Complex Adaptive Systems Initiative
Arizona State University

Stanford MEDICINE

Biosecurity: Complexity, Connectivity, Complacency & Commitment

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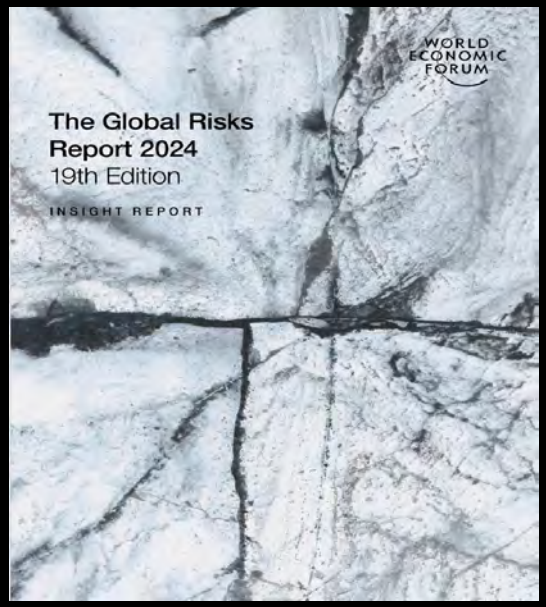
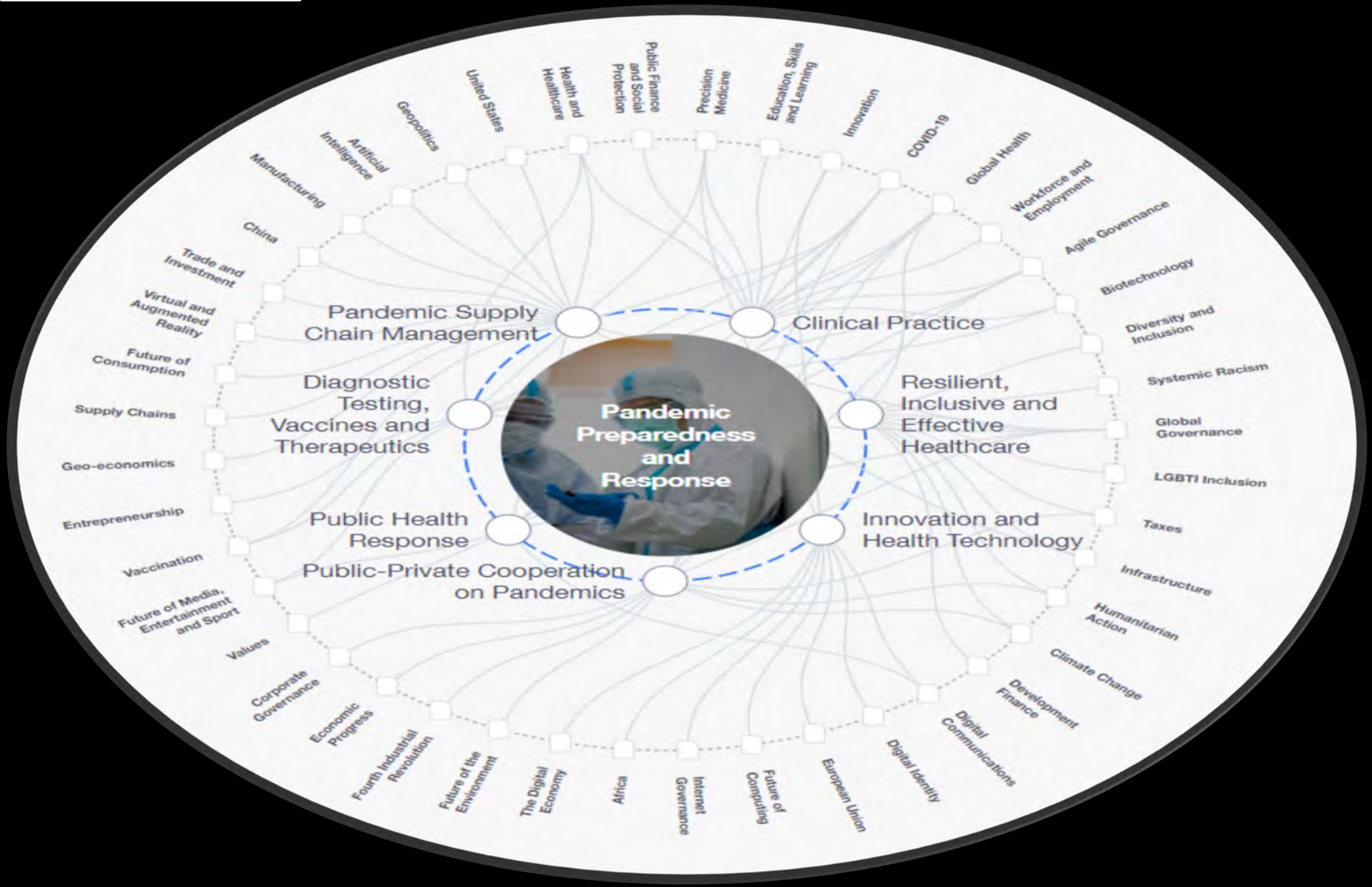
Biosecurity



- more than protection against infectious diseases (natural or engineered)
- a complex spectrum of multi-dimensional events with potential to cause major disruptions in societal stability and/or increase risk of global conflict
- escalating complexity driven by global connectivities and acceleration of technology innovation
- substantial expansion of theoretical dual-use applications from convergence of advances in biotechnology, synthetic biology and AI
- parallel strategic importance of the industrial bioeconomy for national economic competitiveness and military advantage
- increased importance of biosecurity and the bioeconomy in global trade, foreign policy and military strategy

WORLD ECONOMIC FORUM

Biosecurity: Everything Connects



Albrecht Dürer, 1498

The Four Horsemen of the Apocalypse

- pestilence
- war
- famine
- death
- (social media will arrive five centuries later)

Biosecurity Preparedness, Response, Resiliency & Recovery (PR3): Mapping The Risk Spectrum

- shared and unique features of different natural and disaster categories

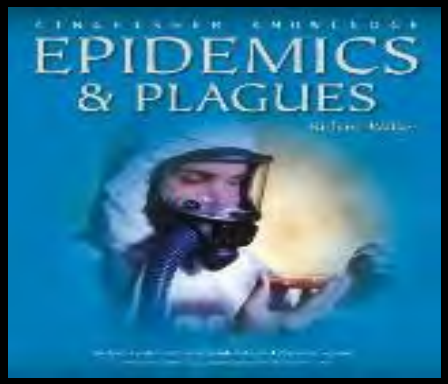
- acute catastrophes/hazards
  - typically of limited duration and damage scale known from the outset

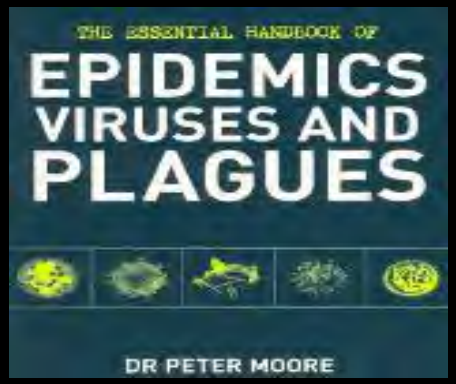
- infectious disease epidemics/pandemics
  - higher-order complexity than most other disaster risk categories
  - large populations at risk across broad geographies (humans, livestock, plants)
  - protracted timelines for full control and recovery (months/years)
  - trigger cascading global systemic vulnerabilities as revealed by COVID-19 pandemic

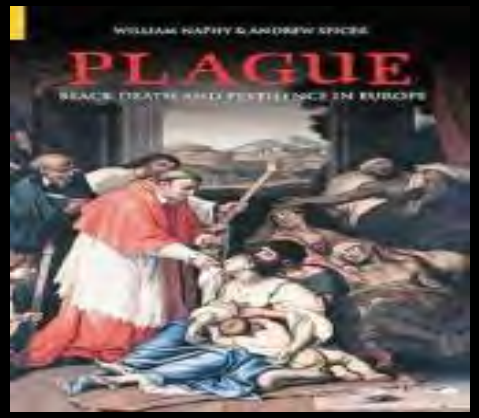
- risk amplification by cyber-disruption and disinformation campaigns

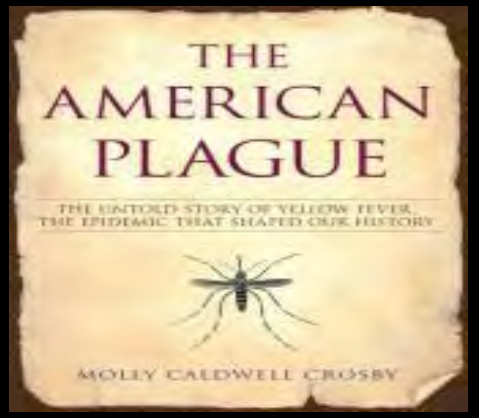
- convergence of advances in biotechnology, engineering, computing and AI
  - proliferation of dual-use technologies and new threat categories

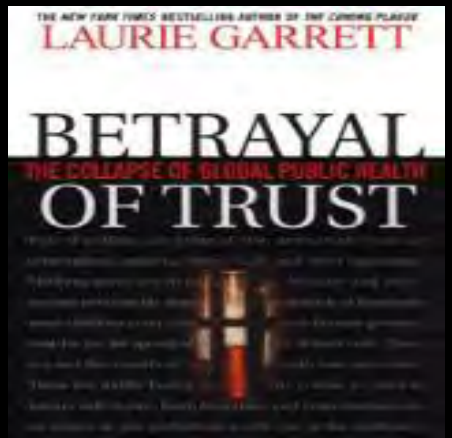
Infectious Diseases:
A Powerful Force in Human Evolution

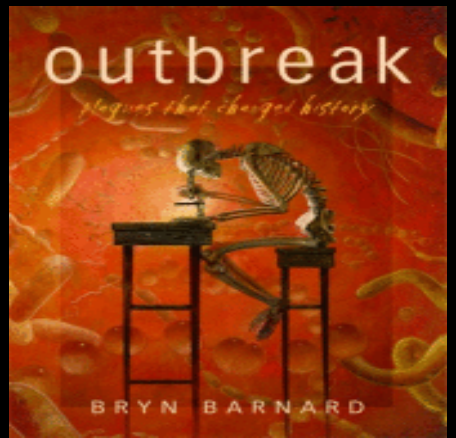


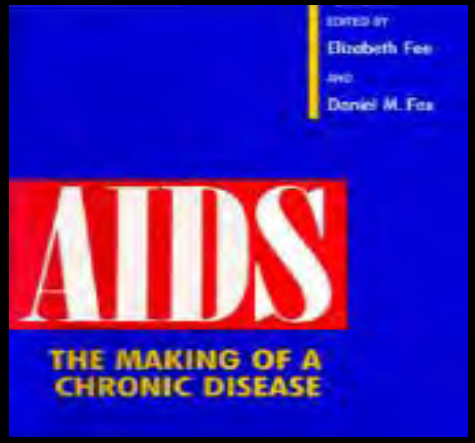


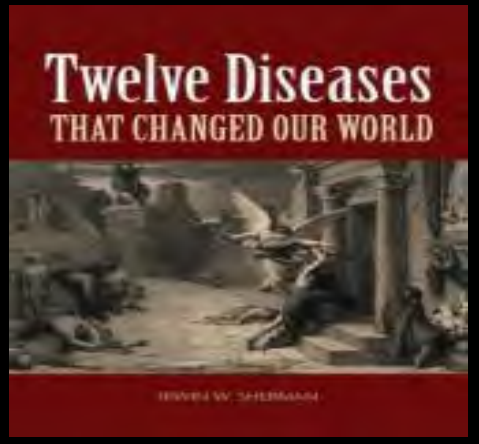










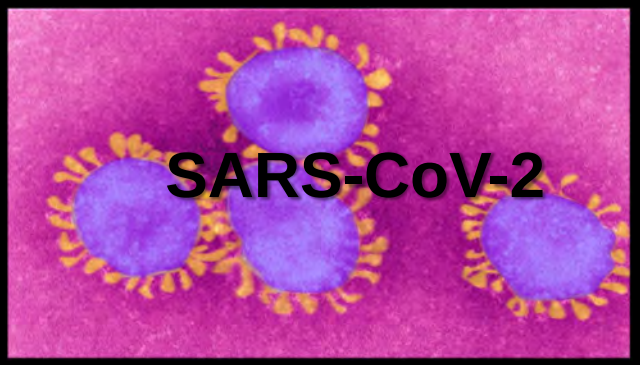


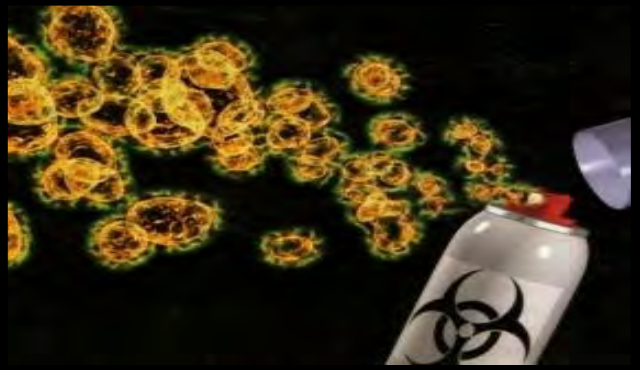
The Relentless Ever-Changing Dynamics of Infectious Diseases

old foes resurgent: Rx – resistance

omnipresent pandemic threats

new foes: emerging infectious diseases





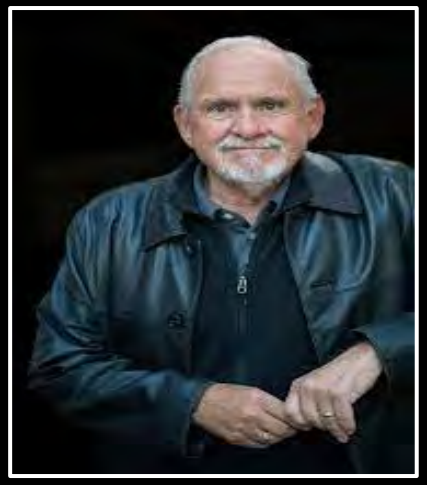
climate change and new vector ranges

bioterrorism and bioweapons

dual-use research of concern

“The State Capacity”: The Ability of a Nation to Get Things Done

Jonathan K. Hanson and Rachel Sigman. “Leviathan’s Latent Dimensions: Measuring Capacity for Comparative Political Research.” Journal of Politics, doi.org/10.10867/715066



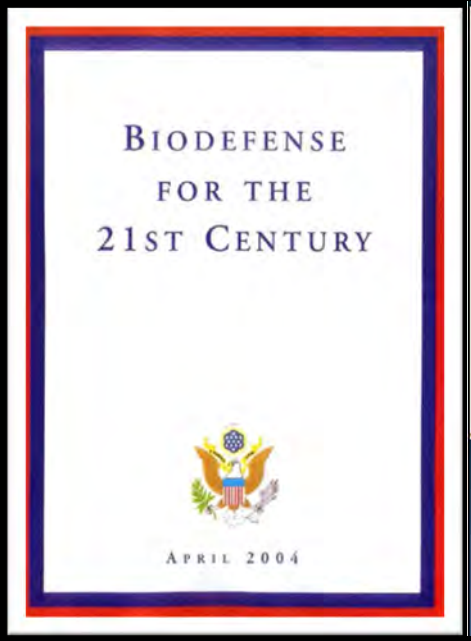
“Outbreaks are inevitable
Pandemics are optional.”

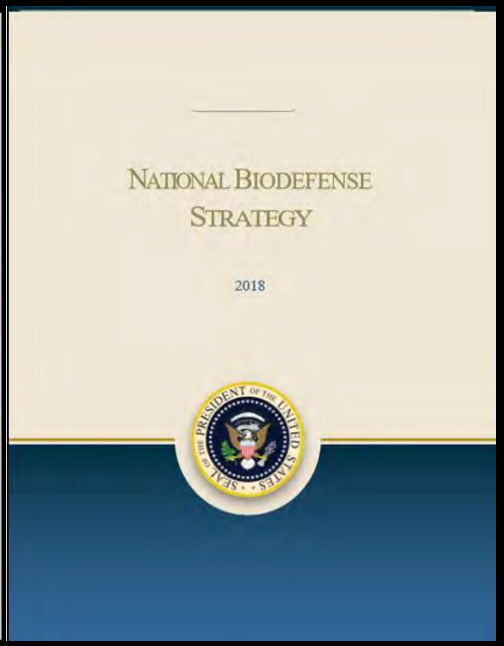
Dr. Larry Brilliant
Commentary on Ebola (2014)

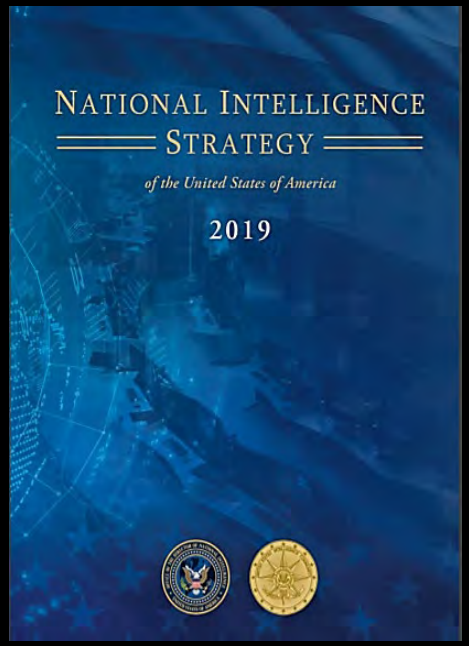
“Resilience is the multivalent vaccine against inevitable surprises”

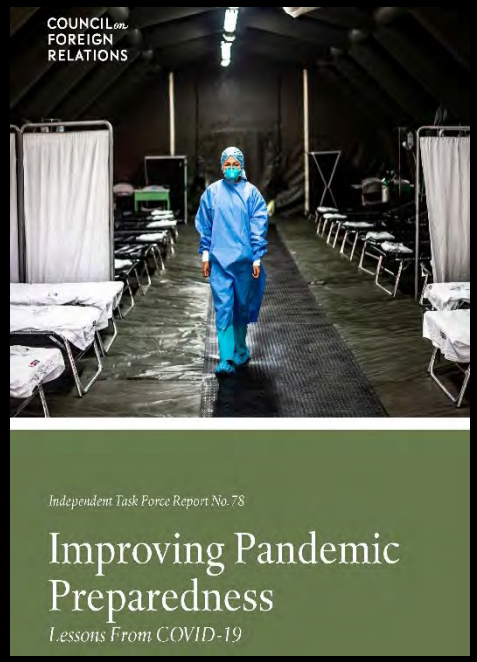
Dr. Jonas Salk
The Survival of the Wisest
The Phi Delta Kappaan (1975) 56, 667-69

