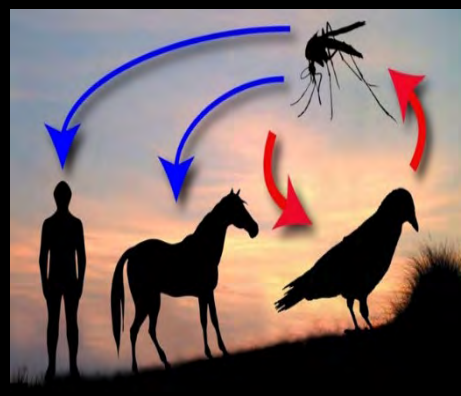
pandemic (avian) influenza



HIV



West Nile virus



MERS- CoV



Ebola virus



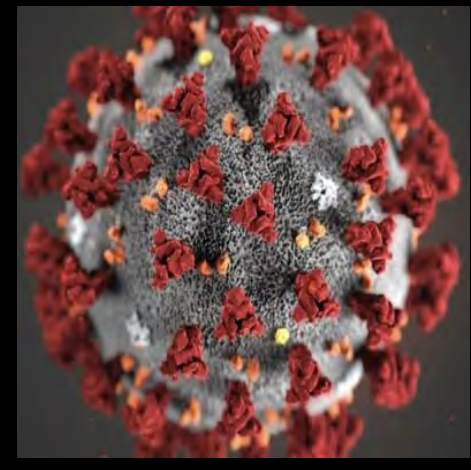
bush meat food chain



Zika virus



SARS-CoV-2



'One Health' Biosurveillance: The Need to Rebuild the Front Line in Biopreparedness



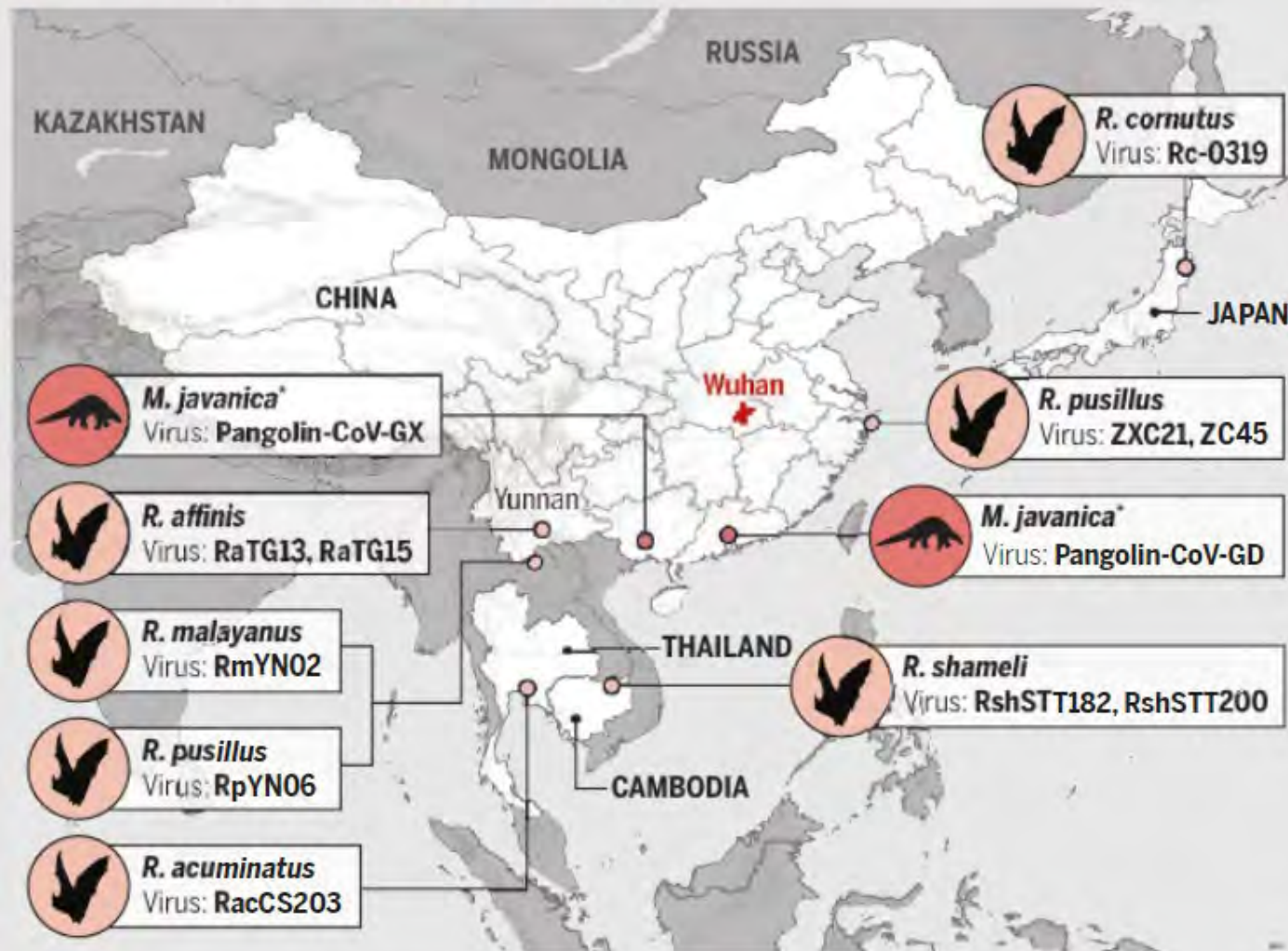
- range and physical contact
- environmental factors

- demographics
- cultural, political and economic factors
- health system capacity to detect/respond

Meet the relatives

Researchers have found a host of coronaviruses similar to SARS-CoV-2 in bats and pangolins in China and neighboring countries. The closest relative, RaTG13, was found in a bat living in a cave in Yunnan province.

○ Horseshoe bat (*Rhinolophus*) ● Pangolin (*Manis*)



*Pangolins were confiscated by customs officers in China but were captured elsewhere.

The 'One Health' Concept

- **identify ever shifting inter-relationships between human and animal hosts and environmental changes as drivers of zoonotic/epizootic risk**
- **still largely siloed investments**
 - **public health programs for human populations**
 - **livestock and crop protection**
 - **environmental and ecosystem initiatives**
- **concept gaining traction in Schools of Public Health and Veterinary Medicine**
- **slow embrace by healthcare systems and poor integration as core element of coherent national/international public health policies and investment**

Urbanization and Mega-Cities in Developing Countries and the Increased Threat of Exotic Zoonotic Diseases

High Population Density With Inadequate Biosurveillance



Expanded Eco-niches and New Zoonotic Exposures/Risks



Major Gaps in Health Infrastructure and Rapid Disease Reporting



Increased Refugee Migration, Humanitarian Disasters and Increased Infectious Disease Events



REPORT ON THE IMPACT OF CLIMATE CHANGE ON MIGRATION


OCTOBER 2021


A REPORT BY
THE WHITE HOUSE



Water Security and Global Health








GLOBAL WATER SECURITY ISSUES CASE STUDIES :