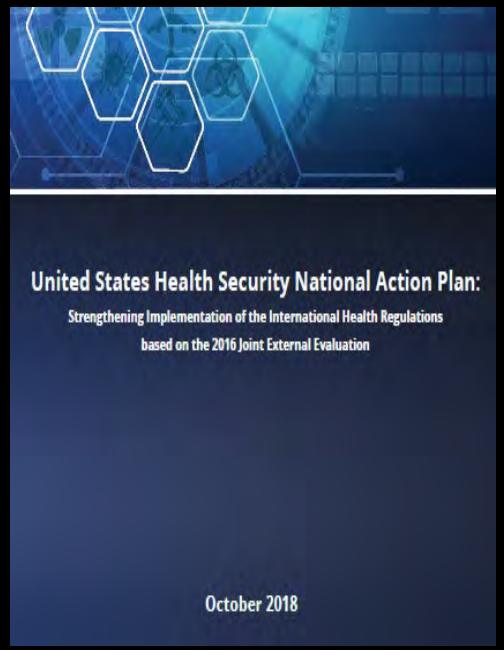
U.S. National Security Policy and Biodefense Pre-COVID

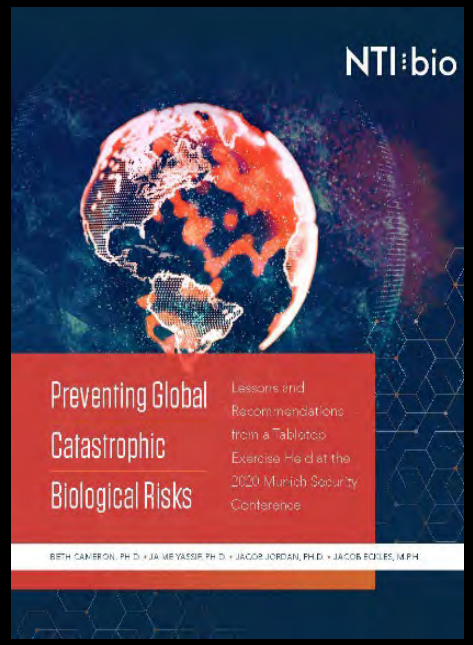


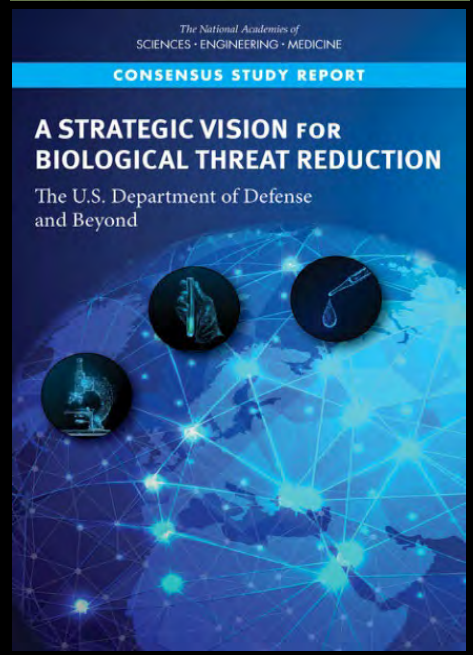




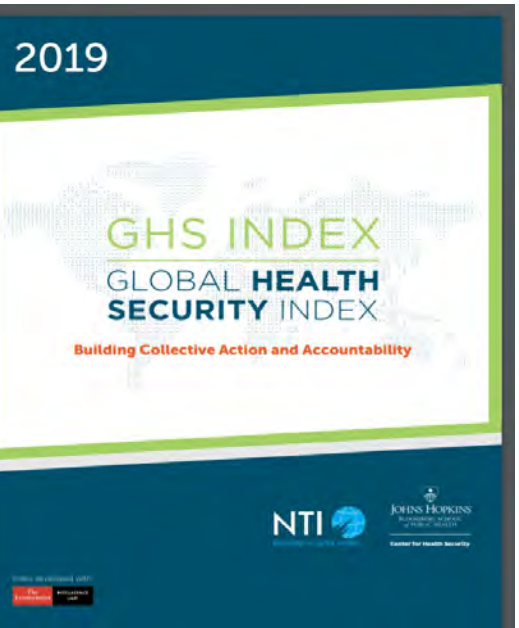








SARS-CoV-2 Revealed Major Shortcomings in US Public Health Capabilities and Fragility of Healthcare Delivery Systems



PREPARED ?

NO !

Key

- Most Prepared
- More Prepared
- Least Prepared

The COVID-19 Pandemic (December 2019 to ?)

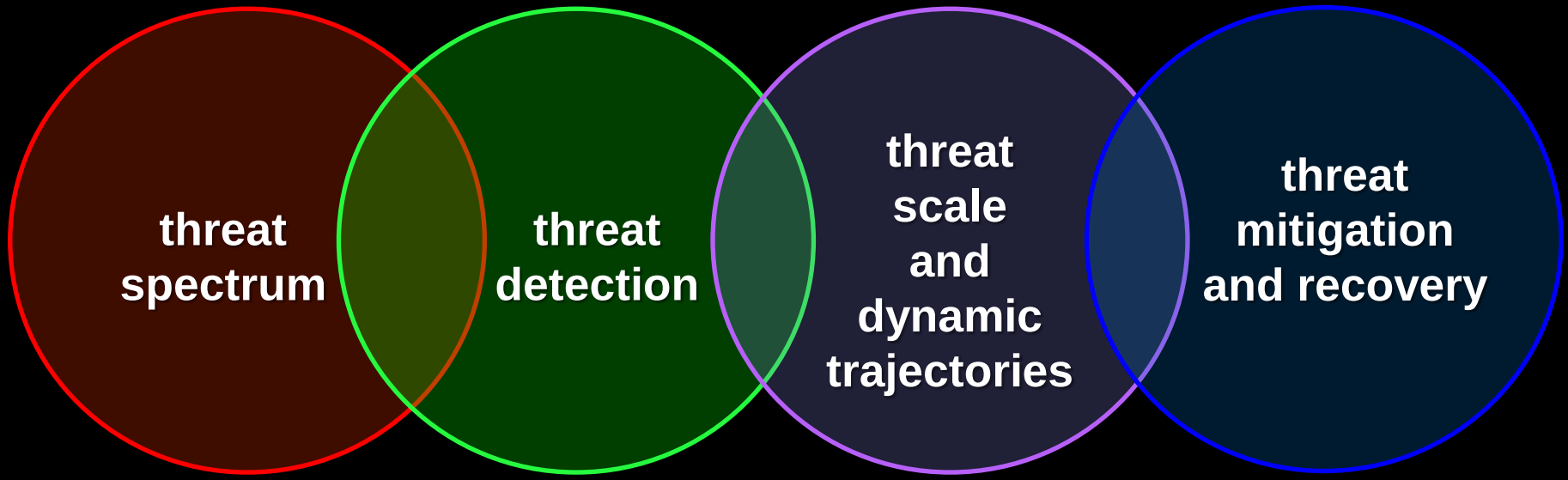
- 700 million cases worldwide with c.7 million deaths
- 111 million US cases and 1.2 million deaths
- US life expectancy declined by 3.8 years
- projected economic losses of $13.8 trillion through 2024
- 25% surge in global prevalence of anxiety and depression
- ‘shadow’ pandemic: adverse consequences of large-scale lockdown
  - delayed medical treatments/screening
  - K-12 education
  - bankruptcy of small businesses

High-level group distills failures, successes of US covid response. CIDRAP. (April 25, 2023). https://www.cidrap.umn.edu/covid-19/high-level-group-distills-failures-successes-us-covid-response

The (False) Comfort and Complacency of the pre-COVID World

- epidemics are something that happens over there!
- unvoiced but persistent belief of American exceptionalism
  - money, resources, sophisticated research capabilities and superior health systems will stop disease in its tracks
  - delusion rudely shattered by COVID-19
- just latest episode in repeated historical cycles of neglect-panic-fund-forget again in preparedness against the threat of infectious/parasitic diseases
- chronic neglect of public health investment in an era of globalization of commerce and transport
- risk warnings long ignored
- rude shocks arrive!!!

Biosecurity: Preparedness, Response, Resiliency & Recovery (PR3) Capabilities



The USG Response to COVID 19

ineptitude

- public health surveillance/detection capabilities

indecision

- uncoordinated silos
- inconsistent messaging
- loss of public trust

interference

- political

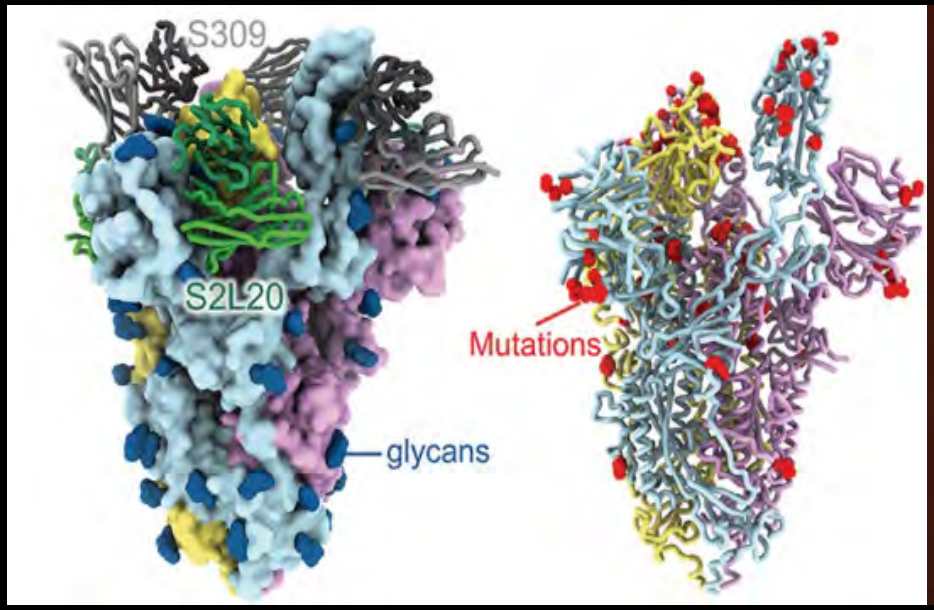
inertia

- future PR3 readiness

PR3 Critical Competencies			
Preparedness	Response	Resiliency	Recovery
F	F		
	F	F	F
	F	F	F
?	?	?	?

*F = failing grade

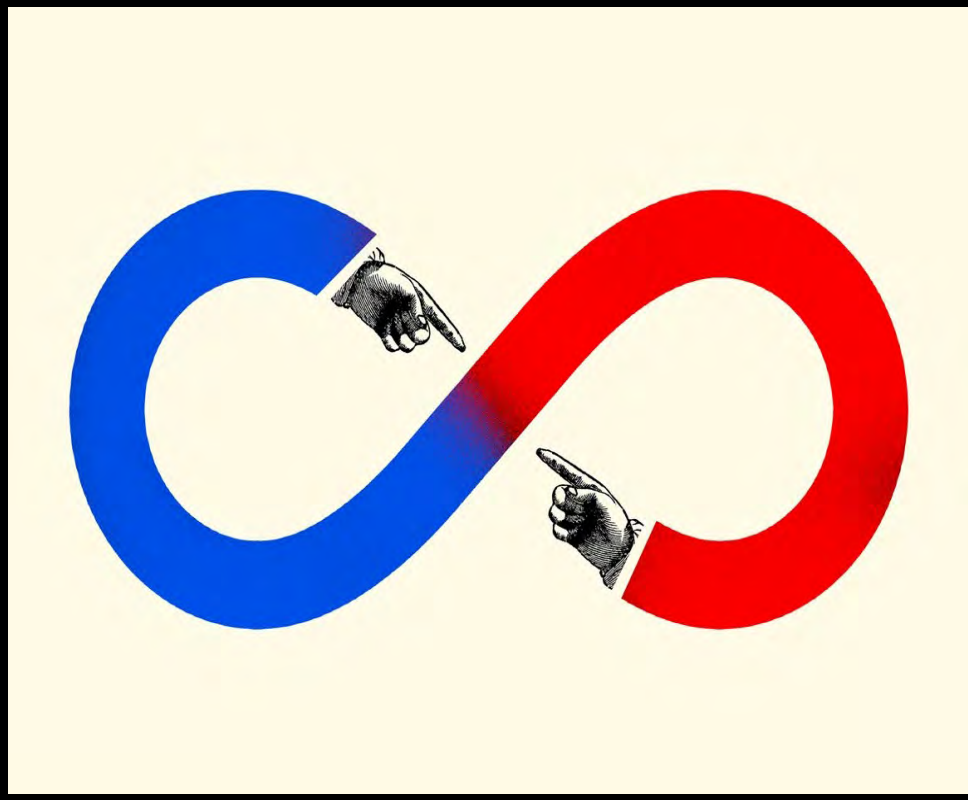
Operation Warp Speed:
The One Great Success in an Otherwise Far From Optimum Management of the COVID-19 Pandemic



*Science***375**,864-868(2022).DOI:10.1126/science.abn8652

Katalin Kariko, Drew Weissman win Nobel in medicine for covid-19 vaccine work. Anadolu Ajansı. (10.2.2023)
https://www.aa.com.tr/en/health/katalin-kariko-drew-weissman-win-nobel-in-medicine-for-covid-19-vaccine-work/3005878

A Critique of the US Response to COVID-19



- mix politics and public health then politics always wins
- technological illiteracy of the legislative and executive branches
- divisive partisan politics
- ever changing messaging
- media sensationalism
- proliferation of disinformation on social media
- public confusion and mistrust

Countering Misinformation/Disinformation in Disasters and Sustaining Public Trust

- COVID-19 revealed major vulnerabilities
- tardy, conflicting and confusing ‘messaging’ by governments
- lack of transparency in decisions regarding major disruptive effects on society
  - economic and social consequences of COVID-19 ‘lockdown’ policies
- increased vaccine hesitancy
  - reduction in herd immunity to multiple non-COVID vaccines
- terminology choice
  - Emergency Use Authorization for Dx/Rx (safety not fully tested?)
  - Operation Warp Speed (cutting corners?)

MATT HANCOCK

PANDEMIC DIARIES

THE INSIDE STORY OF BRITAIN'S BATTLE AGAINST COVID

WITH ISABEL OAKESHOTT

MEMOIR OF A PANDEMIC

*Fighting **COVID** from the Front Lines to the White House*

Brett P. Giroir, MD

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

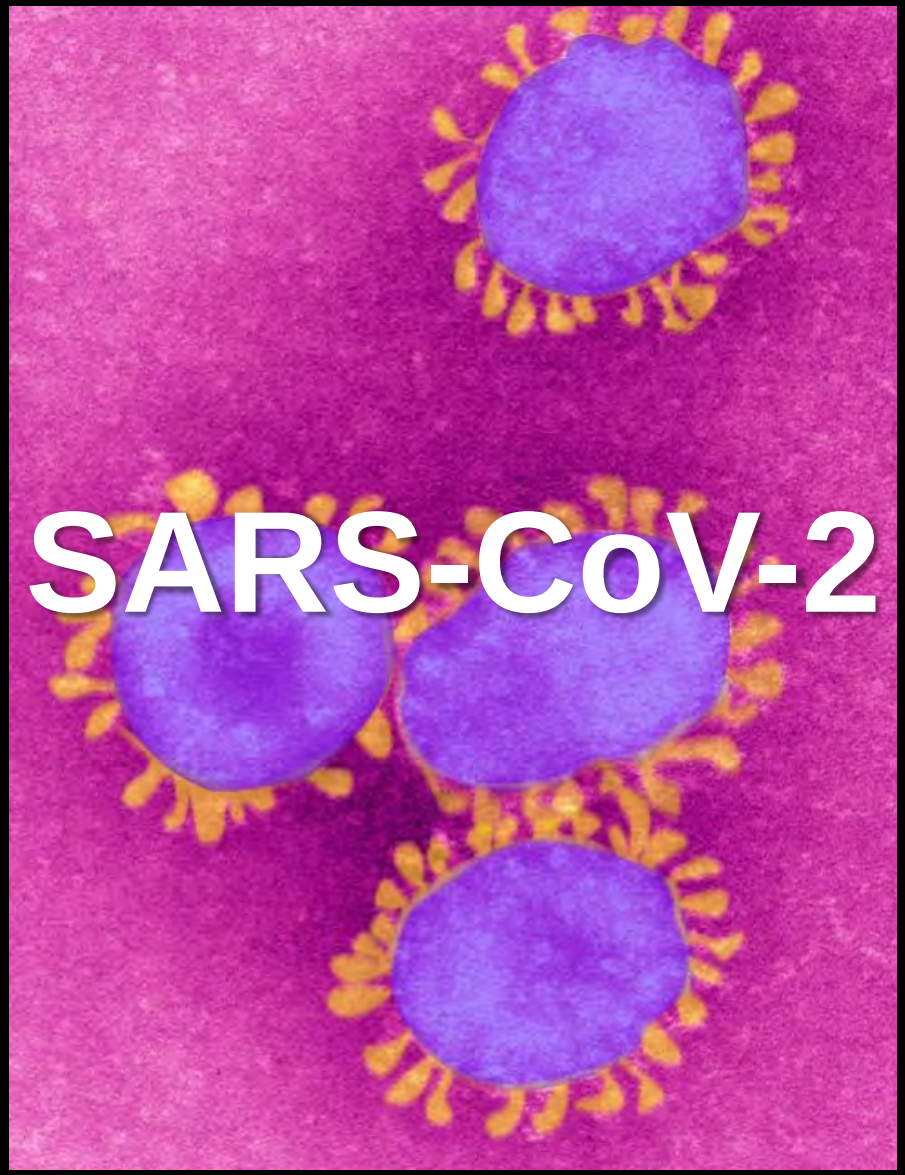
- unchecked dissemination of inaccurate information on social media
- controversy and extremism drives clicks=revenue
- manipulate public opinion, increase socio-political tensions and erode trust in authorities/decisions
- active role of PRC and Russia trolls in COVID-19 pandemic

THE DEADLY RISE OF ANTI-SCIENCE

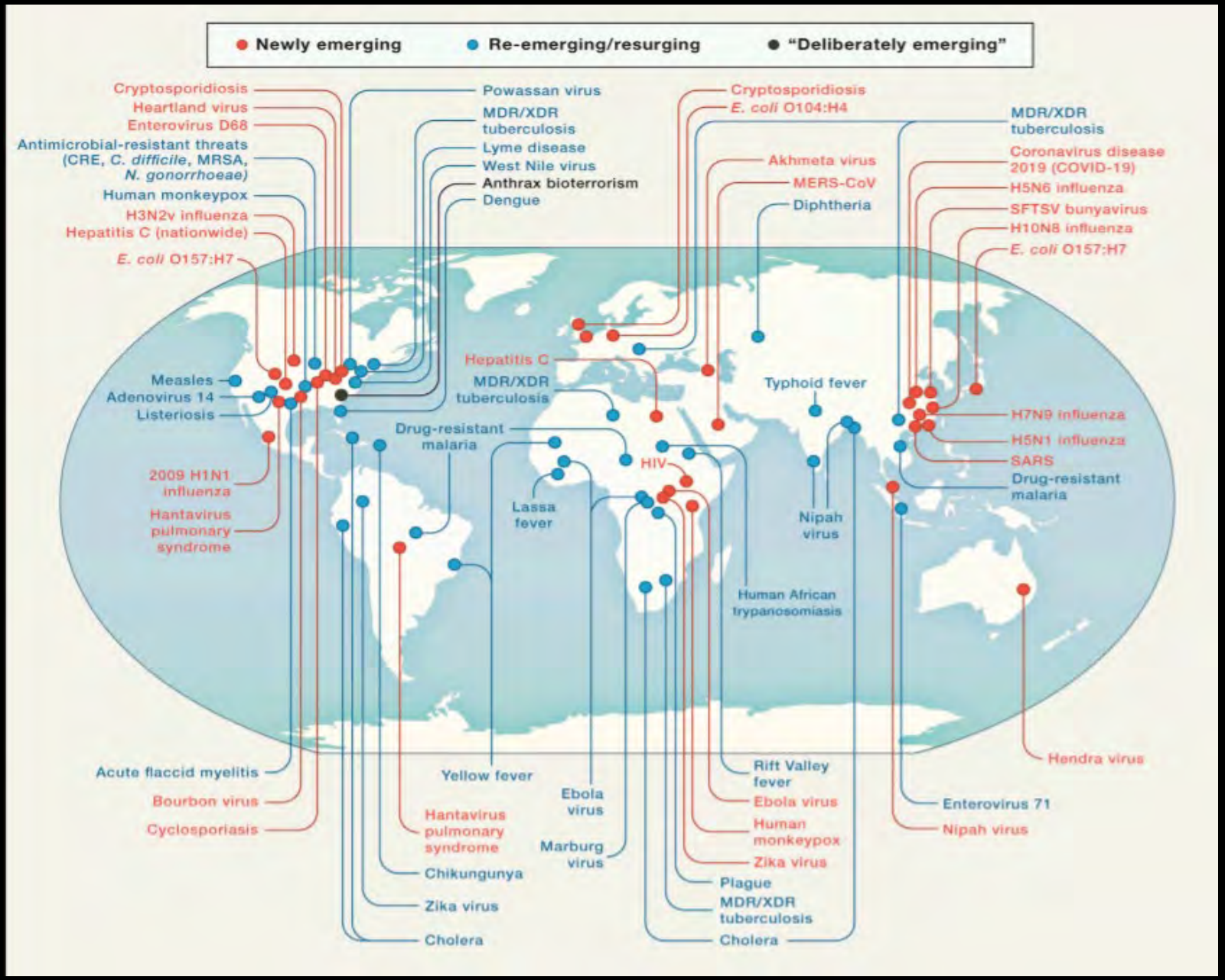
A Scientist's Warning

PETER J. HOTEZ, MD, PhD

Surveillance and Rapid Threat Decision: Comprehensive Global Biosurveillance and Preparedness for Epidemic/Pandemic Threats



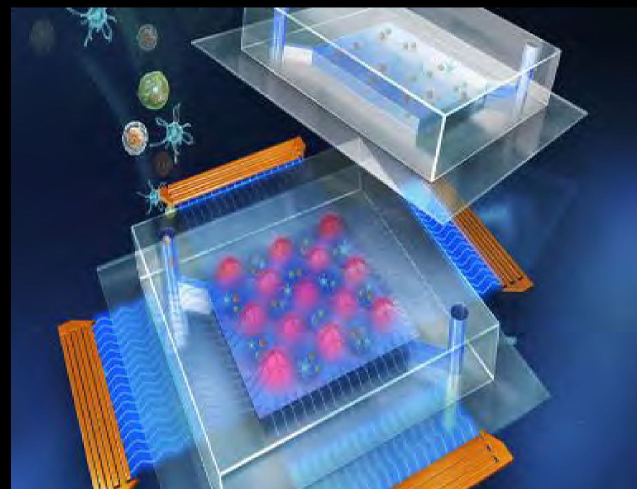
Emerging Infection Diseases (1990-2020)



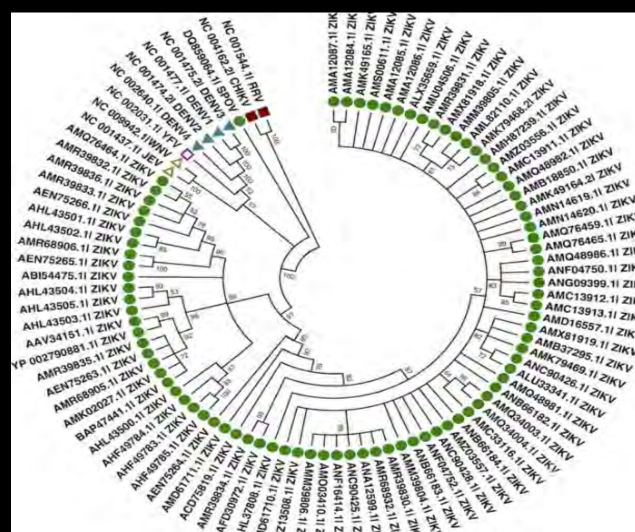
Cell 182, D. Morens, A. Fauci (2020), 1082

The Primacy of Diagnostics and Real-Time Data in Biosurveillance and PR3 Capabilities

Profile: signatures of infectious agents	**Detect:** rapid automated PON/POC diagnostics	**Act:** real-time situation awareness, decisions



surveillance sans frontières



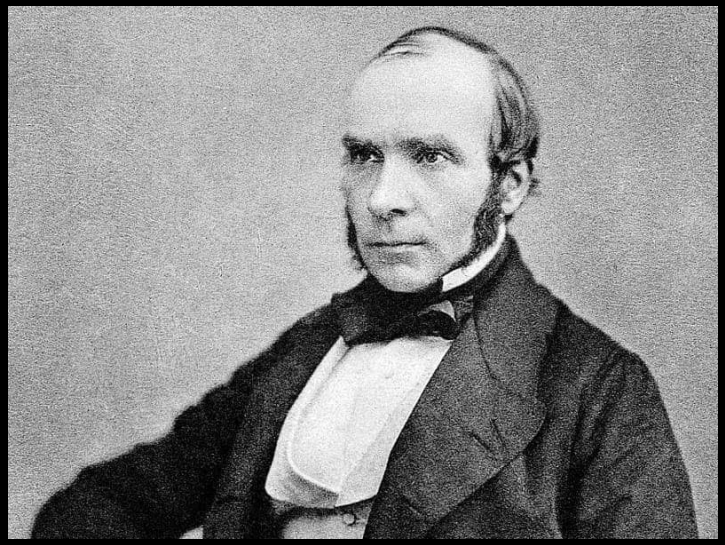
genomics of pathogen evolution

dual-use research and engineered biothreats

New Technologies for Rapid Detection of Biothreats

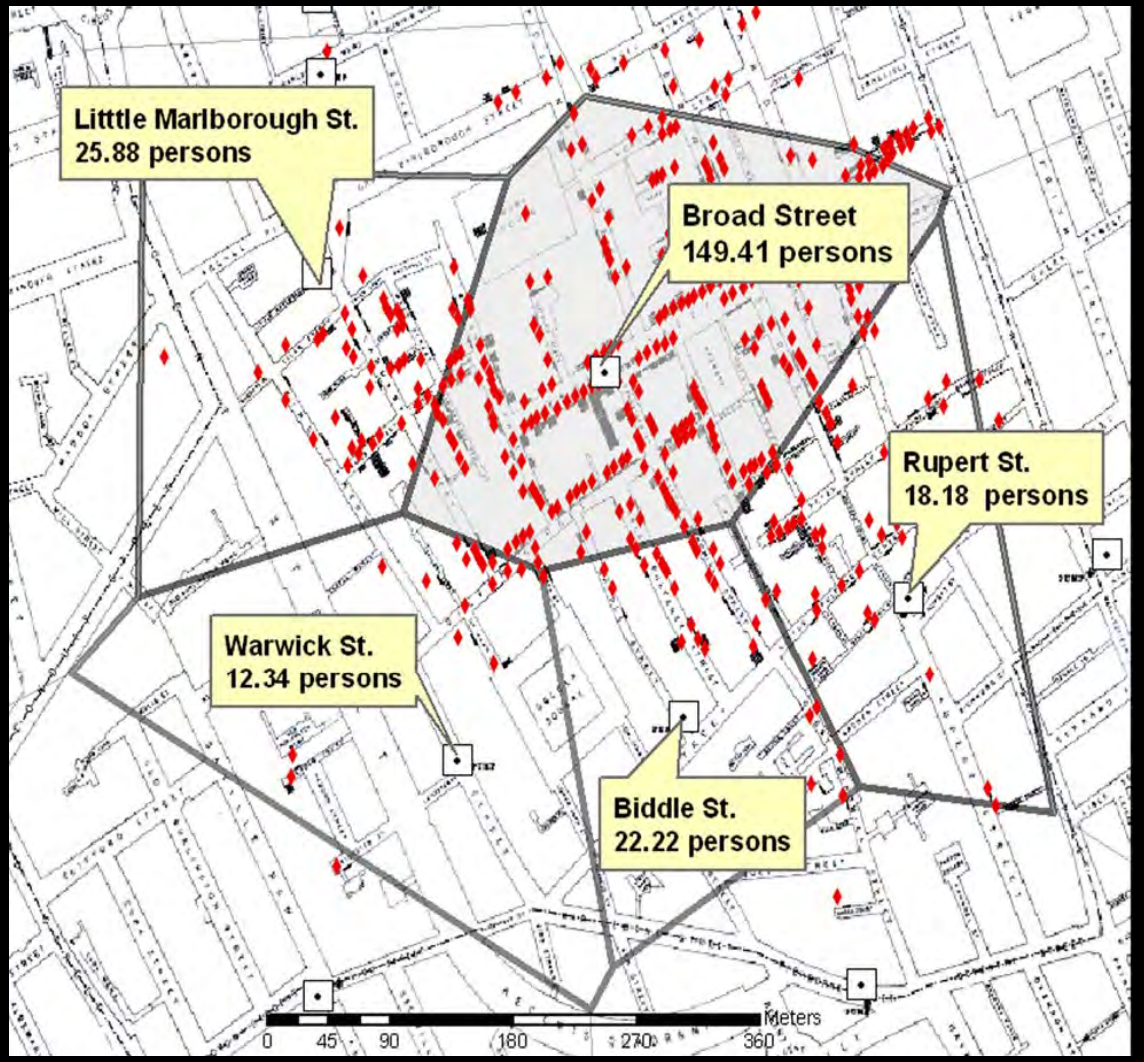
- **waste-water surveillance and pathogen detection**

Data: The Foundation of Epidemiology and Informed Decisions



Dr. John Snow, 1855

- cholera deaths per 1,000 population



Flying Blind: The Dangerous Void Created by Lack of Comprehensive Diagnostic Infrastructure for Pathogen Detection

- CDC ineptitude and massive gaps in real-time spatio-temporal epidemiological data in early stages of COVID-19 pandemic
  - lack of diagnostic tests to map infection prevalence and spread
  - underappreciation of major fraction of asymptomatic infections

- negative impact on accuracy of computational forecast modeling of pandemic trajectory
  - influential in national policy decisions
  - ‘lock downs’, school/work closures, travel bans, unemployment

Biosecurity and BIOINT:
Capture of Threat-Agnostic Multi-Modal Data Classes

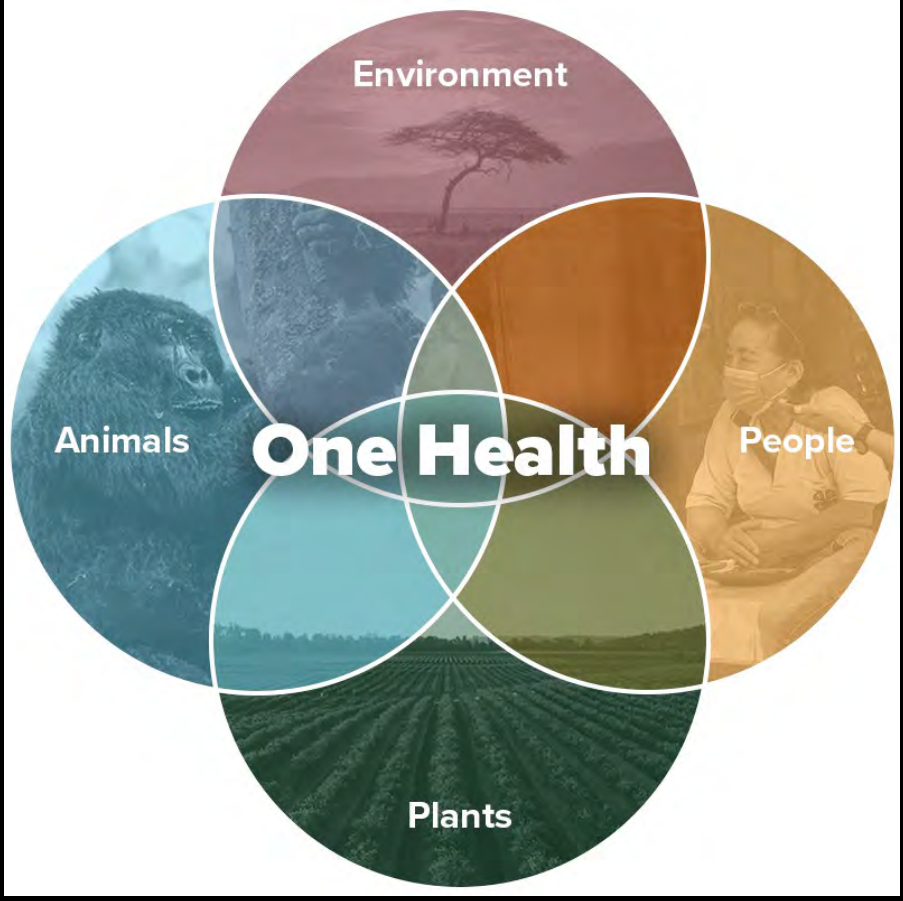
- global to local
- threat tracking (known, suspected, theoretical)
- population demographics
- public health, syndromic surveillance
- geospatial (environmental, meteorological, ecological)
- travel and trade patterns
- social media and behavioral patterns

Biosecurity and BIOINT:
Capture of Threat-Agnostic Multi-Modal Data Classes

- supply chain logistics, purchasing and export patterns
- analysis of open literature and IP filings
- sources of disinformation/misinformation
- espionage (national, industrial) for exfiltration of data and/or physical samples
- monitor “individuals/institution of interest” and interaction patterns
- need for expanded intelligence community (IC) capabilities in BIOINT

One Health and Global Biosecurity

- an integrated, systems-based approach to optimize the health of people, animals and plants, maintaining crucial food chains and sustainable environmental ecosystems



One Health cooperation key to controlling emerging infectious diseases

60% of emerging infectious diseases in humans are zoonotic, the *majority* of these have wildlife origins.

Ebola viruses have caused outbreaks in people, notably in the Central Africa region.

SARS
Thought to come from bats, the virus was first reported in China.

Zika
Zika hit the headlines in 2016 when a massive outbreak struck South and Central America and the Caribbean, causing congenital birth defects.

Middle East Respiratory Syndrome
First identified in 2012, the majority of human cases have been reported in Saudi Arabia.

Emerging infectious diseases can often be linked to poorly regulated wildlife trade, and hotspots are concentrated in tropical regions where wildlife biodiversity is high and land-use change is occurring.

Five actions recommended:

- Build effective collaboration between animal and human health sectors.
- Improve surveillance for early detection of disease threats in humans.
- Strengthen laboratory diagnostic capacities for novel pathogens.
- Improve disease case management and infection control.
- Develop epidemic preparedness and early response capacities for emerging zoonoses.

Health for Animals
global animal health association

‘One Health’ Global Biosurveillance: The Front Line in Preparedness

- range and physical contact
- environmental factors

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

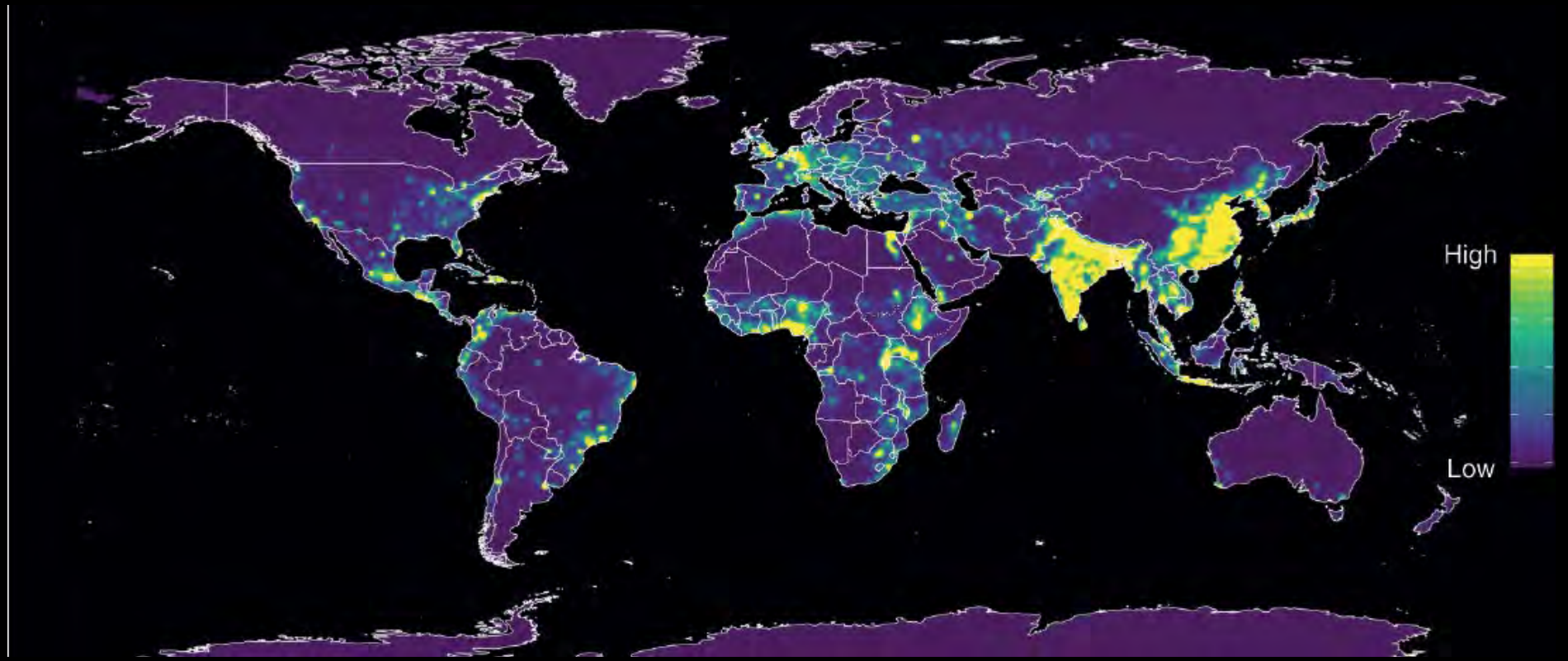
Adapted from: R. A. Medina (2018) Nature Rev. Microbiol. 16, 61