Water Security and the Sustainable Development Goals



The Growing Challenges of Global Food Security

Global Network Against Food Crises

FSIN
Food Security Information Network

2020
GLOBAL REPORT ON FOOD CRISES
JOINT ANALYSIS FOR BETTER DECISIONS

Food and Agriculture Organization of the United Nations

WFP
World Food Programme

FAO-WFP early warning analysis of acute food insecurity hotspots
July 2020

Global Network Against Food Crises | Integrated actions for lasting solutions

Food and Agriculture Organization of the United Nations

IFAD
International Fund for Agricultural Development

unicef

WFP
World Food Programme

World Health Organization

2021

THE STATE OF FOOD SECURITY AND NUTRITION IN THE WORLD

TRANSFORMING FOOD SYSTEMS FOR FOOD SECURITY, IMPROVED NUTRITION AND AFFORDABLE HEALTHY DIETS FOR ALL

True Cost of Food
Measuring What Matters to Transform the U.S. Food System

THE ROCKEFELLER FOUNDATION

JULY 2021

Climate Change and Health Risks



COP26 SPECIAL REPORT ON
CLIMATE CHANGE AND HEALTH

THE HEALTH ARGUMENT FOR CLIMATE ACTION





NATIONAL INTELLIGENCE COUNCIL

NATIONAL INTELLIGENCE ESTIMATE

Climate Change and International Responses Increasing Challenges to US National Security Through 2040

NIC-NIE-2021-10038-A

United States Army War College

Implications of Climate Change for the U.S. Army

Department of Defense Climate Risk Analysis

October 2021



To the National Security Council



Who Pays for Preparedness?

The Obligate Role of Private-Public Partnerships in Biosecurity Policy

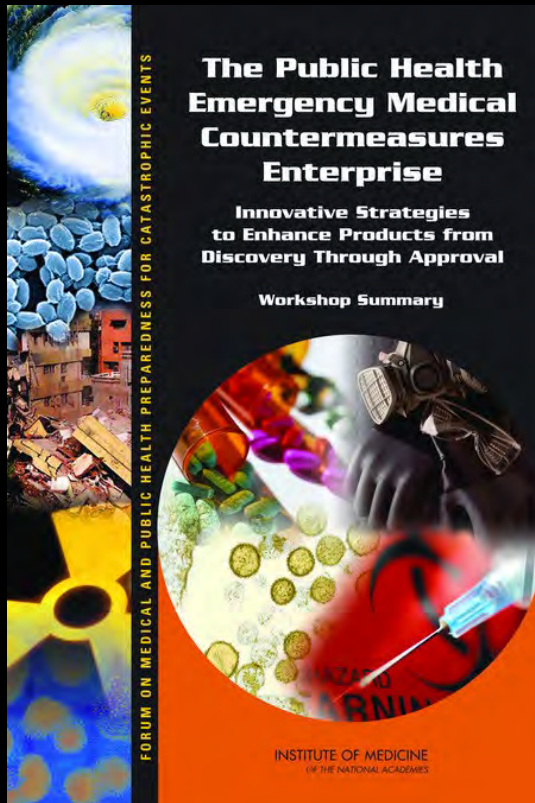
PROCEEDINGS OF A WORKSHOP

Engaging the
Private-Sector Health Care System in Building Capacity to Respond to Threats to the **Public's Health and National Security**

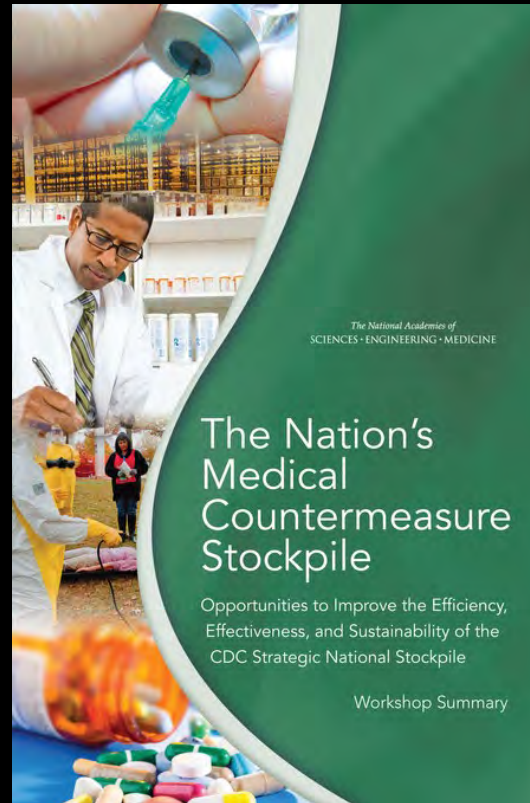
The National Academies of
SCIENCES • ENGINEERING • MEDICINE



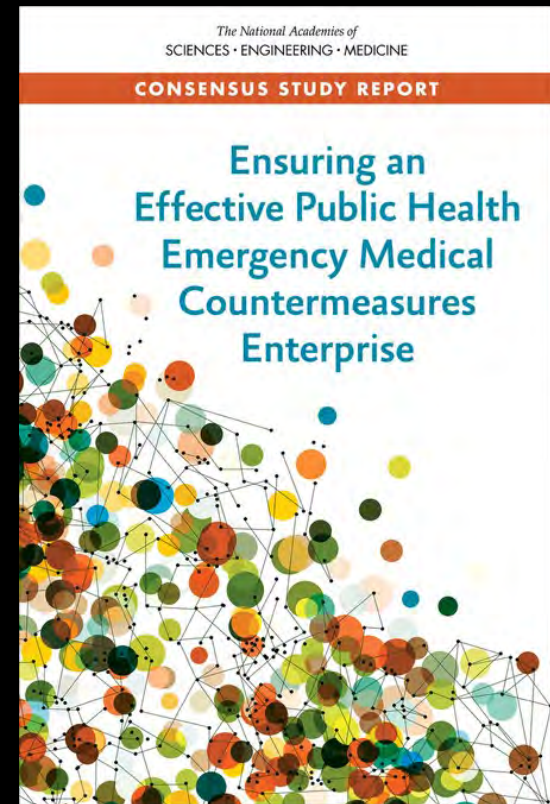
Emergency Medical Countermeasures: Warnings Long Ignored



(2010)



(2016)



(2021)

Notice the Resemblance? Hygiene and Quarantine as the Only Effective Containment Absent Drugs or Vaccines

**Bubonic Plague
Physician 15th Century**



**Ebola, Liberia
21st Century**



**COVID-19
21st Century**



Therapeutics and Vaccines: Critical Dependence on Private Sector Innovation and Investment