RNA Viruses as Major EID Threats

- 45-50% of EIDs
- error-prone replication cycles
- faster evolutionary rates and emergence of variants
  - higher risk of ‘species-jump’
  - immune evasion mutations
  - altered tissue tropism
- genetic reassortment between avian, mammalian and human viruses

Global Hotspot Map of Projected Wildlife Zoonotic Risk Emergence

T. Allen et. al. (2017) Nature Comm. 8, 017-00923-8

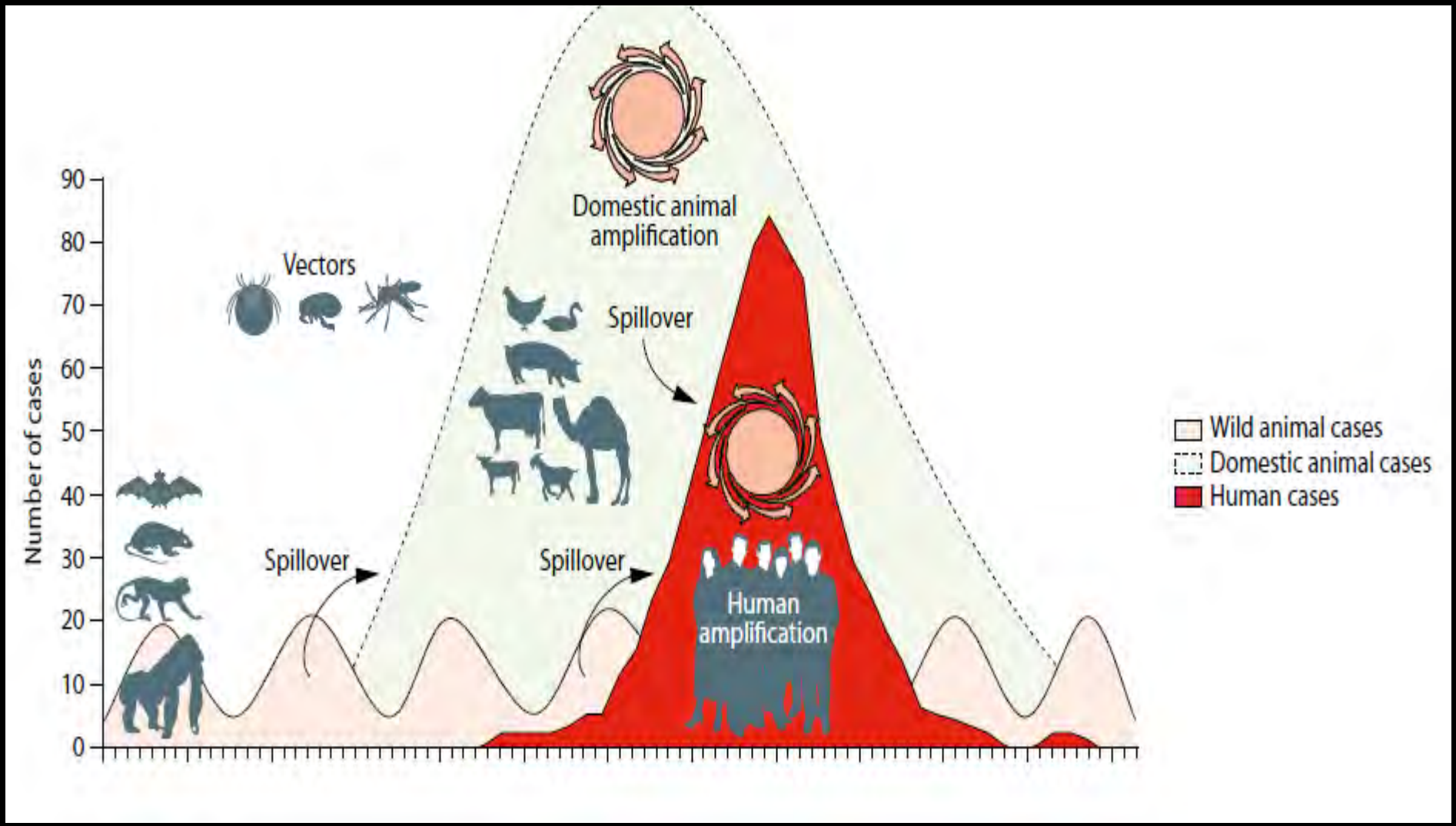


- tropical forested regions
- mammal species richness
- human population density
- altered land use and increased wildlife and domesticated livestock-human interactions

Proactive Large Scale Biosurveillance (BSV) for EID Pathogen Prevalence and Spillover Risk

- obvious logic but financial, technical, logistical and political barriers to implementation at scale
- many predicted zoonotic spillover ‘hot spots’ are located in LICs
  - limited technical infrastructure/workforce
  - access to remote locations and conflict zones
  - political fragility and varied levels of government cooperation from governments/local populations
  - local concern over potential adverse economic input if viewed as a ‘hot spot’ (trade, tourism)

Dynamics of Cross-Species Zoonotic Pathogen Risk Spillover



W. Karesh et. al. (2012) Lancet 380, 1942

Changing Food Production Systems and Infectious Disease Risks in Low-and Middle-Income Countries (LMICs)

- population growth, urbanization and consumer demand for meat-based diets
- intensification of livestock production
  - shift from rural smallholder to large periurban concentrated animal feed operations (CAFOs)
  - changing land use and increased zoonotic risks
  - AMR and antibiotic use
- investment in dams and irrigation systems and altered patterns of vector-borne and water-borne diseases

Habitat Destruction for Expansion of Urban Food Supply Chains

Concentrated Animal Feeding Operations (CAFOs)

Science 380, 6640 Apr 2023

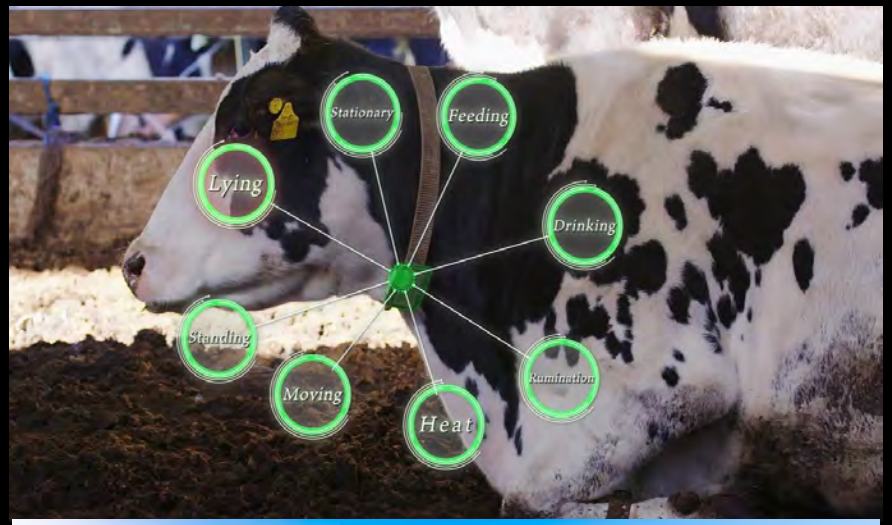
February 2020. Photo: Feature China/Barcroft Media via Getty Images

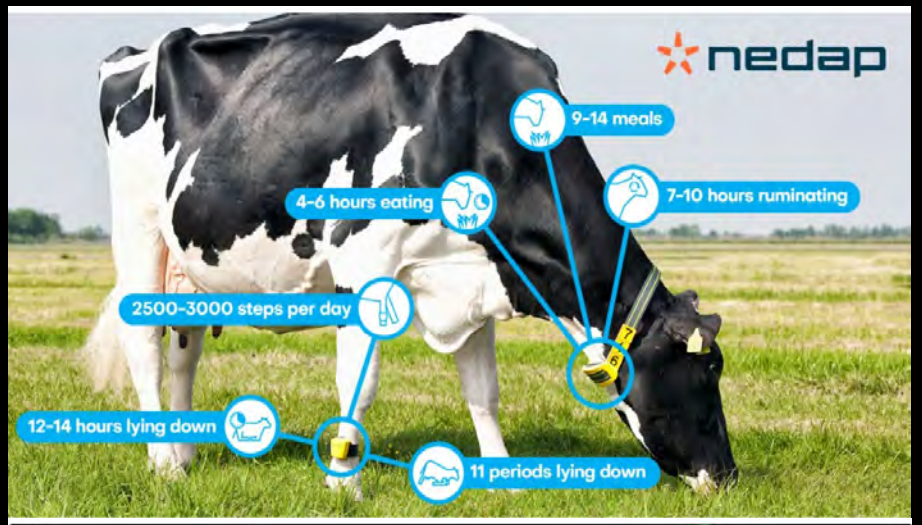
Aggressive Actions to Contain Highly Pathogenic Avian Influenza as Potential Human Pandemic Agent

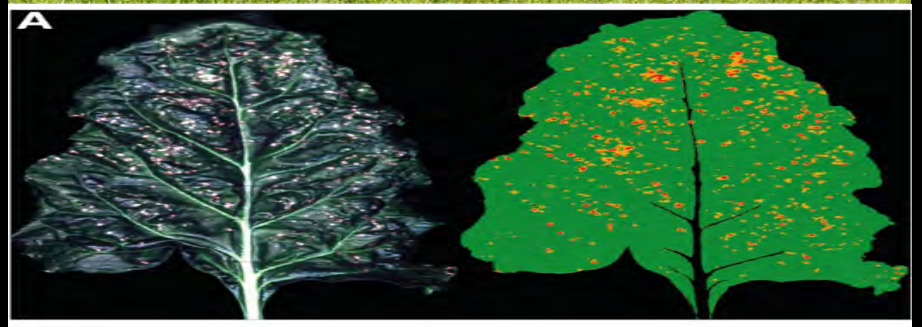


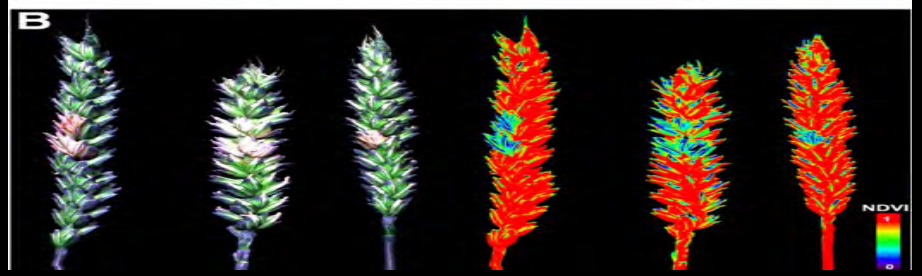



Rapid Growth of Commercial Markets for Digital Diagnostics and Remote Monitoring Systems for Livestock and Crops









Urbanization and Mega-Cities in LMICs and the Increased Threat of Zoonotic EIDs

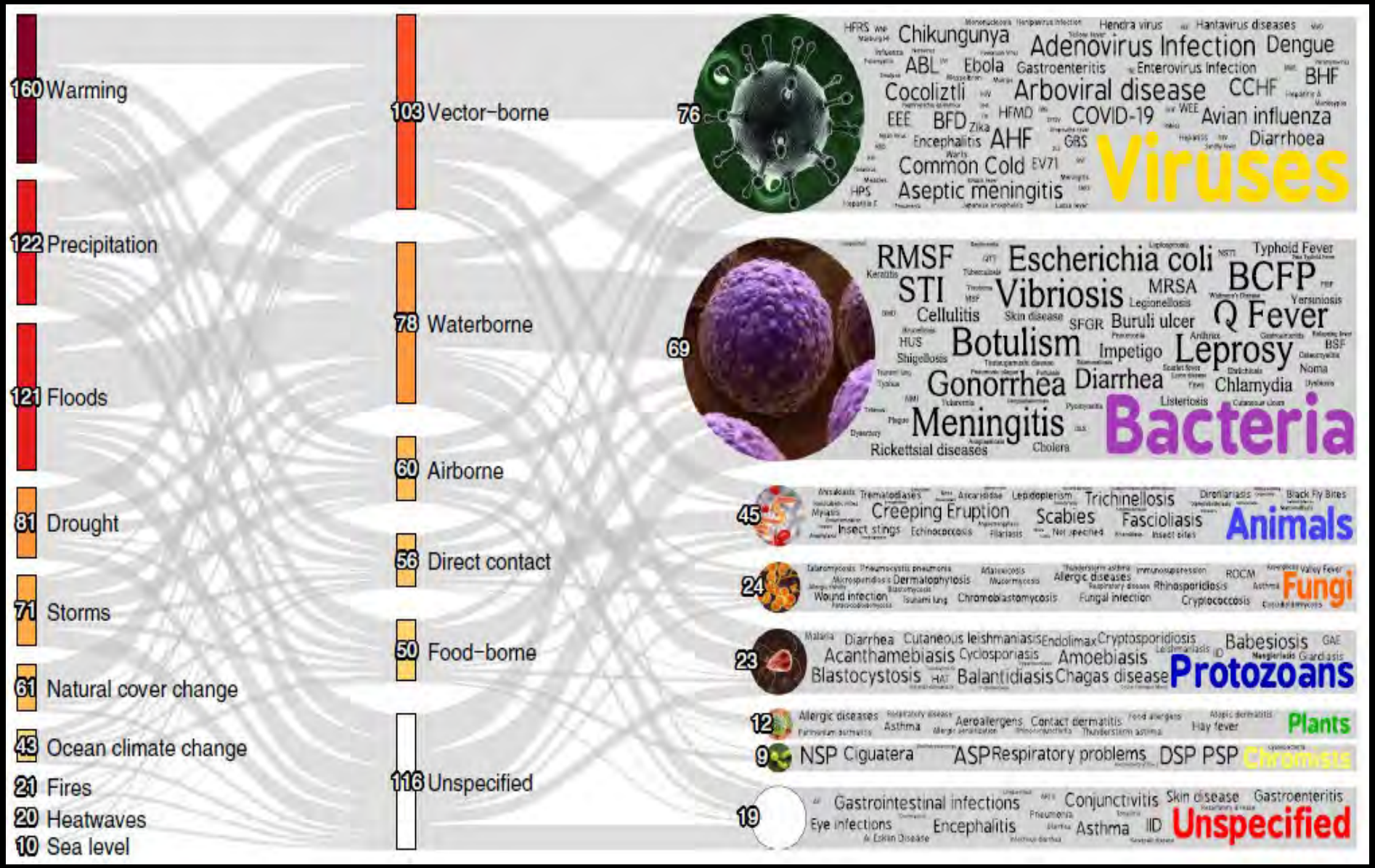
High Population Density With Inadequate Biosurveillance

Expanded Eco-niches and New Zoonotic Exposures/Risks

Major Gaps in Health Infrastructure and Rapid Disease Reporting

Increased Extreme Weather Events and Health Risks

Over Half of Known Human Pathogenic Diseases Can Be Aggravated By Climate Change



C. Mora et. Al. (2022) Nature Clim. Chan. 12, 869

Increased Ocean Temperatures and Algae Blooms: Proliferation of Virulent Microorganisms and Microbial Toxins

Economic and Health Risks from Extreme Weather Events (2022)

Monsoon Floods, Pakistan

Floods, Nigeria

Hurricane Ian, Florida

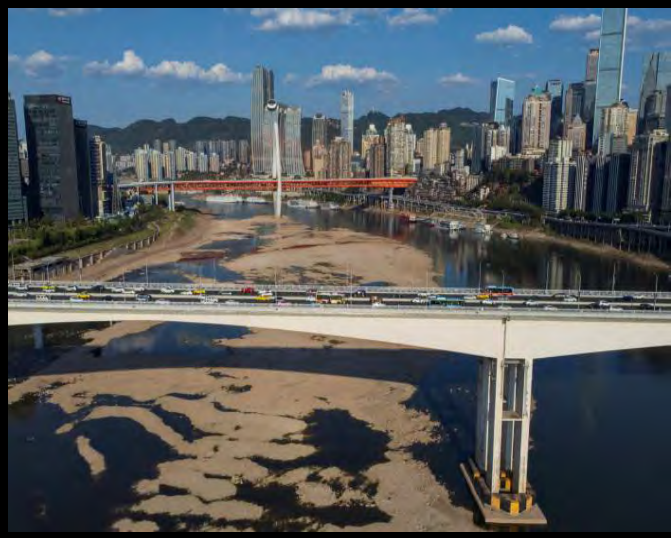
Wildfires (Global)

Economic and Health Risks from Extreme Weather Events:

Drought

Rhine River, Germany

Mississippi River, USA



Jialing River, PRC

Gode, Ethopia

South Sudan

Somalia

THE WORLD BANK

Urbanization and Disaster Vulnerabilities: World Bank 6 Oct. 2022

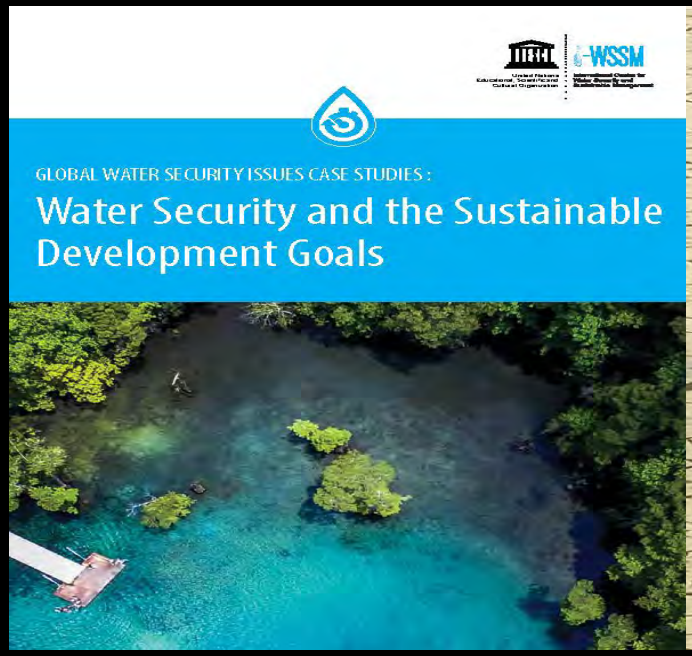
- 76,400 km^2 of new urbanized land added since 1985 in locations with inundation depths of over 0.5 meters in severe floods
- 1.81 billion (1 in 4 people) live in high-risk flood zones