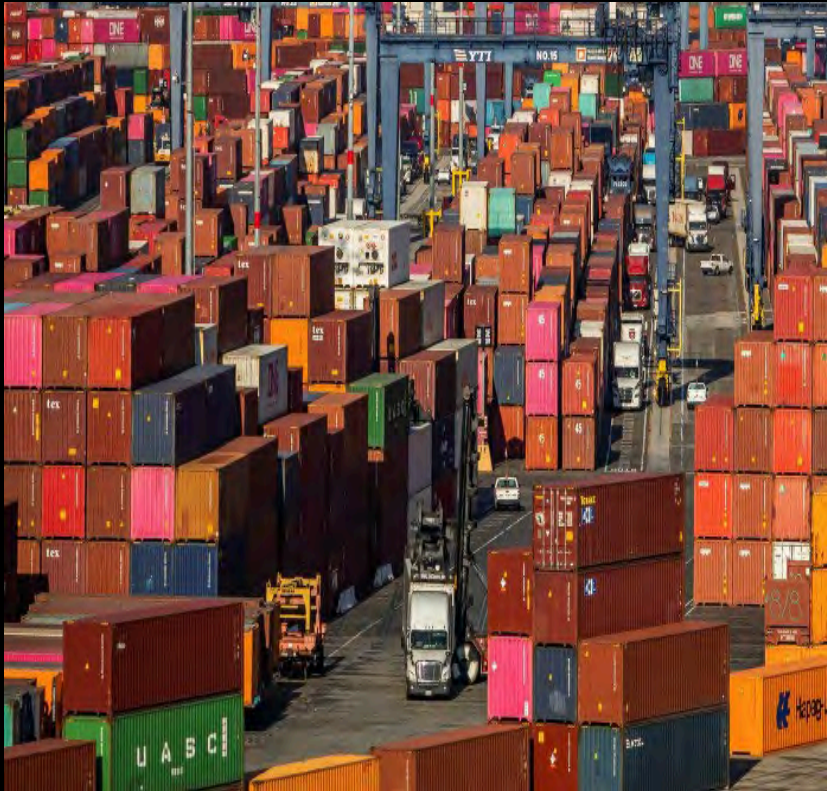
Development of Medical Countermeasures (MCMs) for Emerging Infectious Diseases (EIDs) and Biodefense

- limited private sector engagement until global emergency created by COVID19
- poor productivity of USG agencies (NIH, DOD, CDC) despite multi-billion investment (2001-present)
- pre-Covid BARDA under-funded to meet 'translational mission' to transfer USG innovation to industry
- FAR and annual budget cycle as obstacles to long-term R&D cycles (5-10 years)
- private sector engagement largely limited to small biotechnology companies with no proven track record of FDA-product approval
 - USG as source of non-dilutive capital
 - limited VC interest in EIDs and biodefense (market failure)

Market Failure

- **lack of incentives for private sector to undertake high risk/high-cost R&D absent guaranteed markets and ROI**
 - **MCMs for pandemic threats, EIDs and biowarfare select agents**
 - **neglected diseases of the developing world**
 - **antibiotic resistance**
- **outsourcing of critical medical supply chains (China, India)**
 - **generic drugs (80% of US prescriptions)**
 - **active ingredients for key drug classes (antibiotics)**
 - **PPE**
 - **devices (ventilators)**

The COVID Pandemic and Global Supply Chain Disruption



BUILDING RESILIENT SUPPLY CHAINS, REVITALIZING AMERICAN MANUFACTURING, AND FOSTERING BROAD-BASED GROWTH

100-Day Reviews under
Executive Order 14017

June 2021

A Report by
The White House

Including Reviews by
Department of Commerce
Department of Energy
Department of Defense
Department of Health and Human Services



The National Academies of
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CONSENSUS STUDY REPORT

SAFEGUARDING the BIOECONOMY



Hybrid CoE Strategic Analysis / 26

MAY 2021

Cyber-biosecurity: How to protect biotechnology from adversarial AI attacks

ELEONORE PAUWELS



Hybrid CoE

Dual-Use Technologies and Expansion of the Biothreat Spectrum

**Beyond Bugs: Next-Generation Biothreats Based
on Genetic Engineering and Cognitive Manipulation**

Advances in the Biosciences and the Expanded Dual-Use Dilemma

genomics (and multiOmics)

- mapping the functional properties of living organisms at the molecular level
- understanding the molecular signaling information networks (biocircuits) that control specific biological functions
 - cells, tissues, organs, whole organisms

synthetic biology

- new technologies to alter the properties of existing organisms
- design of biological functions/organisms for which there is no known evolutionary precedent
- powerful new tools for genome modification
 - read, write, edit

Dual-Use Technologies and Expansion of the Biothreat Spectrum

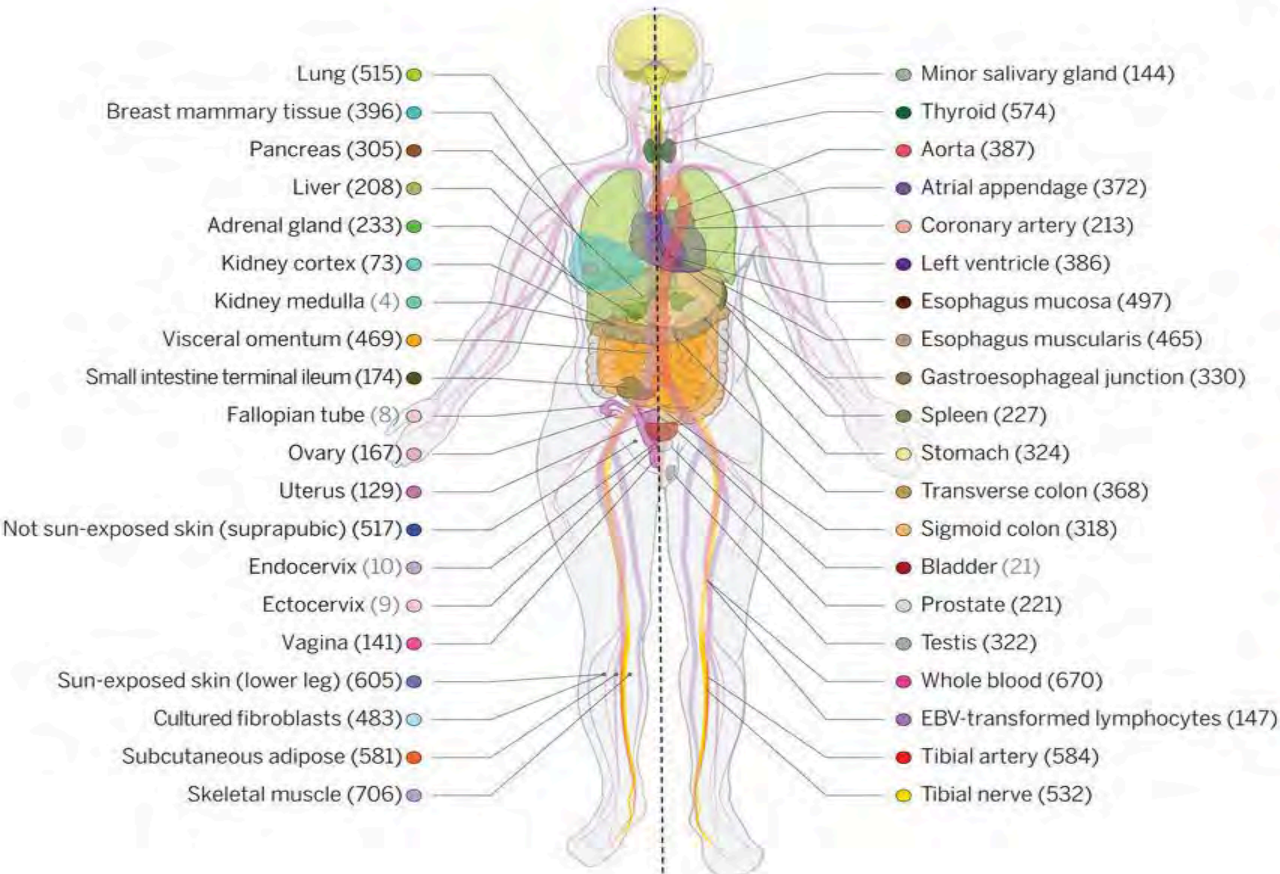
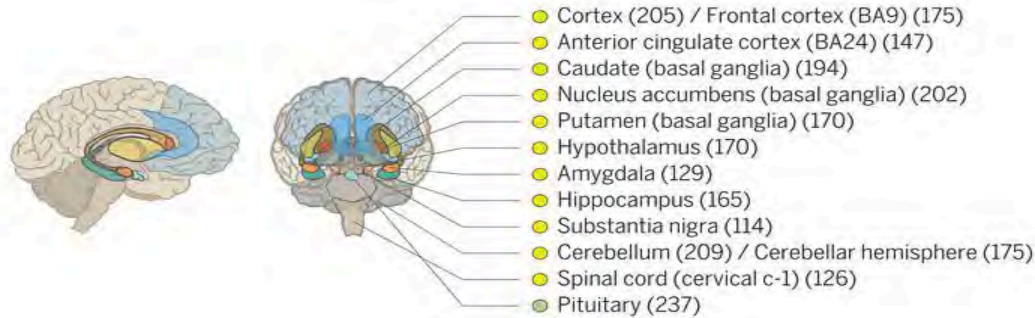
**deliberate engineering of microorganisms for
biowarfare/ bioterrorism**

- **evade detection and circumvent therapeutic countermeasures**
- **new virulence features to alter target organs**
- **induce high levels of chronic disease and unsustainable economic burden to healthcare systems**
- **expand the spectrum of vulnerable host species (animals, crops, ecosystem disruption)**

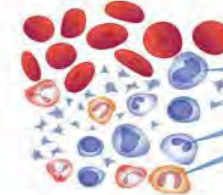
Dual-Use Technologies and Expansion of the Biothreat Spectrum: 'Beyond Bugs'

- **new biothreats that do not involve microorganisms**
- **potential to target any lifeform or biological functions based on knowledge of the underlying molecular control systems**
 - **“biocircuit modulators”**
- **although viruses could theoretically be designed to attack specific biocircuits the more likely scenario will be to design chemical molecules to hit the circuit(s) of interest**

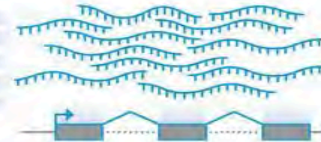
Mapping Genetic Control Circuits in Human Organs and Cells : New Dual-Risk Challenges



Cell type composition in tissues

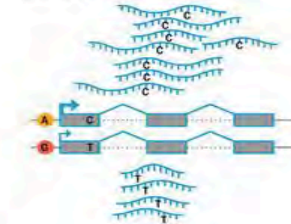


Gene expression and splicing

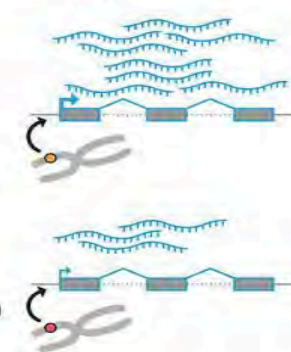


Expression quantitative trait loci (eQTLs)

cis-eQTLs

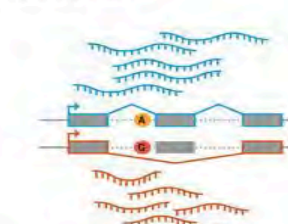


trans-eQTLs

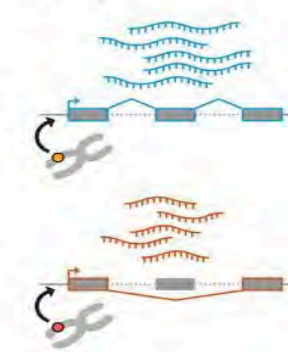


Splicing quantitative trait loci (sQTLs)