IOM UN MIGRATION

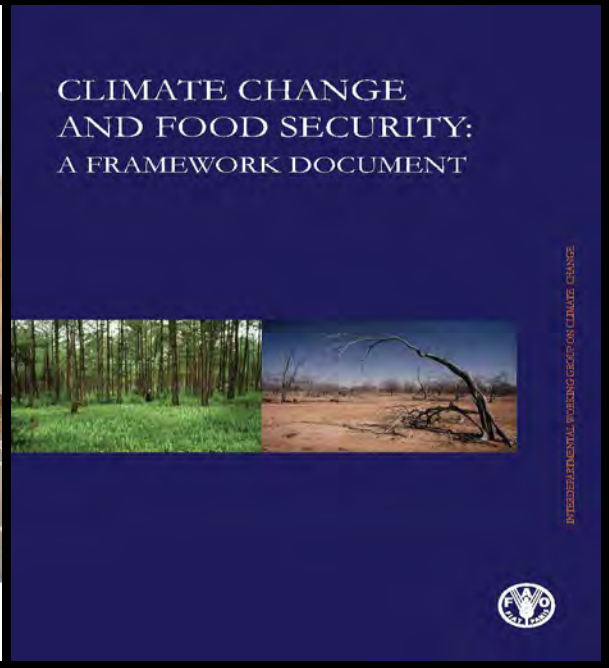
Climate Change and Population Migration:

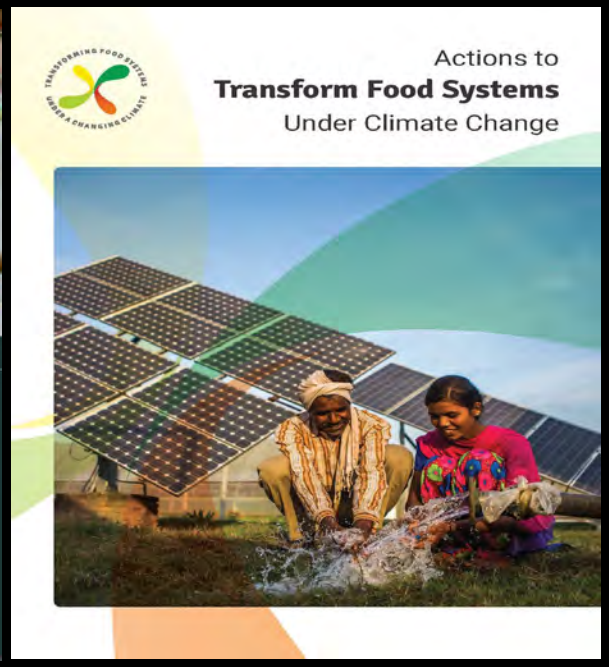
- projected $1.5 billion environmental migrants by 2050
- one billion Indians and 500 million Chinese at risk of displacement
- “belts of habitability”
  - migration, borders, sovereignty, tension, conflict

Water Security

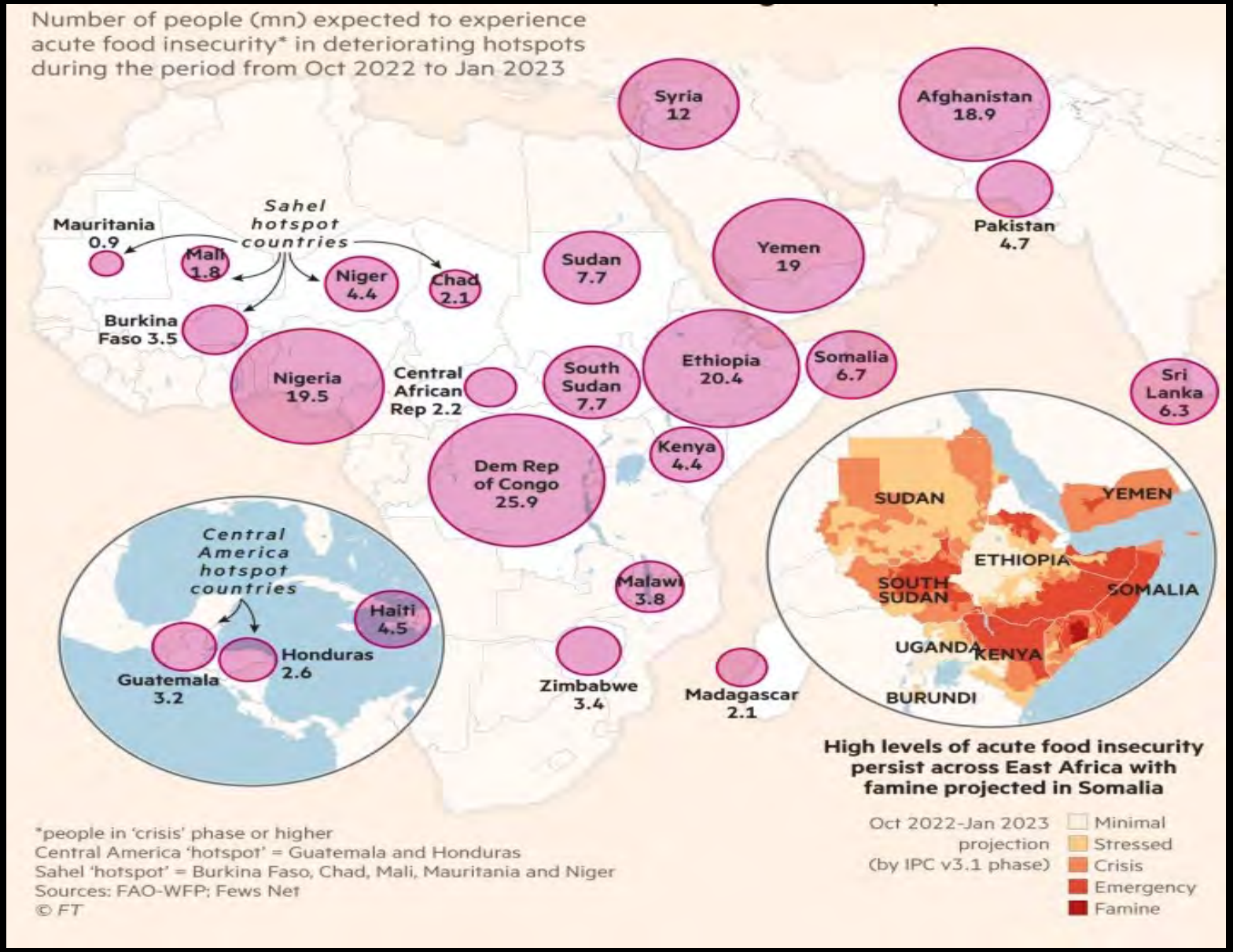


Global Food Security





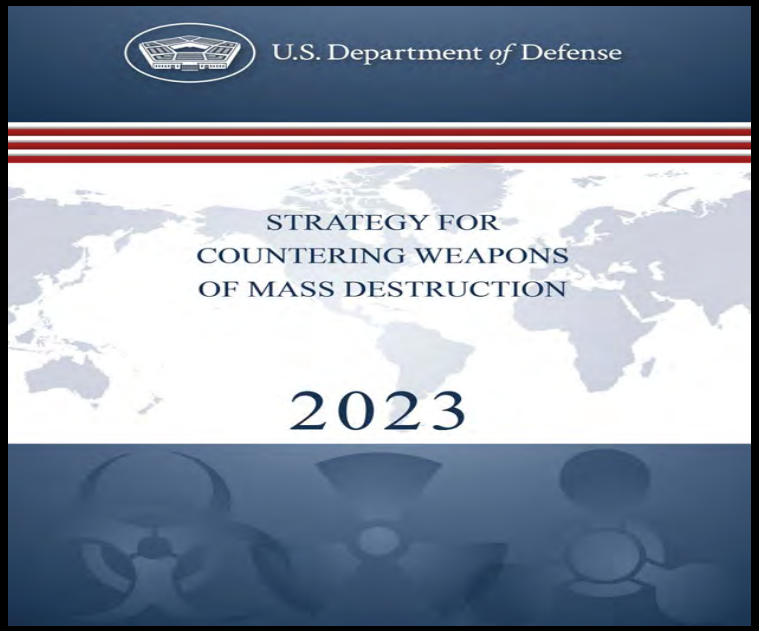
Conflict and Weather Extremes Drive Acute Hunger in ‘Hotspot’ Countries

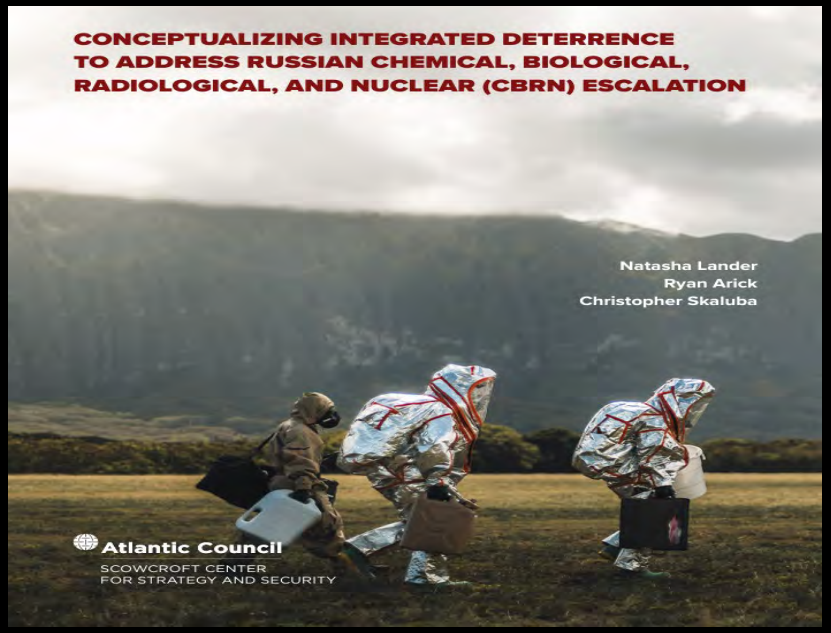


https://www.ft.com/content/2f518a3e-6dce-4ee3-81ec-ebb2bf2580c5

Increased Refugee Migration from Conflict Zones: Humanitarian Disasters and Increased Infectious Disease Events

International Cooperation in Countering the Proliferation of Weapons of Mass Destruction





Dual-Use Risks from New Technologies

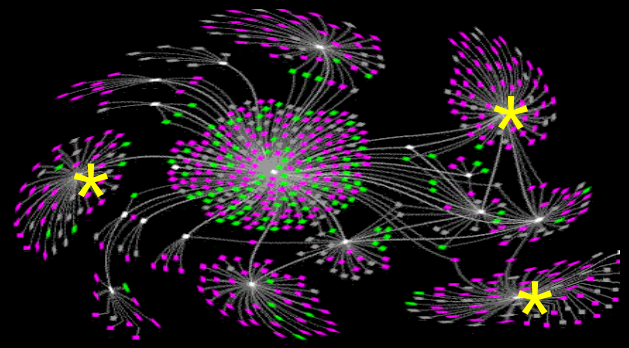
https://www.economist.com/culture/2023/09/09/how-fear-has-shaped-human-affairs

The Proliferation of Dual-Use Risks from the Intersection of Biotechnology, Synthetic Biology and AI

digital biology:
“it from bits”

de novo
synthesis of organisms

engineered
virulence



华大基因学院
BGI college
华大基因研究院
BGI research

targeted modification of any biological pathway in any organ

modulation of neural sensory and cognitive pathways

rapid global technology diffusion and competition

Dual-Use Technologies: Danger of Ignoring How “Low Tech” Can be Combined with “High Tech”

STANFORD UNIVERSITY

THE STANFORD EMERGING TECHNOLOGY REVIEW 2023

A Report on Ten Key Technologies and Their Policy Implications

CHAIRED BY Condoleezza Rice, John B. Taylor, Jennifer Widom, and Amy Zegart
DIRECTED BY Herbert S. Lin

2023

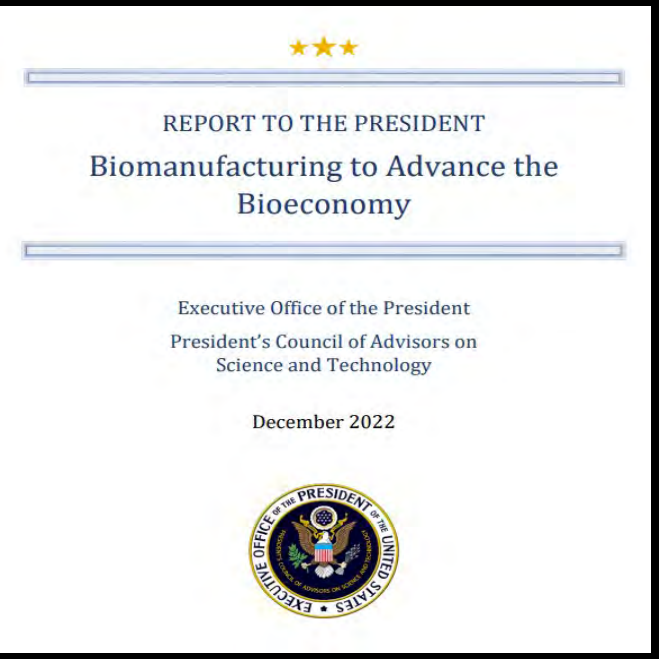
Emerging technologies and scientific innovations:

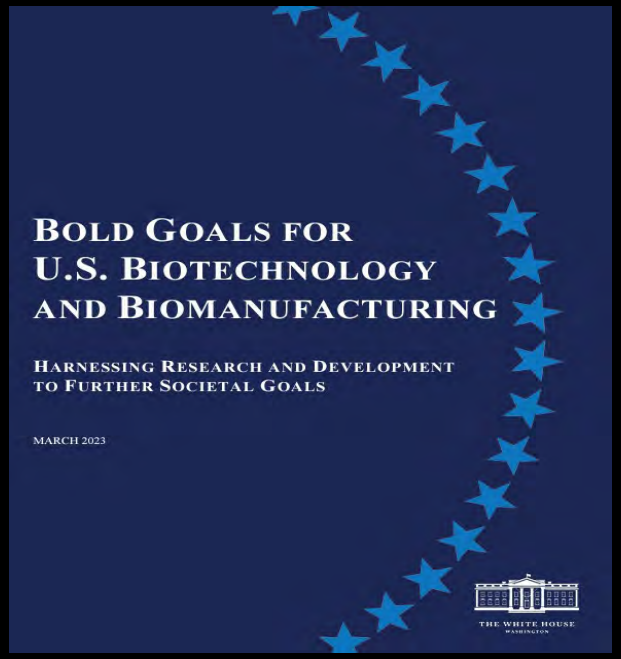
A global public health perspective

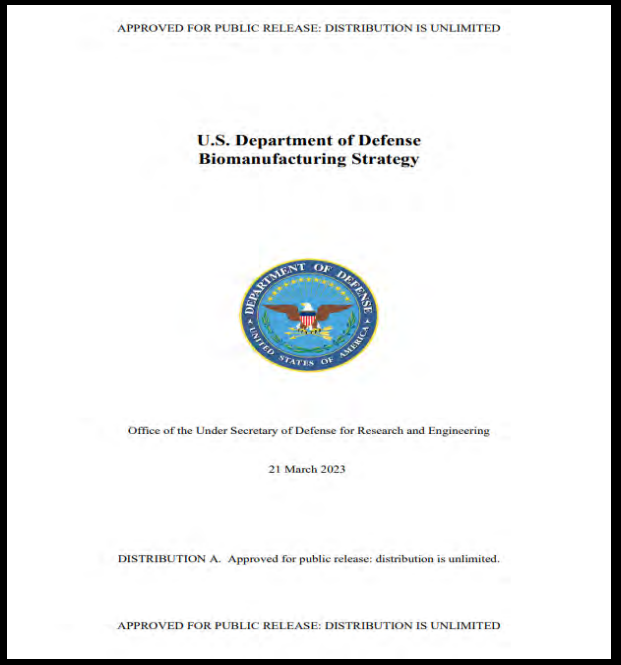
WHO global health foresight series

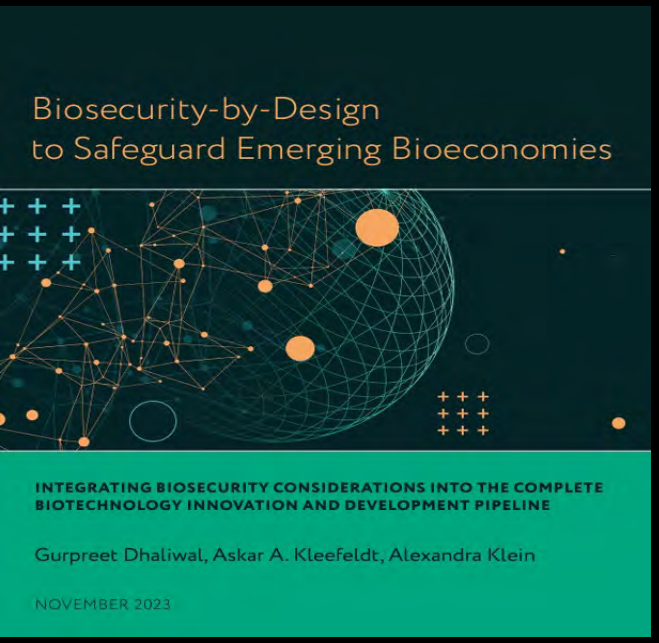
World Health Organization

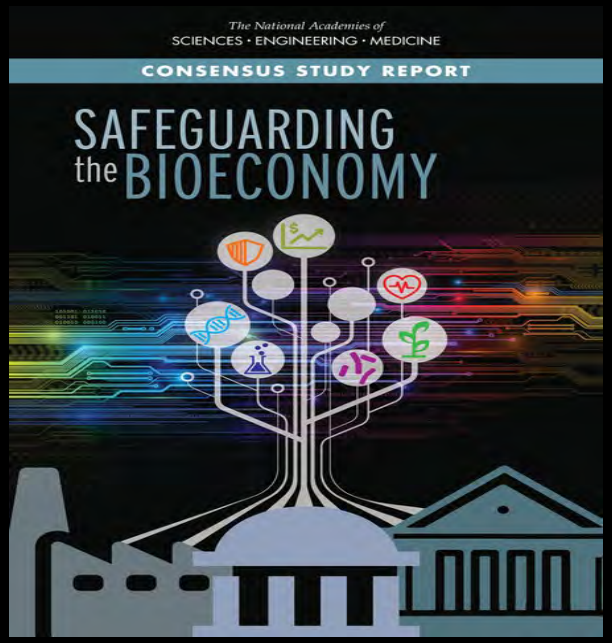
Biosecurity and the Bioeconomy: National Competitiveness in Global Markets for Biology-Based Industries