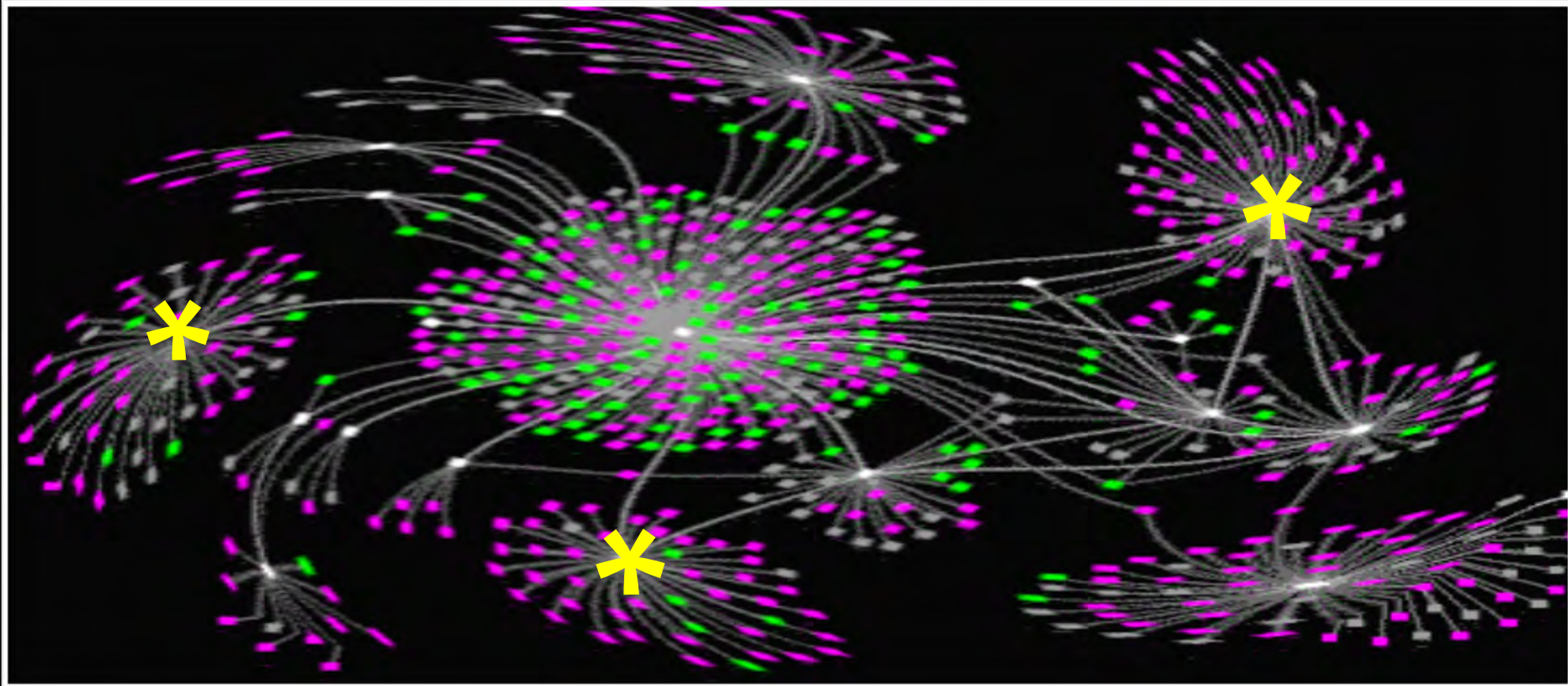
cis-sQTLs



trans-sQTLs



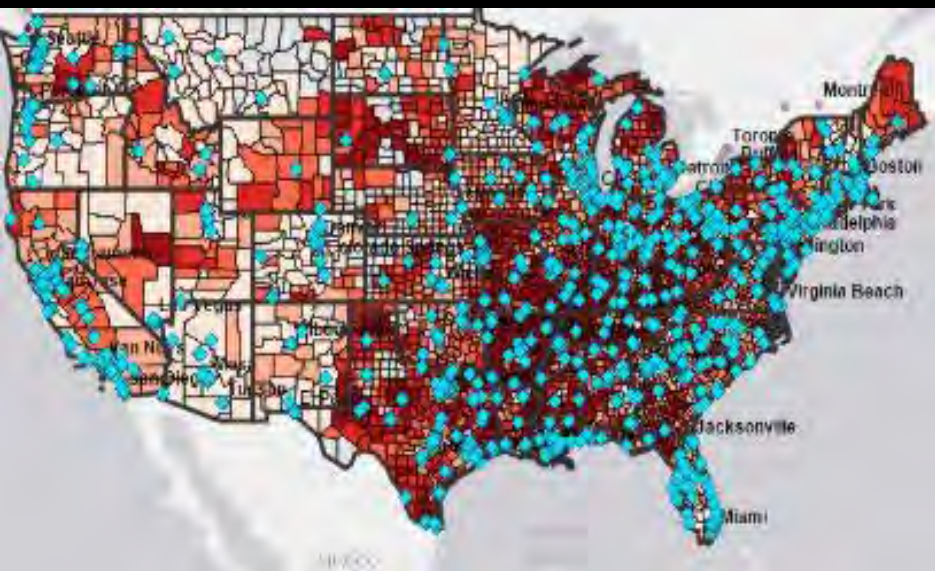
Synthetic Biology and Dual –Use Research : Thinking ‘Beyond Bugs’



- **precision medicine: mapping molecular networks**
- (circuit diagrams) of every cell type in the body and the circuit disruptions that cause disease
- **roadmap for next-generation CBW agents to target specific molecular circuits** *

National Security Implications of Genomic Data on Populations

Population Databanks



Individual Profiles



Foreign Access to Data



华大基因
BGI

Data Security



Next Generation Chemical Threat Agents: 'Inspired by Biology'

- **design of next-generation chemical weapons targeted to specific biocircuits**
- **acute versus chronic effects**
- **altered immune functions**
 - **activation: autoimmune disease**
 - **immunosuppression: vulnerability to multiple infections**
- **neuromodulation**
 - **trigger fear, panic, hallucinations, aberrant memories**
 - **reduce thresholds for violence, addictive behavior**

China's Export of Fentanyl and Derivatives




Testimony

Evolution of the U.S. Overdose Crisis

Understanding China's Role in the Production and Supply of Synthetic Opioids

Bryce Pardo

CT-497
Testimony presented before the House Foreign Affairs Subcommittee on Africa, Global Health, Global Human Rights, and International Organizations on September 6, 2018.



Dual-Use Technologies and the Expanding Biothreat Spectrum

- **rate of technology progress and risk expansion outpacing current national and international oversight mechanisms**
- **new classes of dual-use biothreats will arise from intensifying national competitiveness for commercial domination of advanced technologies**
 - **synthetic biology, neuroscience and AI (among others)**
- **CBW Convention and national export controls were designed to address more narrow, well-defined risks**
 - **“select agents”**

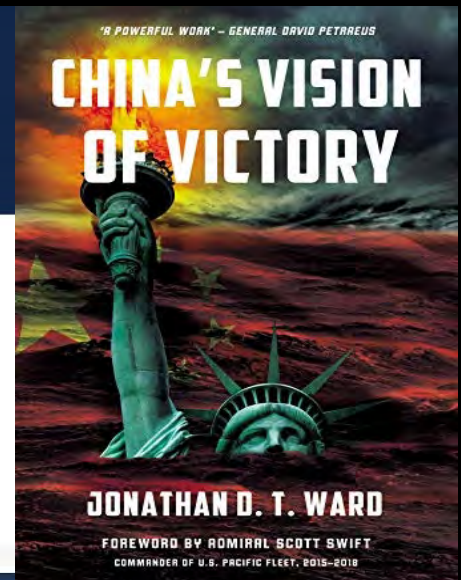
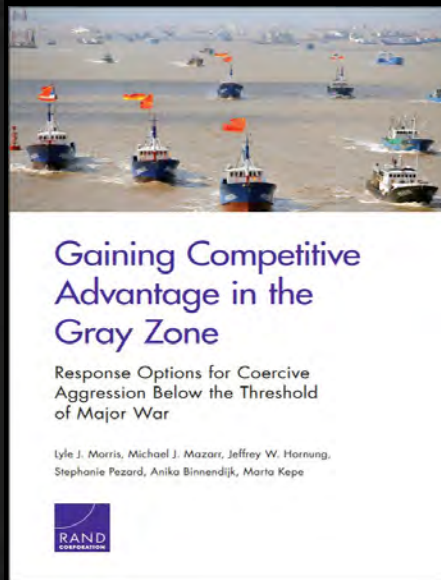
Gray Zone Threats

An Emerging Dimension of Hybrid Warfare

Implications for Biosecurity

Darker Shades of Gray: The Emerging Dimension of Hybrid Warfare

- lawfare: exploiting loopholes to seed confusion and dissent
- deception, disinformation and propaganda
- weaponized narratives (“fake news”)
- plausible deniability



Gray Warfare and Biosecurity

- **targeted psychological manipulation of cognition and beliefs**
- **undermine societal trust in political leadership and institutions**
- **promote social division, tension and civil unrest**
- **'fake news' and self-reinforcing 'echo chamber' propaganda on social media**
- **parallel dimension to cyberwarfare but more subtle, insidious and longer-term impact**

'Big Tech' and the Global Digital Ecosystem

- increasing pervasive reach of data collection on individuals, institutions, societies and governments

amazon

Alphabet



facebook

NETFLIX

Microsoft

LexisNexis

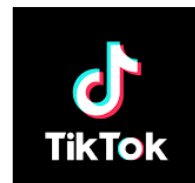
Яндекс

Baidu

Alibaba.com

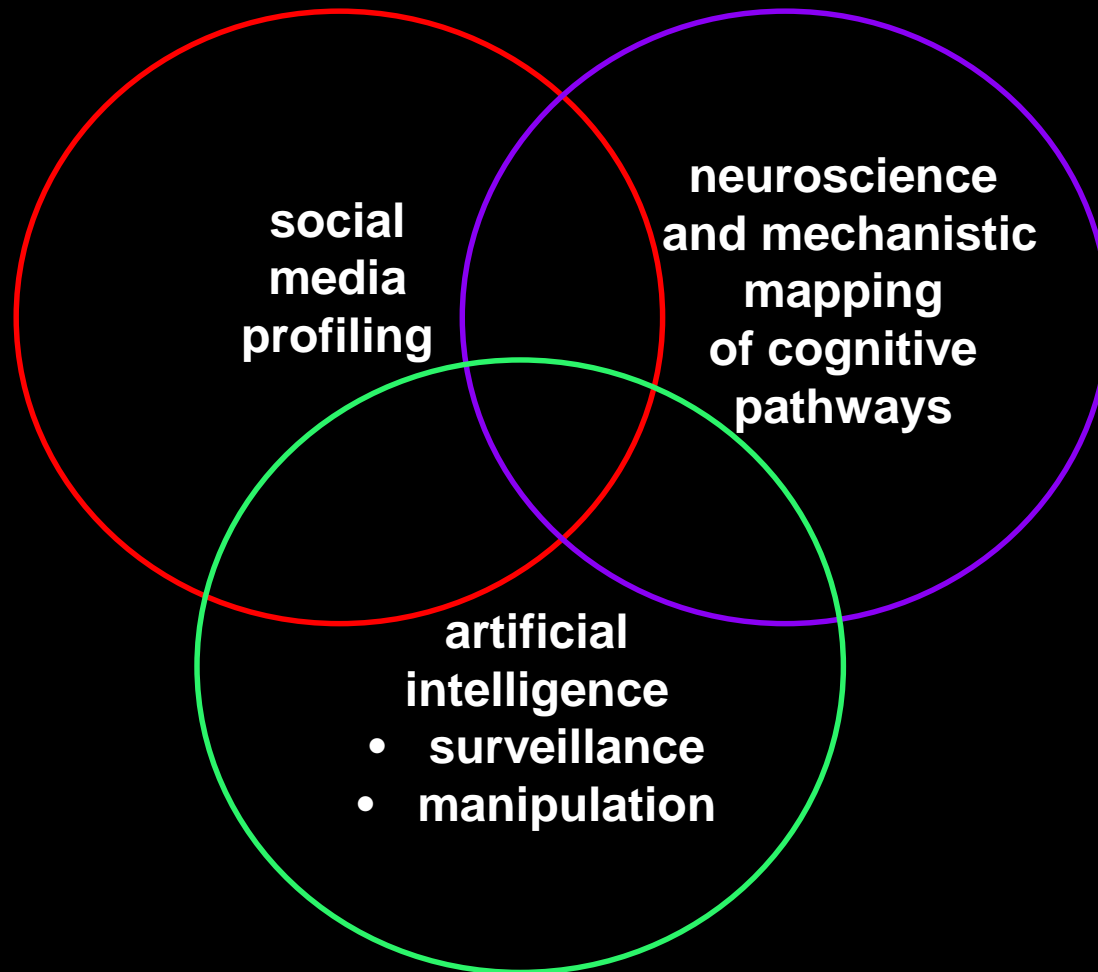
Tencent 腾讯

ByteDance



HUAWEI

Big Data Meets Neuroscience – The Ultimate Technological Triad: Consumerism, Commerce and Control



Big Data Analytics: From Consumerism to Control?



Surrender of Personal Privacy and Autonomy For Access to the Convenience of the Digital Economy

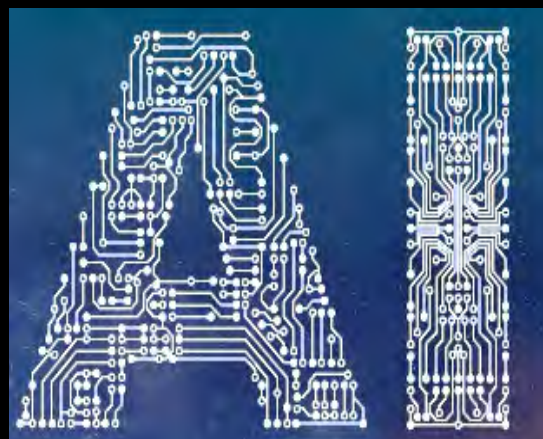
- **anticipating our “wants and needs” as the core business model**
- **the confessional of social media**
- **click-based commercial and political targeting**
- **covert data use and distribution by large data companies/governments**
- **access and prediction of your mental state(s)?**



National Leadership in Advanced Technologies: The Quest for Corporate and Military Superiority