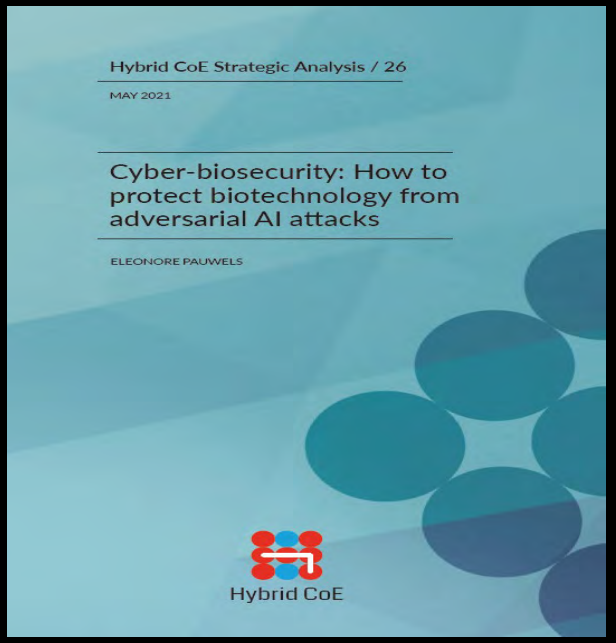








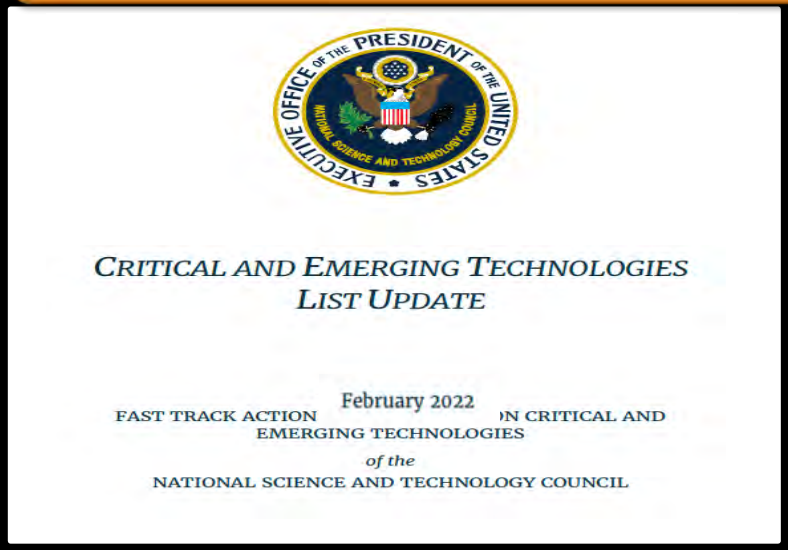




Export Controls and Counter-Espionage Defenses for Advanced Technologies

BGI and CFIUS Disinvestment in US Genome Companies

USG Controls for Critical Technologies



EXECUTIVE OFFICE OF THE PRESIDENT OF THE UNITED STATES
NATIONAL SCIENCE AND TECHNOLOGY COUNCIL

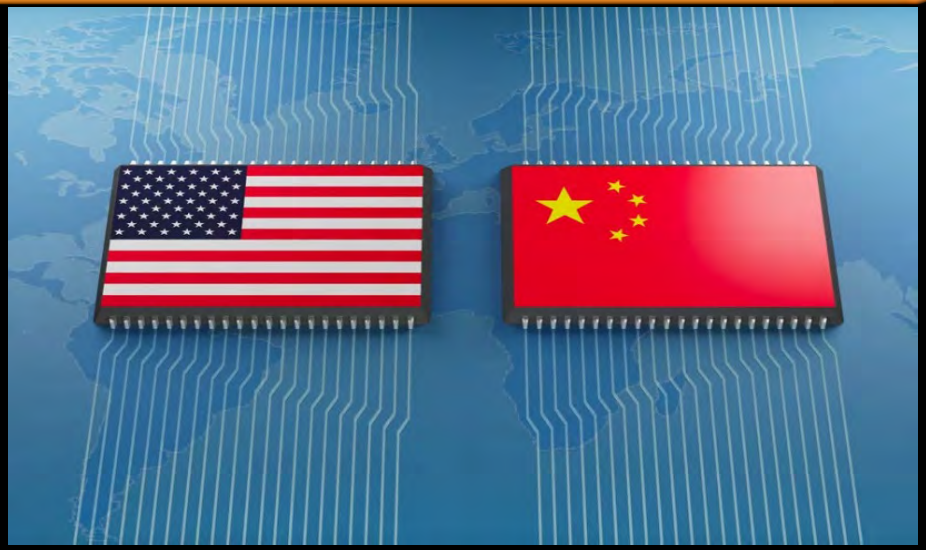
CRITICAL AND EMERGING TECHNOLOGIES LIST UPDATE

February 2022

FAST TRACK ACTION ON CRITICAL AND EMERGING TECHNOLOGIES

of the

NATIONAL SCIENCE AND TECHNOLOGY COUNCIL



Dual Use Research of Concern (DURC)

Biosafety

The Origin of SARS-CoV-2:
Natural Zoonose or PRC Wuhan BSL-4 Laboratory GOF Studies and Inadvertent Biocontainment Breach?

EcoHealth Alliance

An Analysis of the Origins of the COVID-19 Pandemic

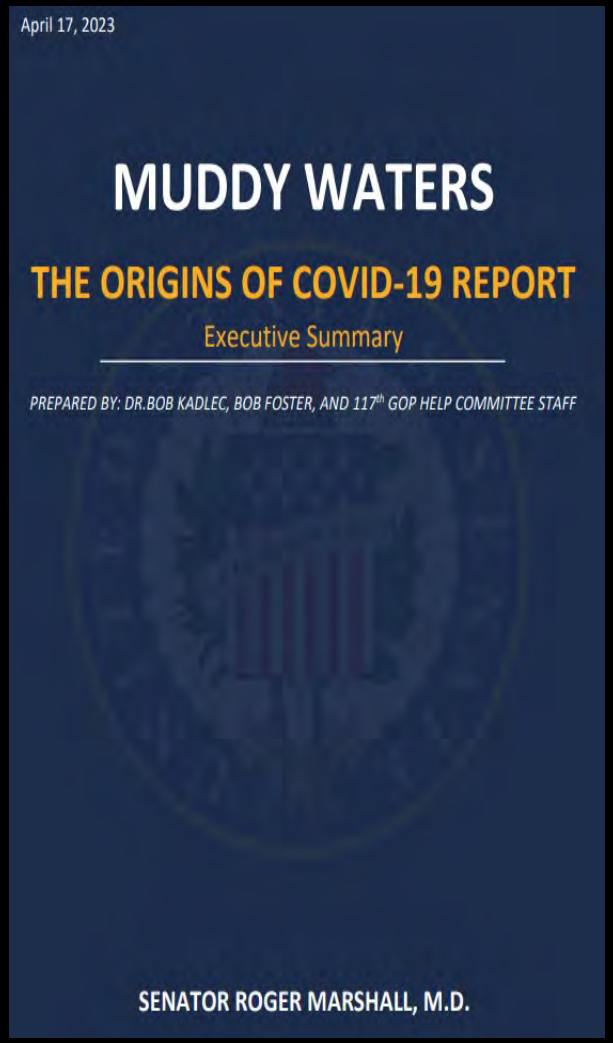
Interim Report

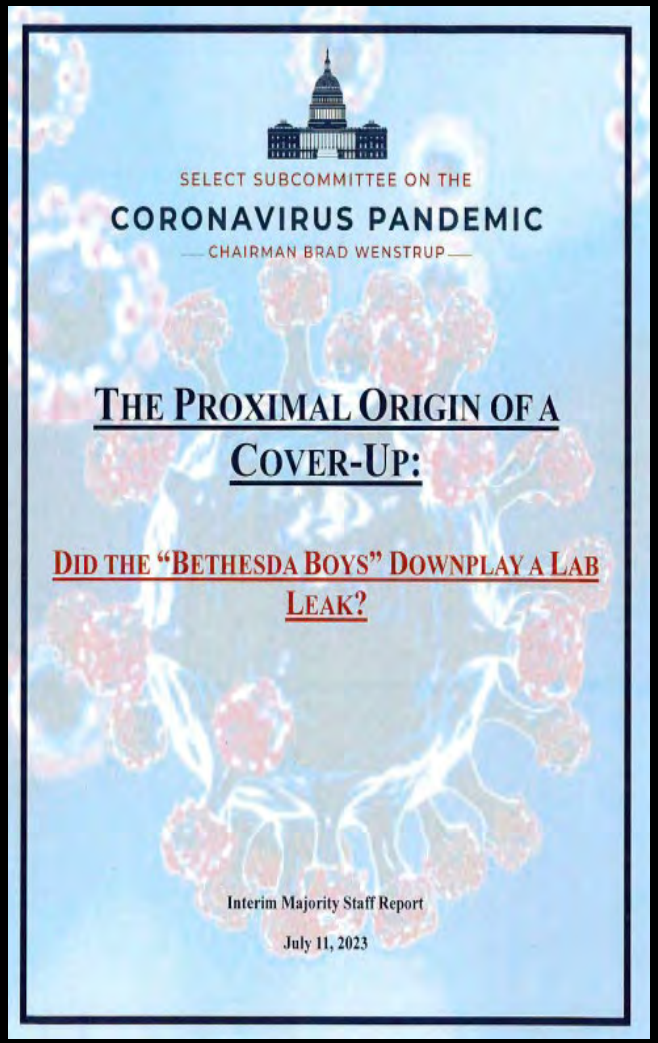
Senate Committee on Health Education, Labor and Pensions

Minority Oversight Staff

October 2022

The Contested Origins of COVID-19

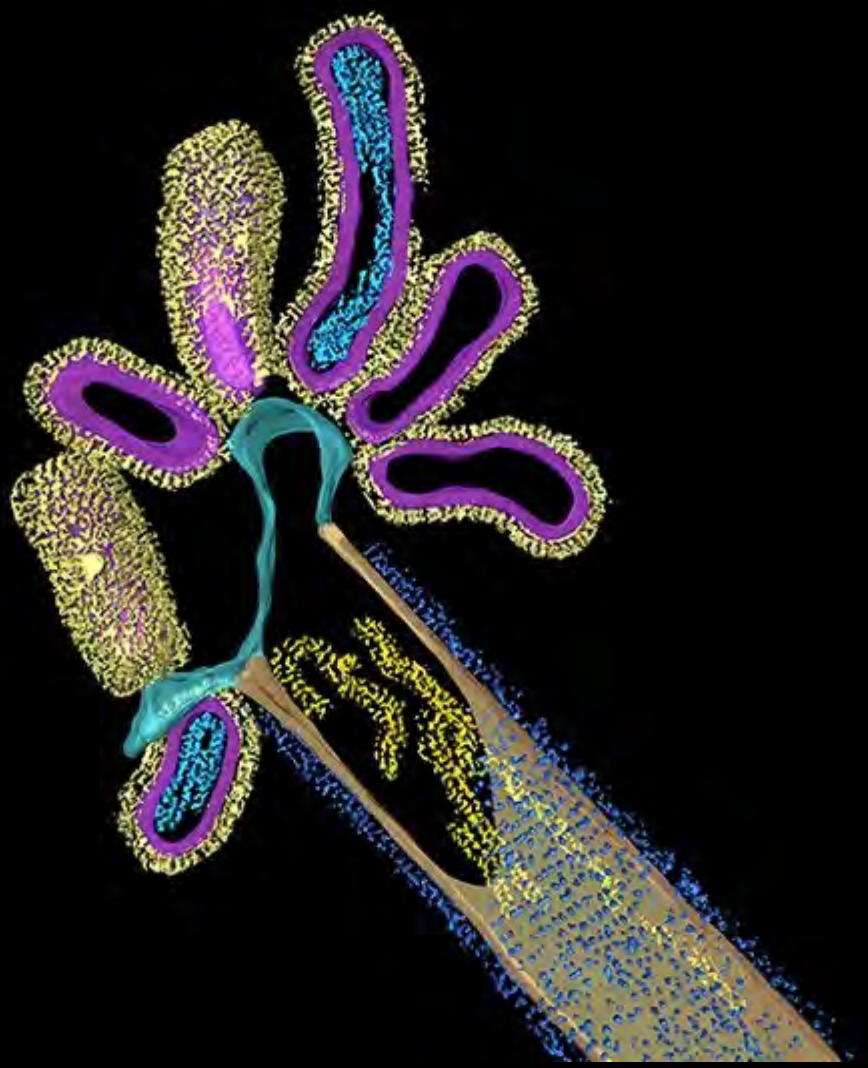




Gain-of-Function (GOF) Research on Modification of Microbial Pathogens

- value of responsible GOF research in providing insight into potential future evolutionary pathways for pathogens
  - inform proactive development of Dx/vaccines/MCMs
- US legislative actions to tighten oversight of GOF research based on perception that PRC coronavirus GOF research created SARS-CoV-2
  - Federal-funded research only or broader controls to include industry?
  - complete ban or strengthened oversight and regulation?
- low probability of harmonization of international standards without robust transparency and enforced inspection (trust but verify)

A hybrid viral particle generated during coinfection by influenza A virus and respiratory syncytial virus



J. Haney et al. Nature Microbiol. 7, 1879–1890 (2022)

Bulletin of the Atomic Scientists

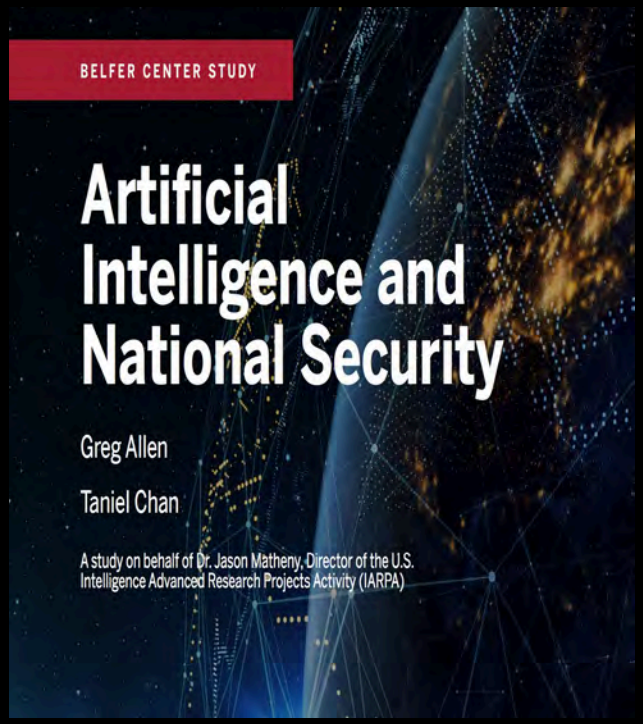
Researchers hacked a lab's pathogen containment system. Was it a good idea to publish the results?

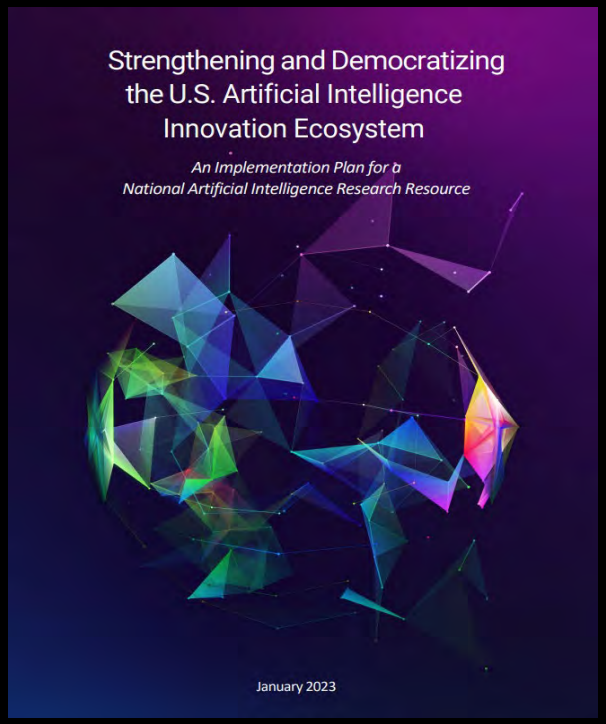
Poste, G. and Gillum, D. (2023, January 19).
Bulletin of the Atomic Scientists

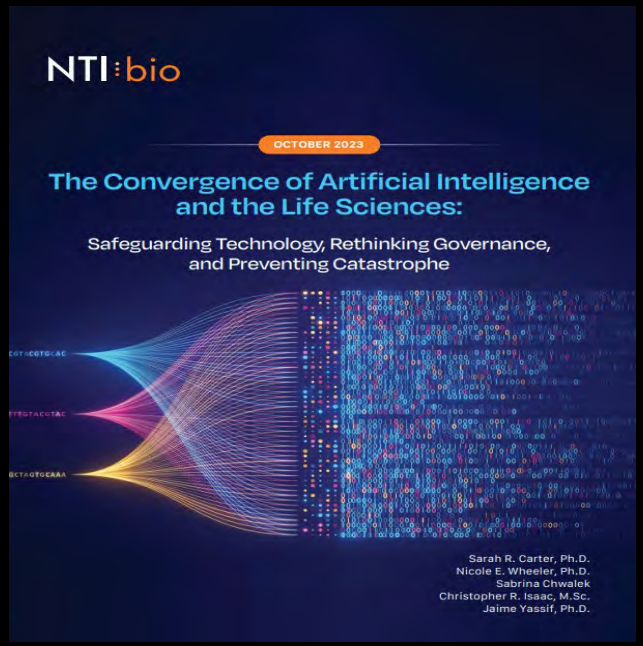
M.A. Faruque and PH.D. Students Y. Achamyeleh and A. Barua
University of California, Irvine, 17 November 22

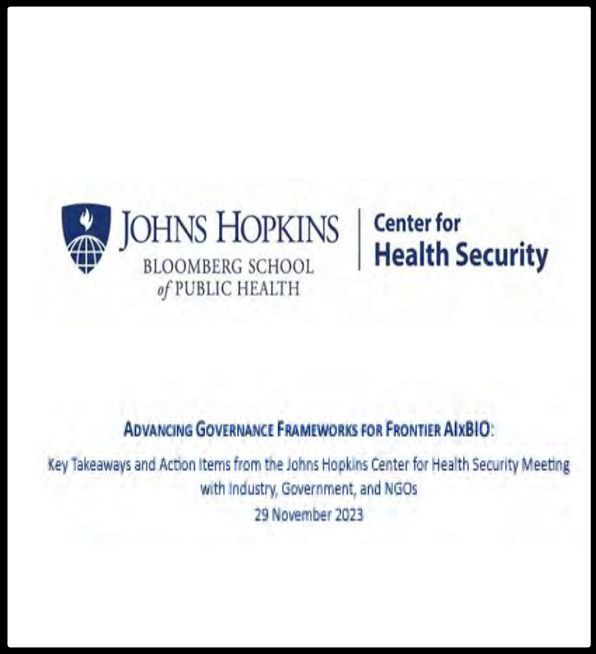
Global Expansion of High Biosafety Level (BSL-3/4) Laboratories

- COVID-19 pandemic highlighted gaps in preparedness resources for handling high risk pathogens
  - conventional public health (BSL-3)
  - expanded capabilities for translational research (Rx, vaccines)
- plans announced to build 27 new BSL-4 facilities
  - Russia (15), PRC (4), India (4), Kazakhstan, Singapore, Philippines, US (1)
- long lead times for construction and certification
- high operational costs ($15-20 million/year)
  - maintenance, air handling, security
- staff training and (re)certification in stringent-biohazard containment protocols to limit risk of biosecurity breach


BELFER CENTER STUDY
Artificial Intelligence and National Security
Greg Allen
Taniel Chan
A study on behalf of Dr. Jason Matheny, Director of the U.S. Intelligence Advanced Research Projects Activity (IARPA)

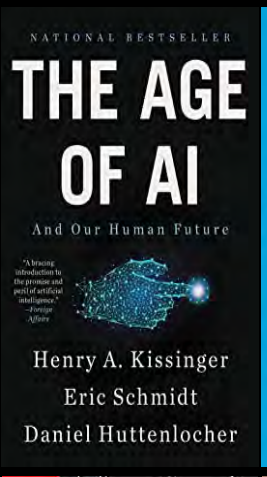

Strengthening and Democratizing the U.S. Artificial Intelligence Innovation Ecosystem
An Implementation Plan for a National Artificial Intelligence Research Resource
January 2023

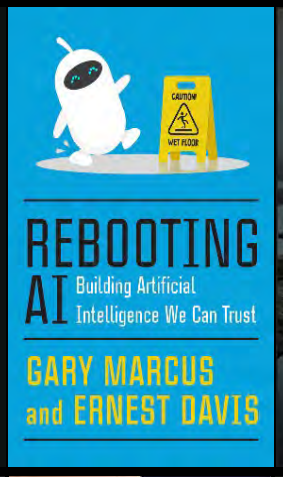

NTI bio
OCTOBER 2023
The Convergence of Artificial Intelligence and the Life Sciences:
Safeguarding Technology, Rethinking Governance, and Preventing Catastrophe
Sarah R. Carter, Ph.D.
Nicole E. Wheeler, Ph.D.
Sabrina Chwalek
Christopher R. Isaac, M.Sc.
Jaime Yassif, Ph.D.

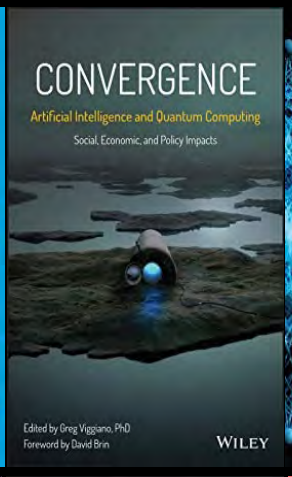

JOHNS HOPKINS
BLOOMBERG SCHOOL of PUBLIC HEALTH
Center for Health Security
ADVANCING GOVERNANCE FRAMEWORKS FOR FRONTIER AIxBIO:
Key Takeaways and Action Items from the Johns Hopkins Center for Health Security Meeting with Industry, Government, and NGOs
29 November 2023

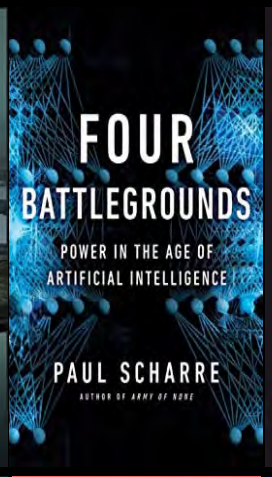
Dual-Use Biosecurity Risks from AI

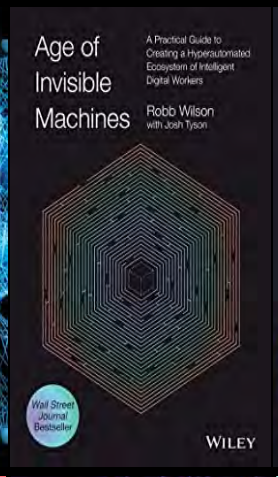
- expanded cyber threats and corruption of databases/communication systems
  - public health/medical infrastructure
  - health records
  - biopharma manufacturing and product safety
- dissemination of disinformation/misinformation
  - erode public trust in institutions/decision-makers
  - amplify public concerns on safety of new technologies (GMO crops, mRNA vaccines)
- targeted espionage and theft of innovation/IP (academia, industry)

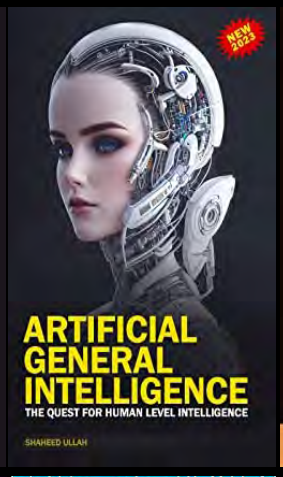

NATIONAL BESTSELLER
THE AGE OF AI
And Our Human Future
Henry A. Kissinger
Eric Schmidt
Daniel Huttenlocher

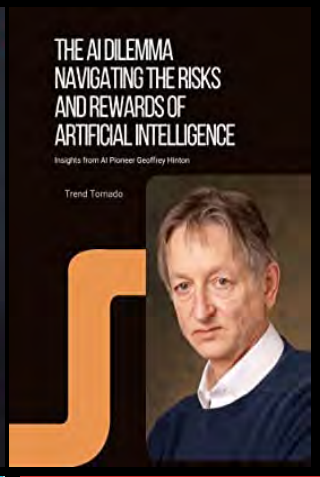

CAUTION
WET FLOOR
REBOOTING AI
Building Artificial Intelligence We Can Trust
GARY MARCUS and ERNEST DAVIS

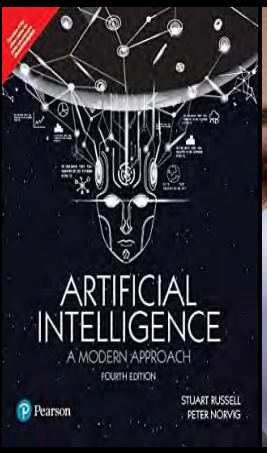

CONVERGENCE
Artificial Intelligence and Quantum Computing
Social, Economic, and Policy Impacts
Edited by Greg Viggiano, PhD
Foreword by David Brin
WILEY

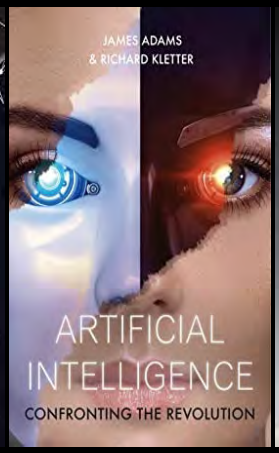

FOUR BATTLEGROUNDS
POWER IN THE AGE OF ARTIFICIAL INTELLIGENCE
PAUL SCHARRE

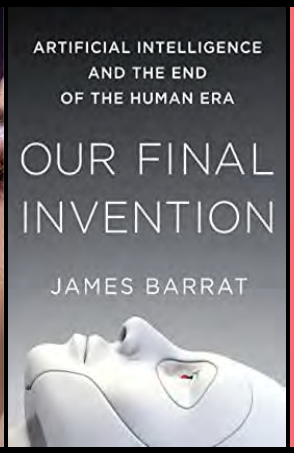

Age of Invisible Machines
A Practical Guide to Creating a Hyperautomated Ecosystem of Intelligent Digital Workers
Robb Wilson with Josh Tyson
Wall Street Journal Bestseller
WILEY

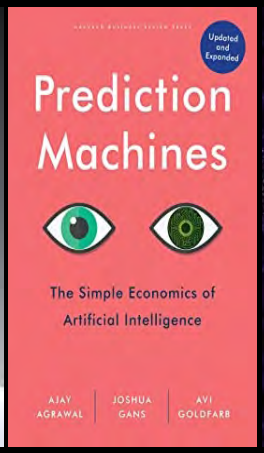

NEW 2023
ARTIFICIAL GENERAL INTELLIGENCE
THE QUEST FOR HUMAN LEVEL INTELLIGENCE
SHAHEED ULLAH


THE AI DILEMMA
NAVIGATING THE RISKS AND REWARDS OF ARTIFICIAL INTELLIGENCE
Insights from AI Pioneer Geoffrey Hinton
Trend Tornado

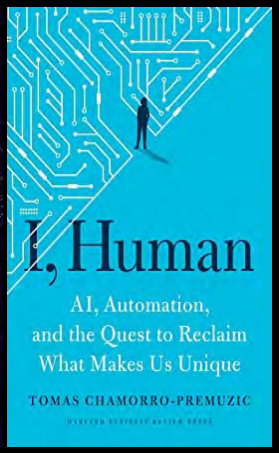

ARTIFICIAL INTELLIGENCE
A MODERN APPROACH
FOURTH EDITION
Pearson
STUART RUSSELL
PETER NORVIG

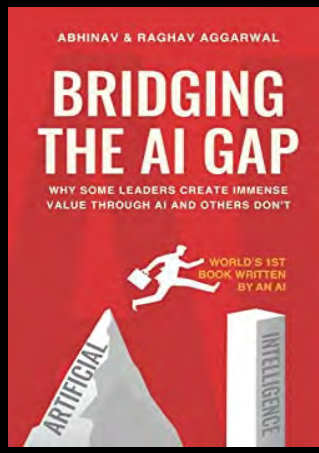

JAMES ADAMS
& RICHARD KLETTER
ARTIFICIAL INTELLIGENCE
CONFRONTING THE REVOLUTION

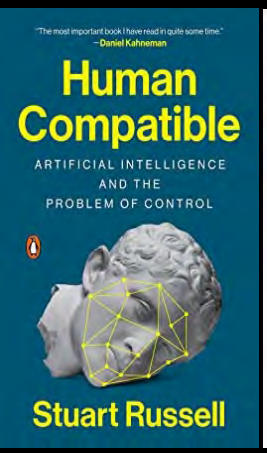

ARTIFICIAL INTELLIGENCE AND THE END OF THE HUMAN ERA
OUR FINAL INVENTION
JAMES BARRAT

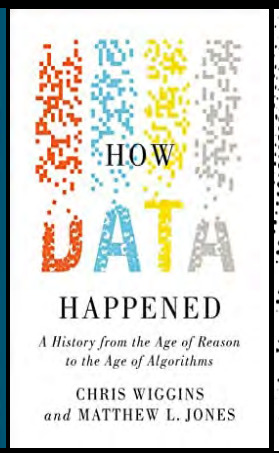

Updated and Expanded
Prediction Machines
The Simple Economics of Artificial Intelligence
AJAY AGRAWAL
JOSHUA GANS
AVI GOLDFARB

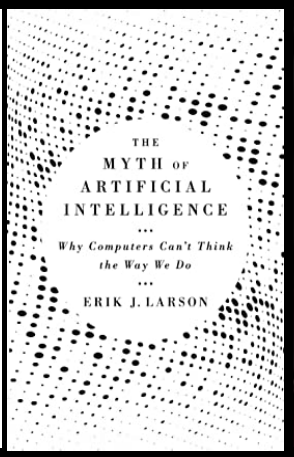

JOHN C. LENNOX
2084
ARTIFICIAL INTELLIGENCE AND THE FUTURE OF HUMANITY

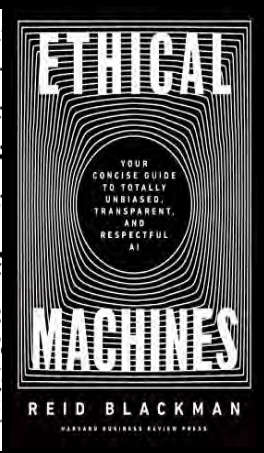

I, Human
AI, Automation, and the Quest to Reclaim What Makes Us Unique
TOMAS CHAMORRO-PREMUZIC

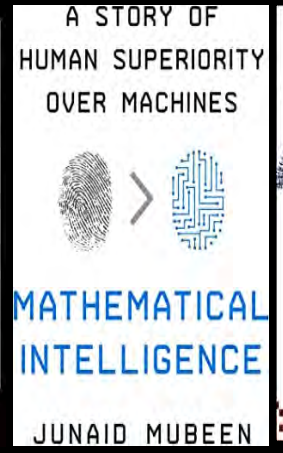

ABHINAV & RAGHAV AGGARWAL
BRIDGING THE AI GAP
WHY SOME LEADERS CREATE IMMENSE VALUE THROUGH AI AND OTHERS DON'T
WORLD'S 1ST BOOK WRITTEN BY AN AI
ARTIFICIAL
INTELLIGENCE

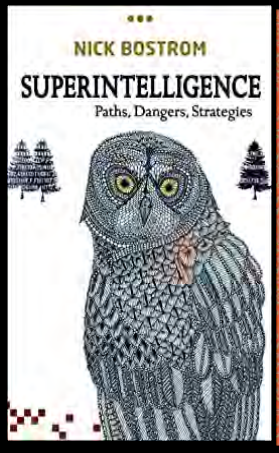

"The most important book I have read in quite some time." —Daniel Kahneman
Human Compatible
ARTIFICIAL INTELLIGENCE AND THE PROBLEM OF CONTROL
Stuart Russell

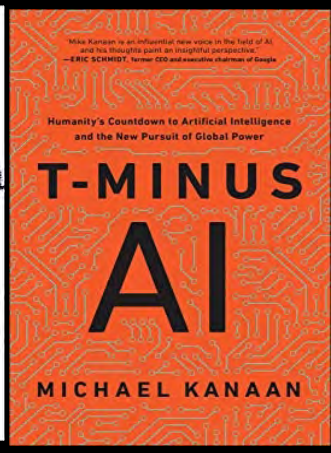

HOW DATA HAPPENED
A History from the Age of Reason to the Age of Algorithms
CHRIS WIGGINS and MATTHEW L. JONES


THE MYTH OF ARTIFICIAL INTELLIGENCE
Why Computers Can't Think the Way We Do
ERIK J. LARSON


ETHICAL MACHINES
YOUR CONCISE GUIDE TO TOTALLY UNBIASED, TRANSPARENT, AND RESPECTFUL AI
REID BLACKMAN


A STORY OF HUMAN SUPERIORITY OVER MACHINES
MATHEMATICAL INTELLIGENCE
JUNAID MUBEEN


NICK BOSTROM
SUPERINTELLIGENCE
Paths, Dangers, Strategies


Humanity's Countdown to Artificial Intelligence and the New Pursuit of Global Power
T-MINUS AI
MICHAEL KANAAN

Dual-Use Risks from the Intersection of AI, Biotechnology and Synthetic Biology

- concerns about potential AI design of altered/novel pathogens/toxins
- LLM training sets require data
  - unless adversaries have access to unique data robust intelligence monitoring platforms should identify risks and nefarious actors/actions
- potential expanded risk spectrum nonetheless requires adaptive risk monitoring tools
  - supply chains, satellite monitoring of activities at laboratories of concern
  - advances in automated synthesis instruments (integrated gene-to-protein) and foreign purchase

LLM Models, Intelligent Agents and Automation of Research Laboratory Processes

- acceleration of the design-make-test-analyze (DMTA) cycle
- autonomous design and execution of scientific experiments
  - ChemCrow[a], Coscientist[b], LangChain[c]
- integrated control of software and hardware, automated code generation and robotics
- beyond single step synthesis to rapid multi-step iterative syntheses

a A. Bran et al. (2023) arix.org/abs/2304.05376
b D.A. Boiko et al. (2023)Nature 624, 570
c N. Chase et al. (2023) GitHub.com/yoheinakajima/babyargi

Building an AI Scientist.

Our 10-year mission is to build semi-autonomous AIs that can scale scientific research, to accelerate the pace of discovery and to provide world-wide access to cutting-edge scientific, medical, and engineering expertise.

WikiCrow: Automating Synthesis of Human Scientific Knowledge

FutureHouse

OCTOBER 30, 2023

FACT SHEET: President Biden Issues Executive Order on Safe, Secure, and Trustworthy Artificial Intelligence

European Parliament

9/5/2023

KMB/DA/AS Committee on the Internal Market and Consumer Protection
Committee on Civil Liberties, Justice and Home Affairs

Version: 1.0

DRAFT Compromise Amendments

on the Draft Report

Proposal for a regulation of the European Parliament and of the Council on harmonised rules on Artificial Intelligence (Artificial Intelligence Act) and amending certain Union Legislative Acts

(COM(2021)0206 – C9 0146/2021 – 2021/0106(COD))

OpenAI

December 18, 2023

Preparedness Framework (Beta)

We believe the scientific study of catastrophic risks from AI has fallen far short of where we need to be.

To help address this gap, we are introducing our Preparedness Framework, a living document describing OpenAI's processes to track, evaluate, forecast, and protect against catastrophic risks posed by increasingly powerful models.

U.S. DEPARTMENT OF DEFENSE RESPONSIBLE ARTIFICIAL INTELLIGENCE STRATEGY AND IMPLEMENTATION PATHWAY

Prepared by the DoD Responsible AI Working Council in accordance with the memorandum issued by Deputy Secretary of Defense Kathleen Hicks on May 26, 2021, Implementing Responsible Artificial Intelligence in the Department of Defense.