- **biotechnology**
- **genomics**
- **synthetic biology**



- **artificial intelligence**
- **quantum computing**



- **control of low earth orbits**
 - **commercial**
 - **military**



THE NATIONAL COUNTERINTELLIGENCE AND SECURITY CENTER

Protecting Critical and Emerging U.S. Technologies from Foreign Threats

October 2021



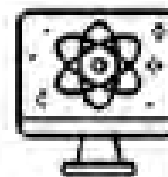
ARTIFICIAL
INTELLIGENCE



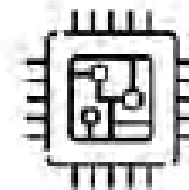
BIOECONOMY



AUTONOMOUS
SYSTEMS



QUANTUM



SEMICONDUCTORS

PRC: Strategy for Global Commercial and Military Dominance

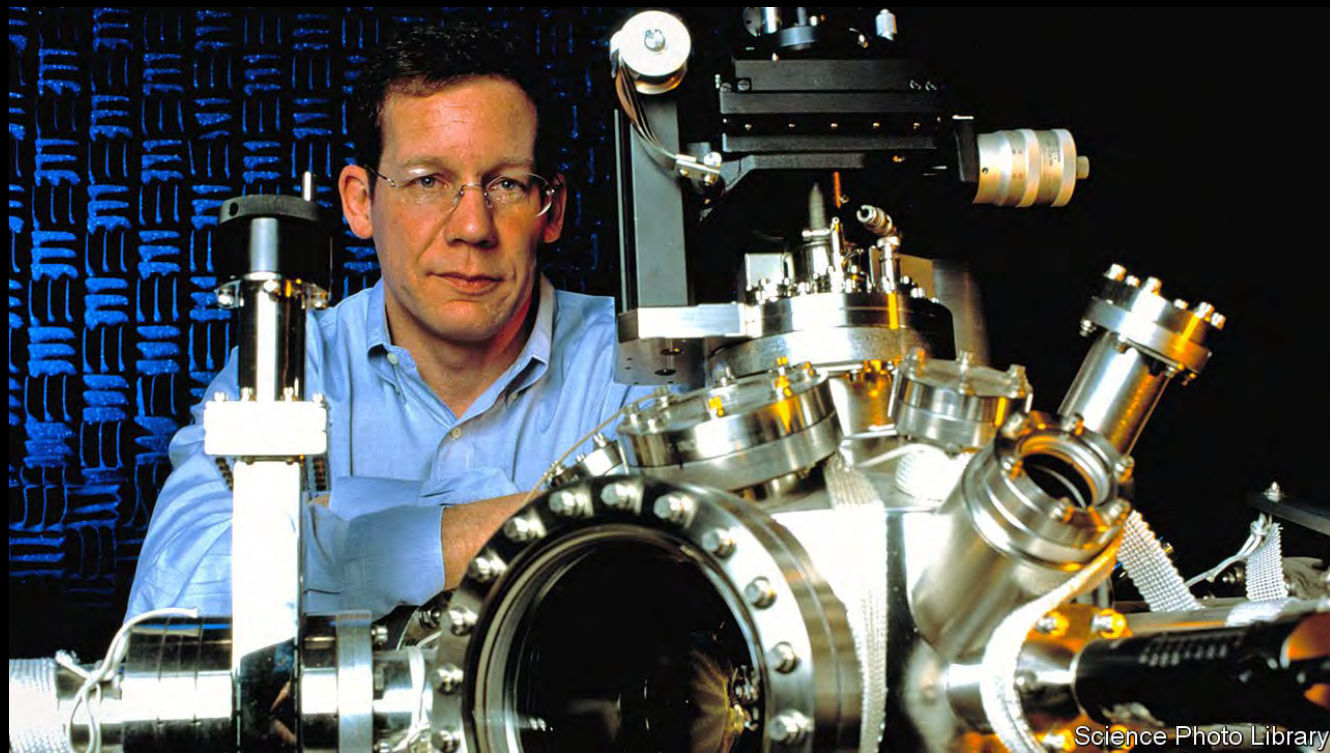


- military - civil fusion plan
- major R.& D. investments and sophisticated biotechnology/computing expertise
- purposeful creation of large diaspora for training in US/EU universities
- relentless industrial espionage and relentless cyber- exfiltration efforts
- mapping the genetic diversity of human populations

The Conviction of Charles Lieber, Chair, Dept. of Chemistry, Harvard University (21 December 2021)



RECRUITMENT
PROGRAM OF GLOBAL EXPERTS



Science Photo Library



RECRUITMENT
PROGRAM OF GLOBAL EXPERTS

祖国需要你们 祖国欢迎你们，祖国寄希望于你们

欢迎海外高层次人才回国（来华）创新创业



The Origin of SARS-CoV-2

Bat-Derived Zoonose?



Biocontainment Breach at Wuhan Institute of Virology ?





'Science' in Pandemic Times

- **IHR non-compliance by failure to promptly report novel pathogen and human-to-human transmission to WHO (12/20 and 1/20)**
- **ensorship of internal scientific, clinical and public health communications about SARS-CoV-2 without political approval**
- **lack of transparency in data provided to WHO investigation panel**
- **launch of disinformation campaign (USAMRID Ft. Detrick as source of the pandemic)**

The Unresolved Origin of SARS-CoV-2

SEPTEMBER 21, 2020


FINAL REPORT

THE ORIGINS OF THE COVID-19 GLOBAL PANDEMIC, INCLUDING THE ROLES OF THE CHINESE COMMUNIST PARTY AND THE WORLD HEALTH ORGANIZATION


HOUSE FOREIGN AFFAIRS COMMITTEE MINORITY STAFF REPORT

LEAD REPUBLICAN MICHAEL T. MCCAUL

ONE HUNDRED SIXTEENTH CONGRESS



Unclassified Summary
of Assessment on
COVID-19 Origins



**INTELLIGENCE
COMMUNITY
ASSESSMENT**

 中华人民共和国驻美利坚合众国大使馆
Embassy of the People's Republic of China in the United States of America

@AmbCuiTiankai @ChineseEmbinUS @ChineseEmbinUS @ChineseEmbassyinUS

**Remarks by Spokesperson of the Chinese
Embassy in the US on the Origin Tracing of
COVID-19**
2021/05/26

Evidentiary Standards in the Analysis of the Origin of SARS-CoV-2

THE LANCET VOLUME 395, ISSUE 10226, E42-E43, MARCH 07, 2020

Statement in support of the scientists, public health professionals, and medical professionals of China combatting COVID-19

We are public health scientists who have closely followed the emergence of 2019 novel coronavirus disease (COVID-19) and are deeply concerned about its impact on global health and wellbeing. We have watched as the scientists, public health professionals, and medical professionals of China, in particular, have worked diligently and effectively to rapidly identify the pathogen behind this outbreak, put in place significant measures to reduce its impact, and share their results transparently with the global health community. This effort has been remarkable.

We sign this statement in solidarity with all scientists and health professionals in China who continue to save lives and protect global health during the challenge of the COVID-19 outbreak. We are all in this together, with our Chinese counterparts in the forefront, against this new viral threat,

nothing but create fear, rumours, and prejudice that jeopardise our global collaboration in the fight against this virus. We support the call from the Director-General of WHO to promote scientific evidence and unity over misinformation and conjecture.²⁴ We want you, the science and health professionals of China, to know that we stand with you in your fight against this virus.

We invite others to join us in supporting the scientists, public health professionals, and medical professionals of Wuhan and across China. Stand with our colleagues on the frontline!

We speak in one voice. To add your support for this statement, sign our letter online. LM is editor of ProMED-mail. We declare no competing interests.

Charles Calisher, Dennis Carroll, Rita Colwell, Ronald B Corley, Peter Daszak, Christian Drosten, Luis Enjuanes, Jeremy Farrar, Hume Field, Josie Golding, Alexander Gorbalenya, Bart Haagmans, James M Hughes, William B Karesh, Gerald T Keusch, Sai Kit Lam, Juan Lubroth, John S Mackenzie, Lary Madoff, Jonna Mazet, Peter Palese, Stanley Perlman, Leo Poon, Bernard Roizman, Linda Saif, Kanta Subbarao, Mike Turner

LETTERS

SCIENCE • 14 May 2021 • Vol 372, Issue 6543 • p. 694

Edited by Jennifer Sills

Investigate the origins of COVID-19

On 30 December 2019, the Program for Monitoring Emerging Diseases notified the world about a pneumonia of unknown cause in Wuhan, China (1). Since then, scientists have made remarkable progress in understanding the causative agent, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), its transmission, pathogenesis, and mitigation by vaccines, therapeutics, and non-pharmaceutical interventions. Yet more investigation is still needed to determine the origin of the pandemic. Theories of accidental release from a lab and zoonotic spillover both remain viable. Knowing how COVID-19 emerged is critical for informing global strategies to mitigate the risk of future outbreaks.

In May 2020, the World Health

inclusive of broad expertise, subject to independent oversight, and responsibly managed to minimize the impact of conflicts of interest. Public health agencies and research laboratories alike need to open their records to the public. Investigators should document the veracity and provenance of data from which analyses are conducted and conclusions drawn, so that analyses are reproducible by independent experts.

Finally, in this time of unfortunate anti-Asian sentiment in some countries, we note that at the beginning of the pandemic, it was Chinese doctors, scientists, journalists, and citizens who shared with the world crucial information about the spread of the virus—often at great personal cost (8, 9). We should show the same determination in promoting a dispassionate science-based discourse on this difficult but important issue.

Jesse D. Bloom^{1,2}, Yujia Alina Chan³, Ralph S. Baric⁴, Pamela J. Bjorkman⁵, Sarah Cobey⁶, Benjamin E. Deverman⁷, David N. Fisman⁸, Ravindra Gupta⁸, Akiko Iwasaki^{9,2}, Marc Lipsitch¹⁰, Ruslan Medzhitov^{9,2}, Richard A. Neher¹¹, Rasmus Nielsen¹², Nick Patterson¹³, Tim Stearns¹⁴, Erik van Nimwegen¹¹, Michael Worobey¹⁵, David A. Relman^{16,17*}

‘Science’ in Pandemic Times: The Origins of SARS-CoV-2 Controversy

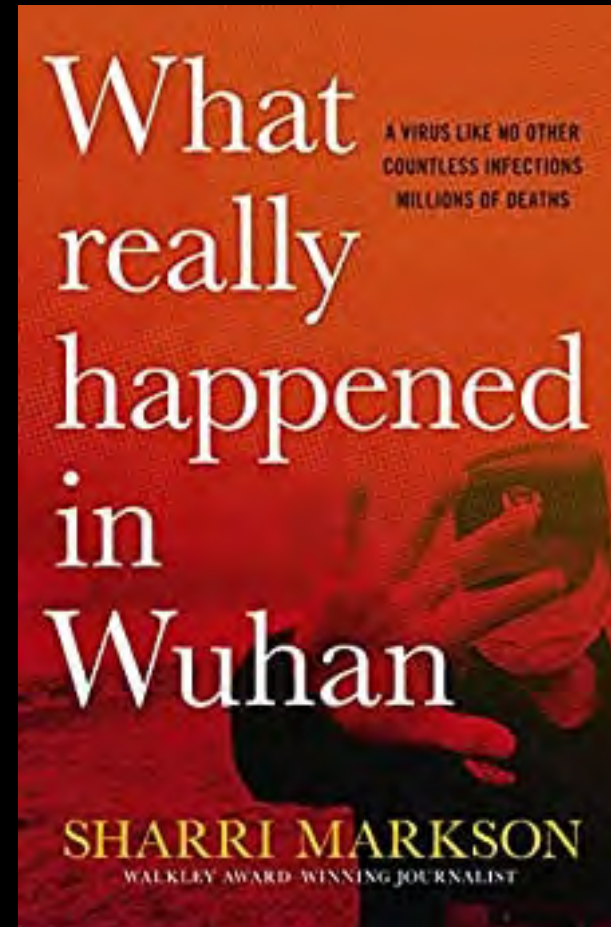
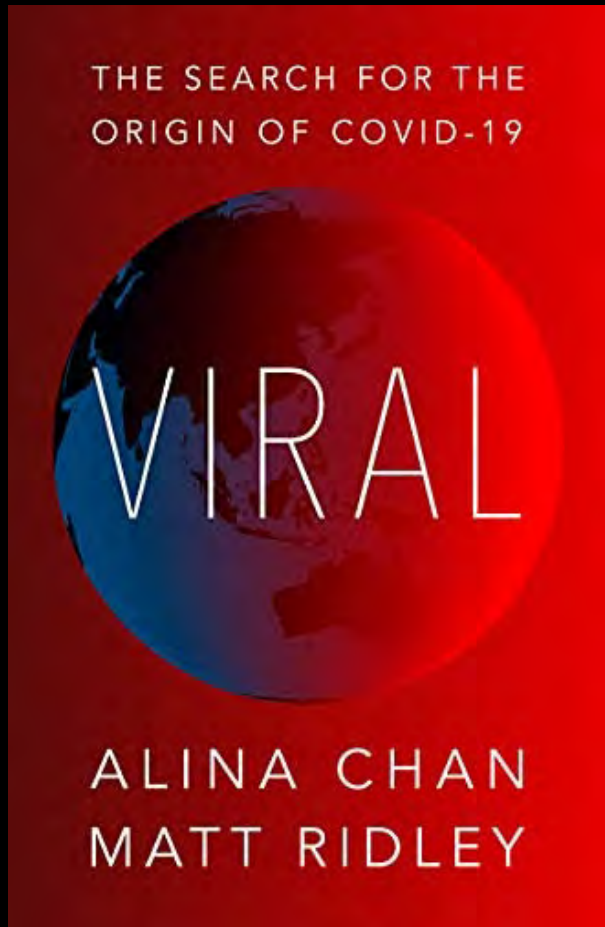
- **a revealing and not always reassuring insight into the ‘culture’ of western science**
- **premature dismissal of leak hypothesis given the extensive phylogenetic distance between proposed bat reservoir and SARS-CoV-2**
- **despite comprehensive field sampling of regional bat species no precursor with closer phylogenetic status yet identified**
 - **Laos 2021 isolate only a minor gain in phylogenetic similarity**

'Science' in Pandemic Times: Group Think, Bias and Unrevealed Conflicts of Interest



- premature dismissal of Wuhan lab leak as viable alternative the natural zoonotic spread of a bat coronavirus to humans
- coordinated campaign (IH/2020) by zoonosis KOLs advocates to portray lab leak hypothesis as a fringe, conspiracy theory
- unrevealed COI by zoonosis KOLs regarding Wuhan collaborations and concern that scrutiny of GoF studies on bat coronaviruses would curtail future broader GoF research

The Case for the Lab-Leak Hypothesis



The Origin of SARS- CoV-2



“Without transparency and sharing of data (by PRC) I don’t think the origins (search) could reach a successful conclusion.”

**Dr. Tedros Ghebreyesus
WHO Director General December 2021**



“We urgently call for closer international cooperation, increased vaccine supply and sharing and rapid information exchange.”

**Dr. George Gao
Head, Chinese CDC Nature (2021) 600,408**

The Evolution of Global Public Health Aspirations: Alma-Ata (1978) to Astana (2018)



**Global Health
Security Agenda**

- **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**

Unfortunate Truisms in Public Health:

Comfort and Complacency Erode Robust Preparedness

Out-of-Sight, Out-of-Mind

**If Nothing Happens, the Preparedness
Budget is Neglected or Reduced**

Why Don't We Learn from History?

The Imperative for Proactive Actions for Robust Biosecurity

- **need for higher priority of biosecurity in national security strategy and international engagement**
- **development of more sophisticated threat assessment capabilities**
- **strengthen and integrate surveillance, analysis deterrence capabilities in national security, IC, and public health**
- **closer coupling of public health and healthcare delivery systems**
- **greater investment in robust threat mitigation capabilities**
 - **new diagnostic technologies and MCMs**
 - **obligate private sector engagement**
 - **supply chain logistics**
 - **workforce expertise and readiness training**
- **international cooperation and harmonization**

Guaranteed Certainties!

- **escalating technological complexity**
- **new dual use technologies and the expanded threat spectrum**
- **intensified international competition for commercial and military dominance of advanced technologies**
- **decision-making in the face of greater uncertainty**

“Plus ça change, plus c’est la même chose”

**“Politics is the art of the possible,
the calculated science of survival”**

Prince Otto von Bismarck



**“Survival owes little to the art of politics,
but everything to the calculated application
of science”.**

**Professor Rudolph Virchow
(in reply)**



“Plus ça change, plus c’est la même chose”

**“Politics is the art of the possible,
the calculated science of survival”**

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Slides available @ casi.asu.edu/presentations

**“Survival owes little to the art of politics,
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(in reply)**