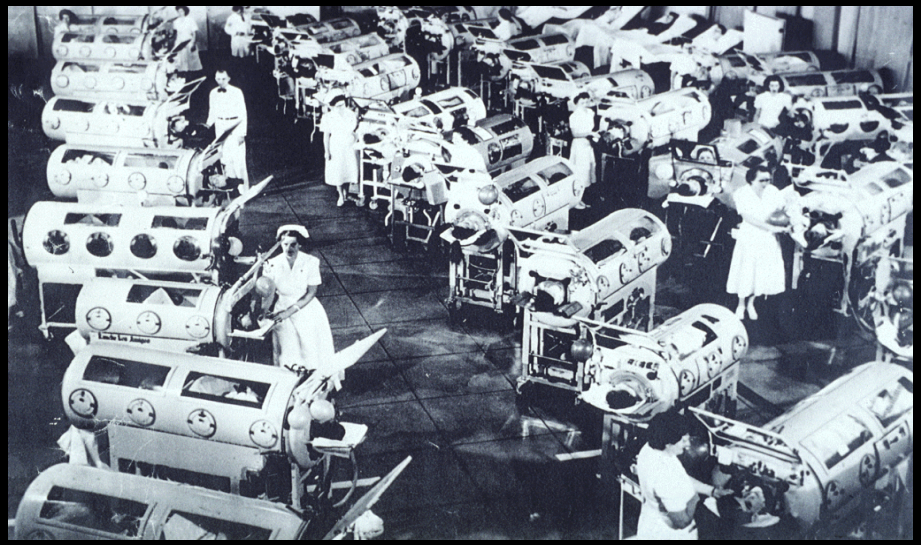
June 2022

Oversight, Regulation and Governance of AI and Advanced Computing

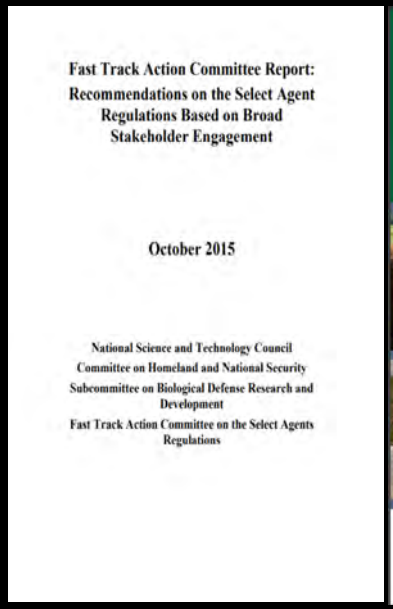
- dangers of premature one-size-fits all
  - inflexible constraints
  - bureaucratic overreach and sclerosis
  - stifle innovation in emergent applications or uses not yet envisaged
- low probability of international harmonization based on strategic national and corporate race for technological superiority for economic and military advantage

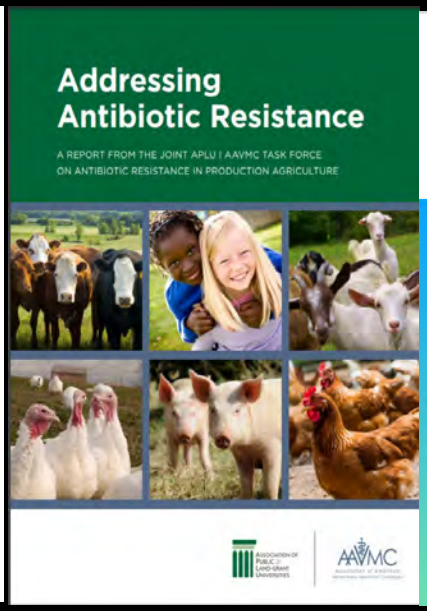
Complacency

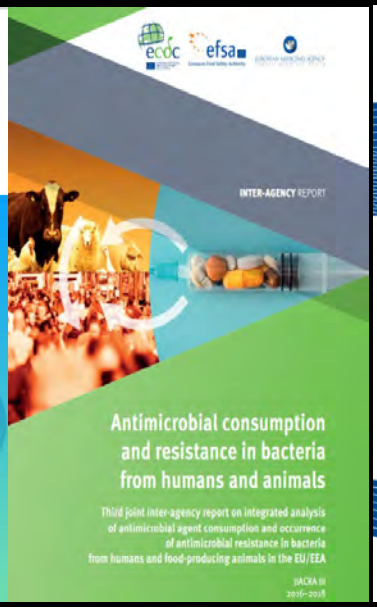
Comfort and Complacency: The Enemies of Vigilance and Preparedness



Antibiotic Resistance: Lots of Paper but No New Antibiotics

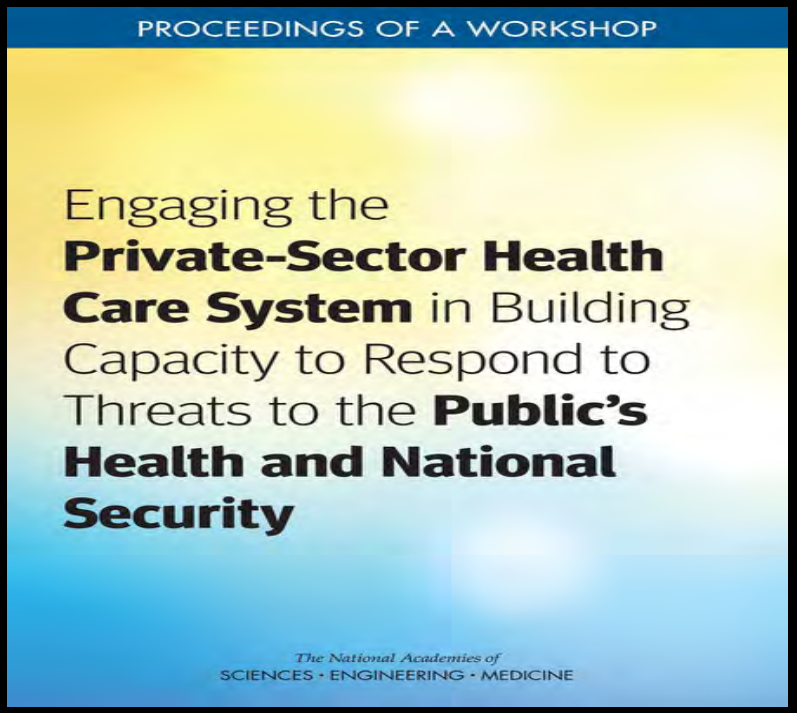






Who Pays for Preparedness?

The Obligate Role of Private-Public Partnerships in Biosecurity Policy



'Market Failure'

- lack of incentives for private sector to undertake high-risk/high-cost R&D absent guaranteed markets and ROI
  - antibiotic resistance (global)
  - MCMs for EIDs and biowarfare select agents
  - neglected diseases of the developing world

National Security

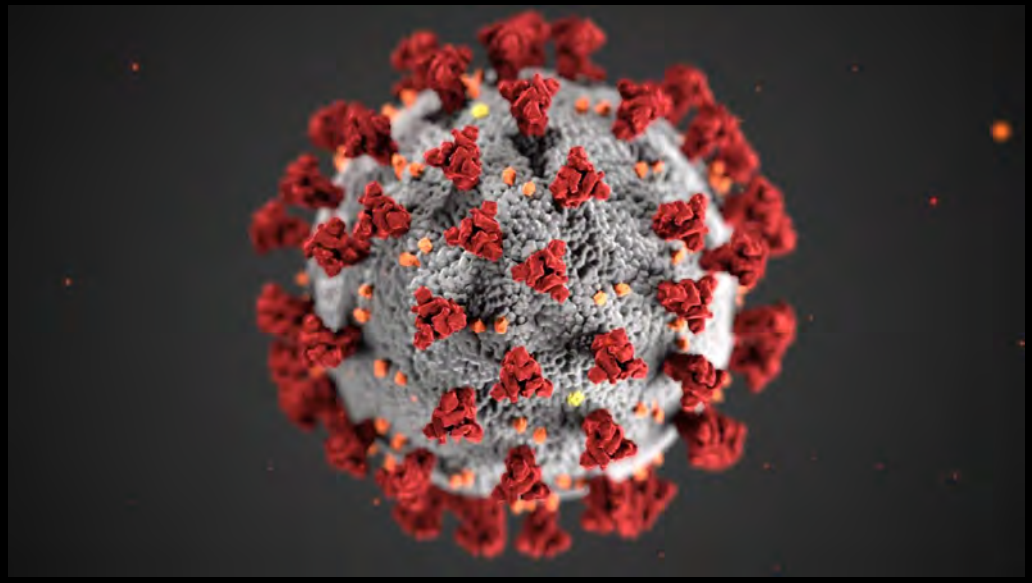
- the Cold War brought a sense of urgency to government decision making and whole of society engagement
  - USG (and allies), academia, industry
- similar engagement for biosecurity has not yet taken hold
- proactive inventory of known and potential threats to provide decision makers with timely information/options to mobilize proficient PR3 capabilities
- many future threats are not the kind that can be defeated, only managed
  - microbes, climate, genes, digits

“We've been in a strategic cul-de-sac
because of our twenty-year fixation on counterterrorism
since September 11, 2001.”

Robert Work
Former Deputy Secretary of Defense Under President Obama
In: Age of Danger
A. Hoehn and T. Shanker (2023) p.121
B. Hachette Books

Persistent Political Problems in Pandemics and Disasters

- who’s in charge?
- neglect-panic-fund-neglect
- who’s to blame?
- growing impact of global political tensions and distrust on essential future collaboration

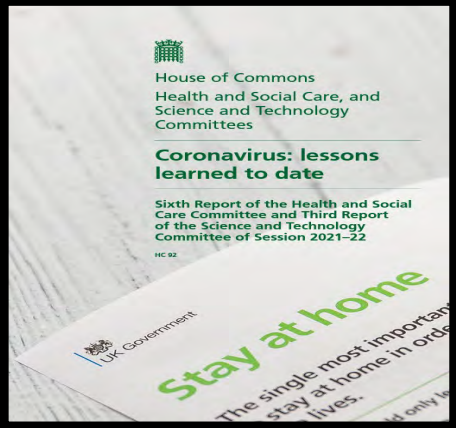


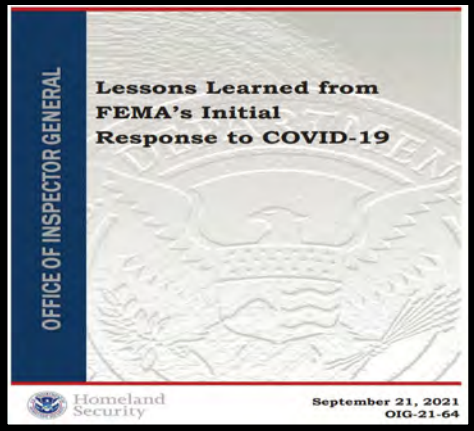
If we knew then what we know now,
what would we have done differently?

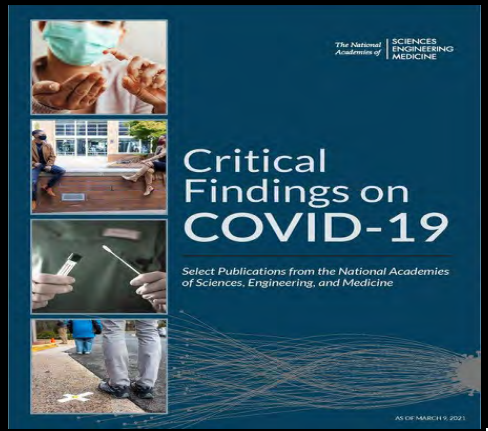
If We Knew Then What We Know Now, What Would We Have Done Differently?

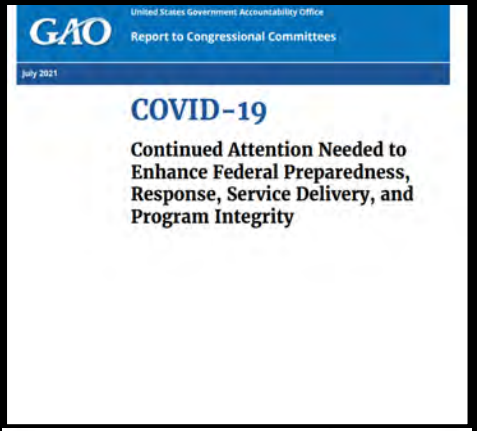
- proactive investment in national public health system and PR3 capabilities
- availability of large-scale diagnostic testing and earlier engagement of private sector
- real time data capture and integration
  - support decisions and customized risk management for different populations
- earlier recognition of airborne transmission and value of masking and ventilation versus obsession with sanitized surfaces
- PPE stockpiles
- informed lockdown policies: duration; risk-based triage
- proactive messaging and public trust

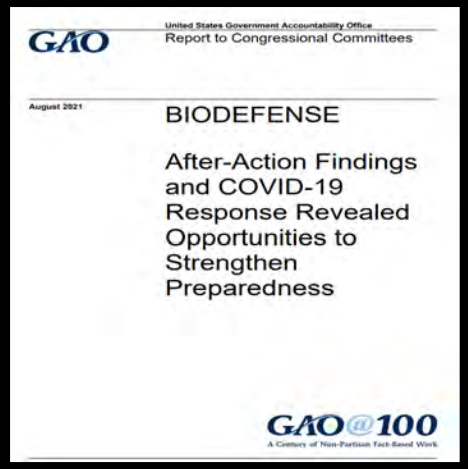
Commitment

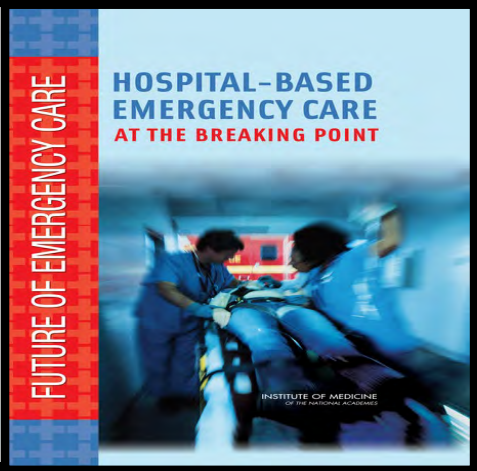

House of Commons
Health and Social Care, and Science and Technology Committees
Coronavirus: lessons learned to date
Sixth Report of the Health and Social Care Committee and Third Report of the Science and Technology Committee of Session 2021–22
HC 92
UK Government
Stay at home

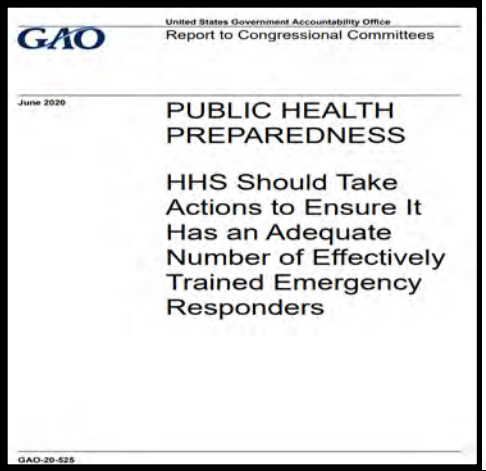

OFFICE OF INSPECTOR GENERAL
Lessons Learned from FEMA's Initial Response to COVID-19
Homeland Security
September 21, 2021
OIG-21-64

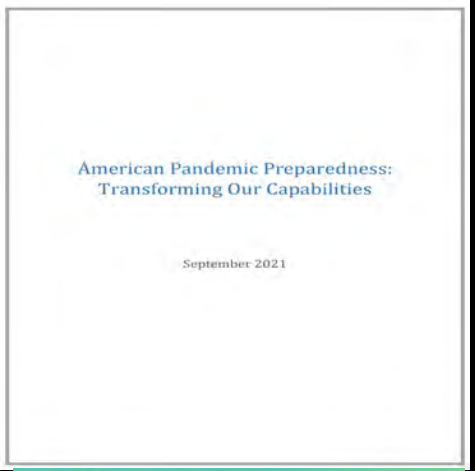

The National Academies of SCIENCES ENGINEERING MEDICINE
Critical Findings on COVID-19
Select Publications from the National Academies of Sciences, Engineering, and Medicine


GAO
United States Government Accountability Office
Report to Congressional Committees
July 2021
COVID-19
Continued Attention Needed to Enhance Federal Preparedness, Response, Service Delivery, and Program Integrity

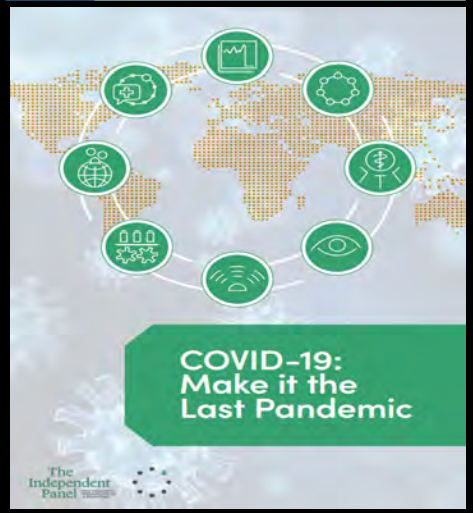

GAO
United States Government Accountability Office
Report to Congressional Committees
August 2021
BIODEFENSE
After-Action Findings and COVID-19 Response Revealed Opportunities to Strengthen Preparedness
GAO@100

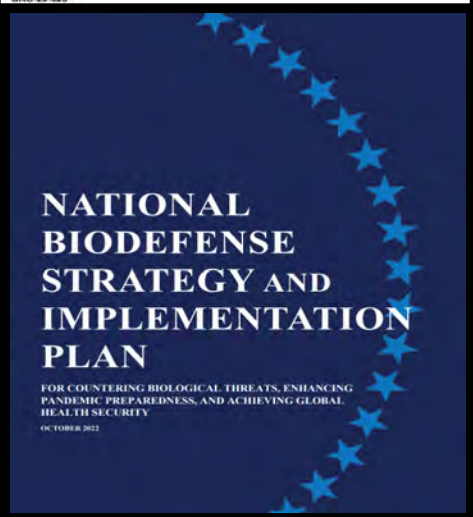

FUTURE OF EMERGENCY CARE
HOSPITAL-BASED EMERGENCY CARE
AT THE BREAKING POINT
INSTITUTE OF MEDICINE


GAO
United States Government Accountability Office
Report to Congressional Committees
June 2020
PUBLIC HEALTH PREPAREDNESS
HHS Should Take Actions to Ensure It Has an Adequate Number of Effectively Trained Emergency Responders
GAO-20-525


American Pandemic Preparedness: Transforming Our Capabilities
September 2021


Let's end pandemics forever
CEPI


COVID-19: Make it the Last Pandemic
The Independent Panel


NATIONAL BIODEFENSE STRATEGY AND IMPLEMENTATION PLAN
FOR COUNTERING BIOLOGICAL THREATS, ENHANCING PANDEMIC PREPAREDNESS, AND ACHIEVING GLOBAL HEALTH SECURITY
OCTOBER 2022


HUMAN DEVELOPMENT
REPORT 2021/2022
UNDP
Uncertain Times, Unsettled Lives: Shaping our Future in a Transforming World

Pathogens Sans Frontières
Strengthened Global Governance of Health Security

- update IHRs (original 2005)
- risk assessment, biosurveillance and early warning triggers
- transparency and timely sharing of critical data on outbreaks
- health equity, technology transfer, distributed manufacturing
- biosafety protocols for dual-use research
- intensified inspection, compliance and capability assessments

Pathogens Sans Frontières
Strengthened Global Governance of Health Security

- update IHRs (original 2005)
- risk assessment, biosur… d early warning triggers
- transparency an… ring of … on outbreaks
- health e… logy tr… buted manu…
- h… tocols … research
- …ed insp… pliance and capability a…ssment

Accountability

Trust But Verify

THE NEW PANDEMIC FUND AIMS TO:

- *bring additional, dedicated resources*
- *incentivize countries to increase investments*
- *enhance coordination among partners*
- *serve as a platform for advocacy*

WORLD BANK GROUP

World Health Organization

Complacency:
The Emptiness of Political Platitudes Without Action or Accountability

Over 120 countries back COP28 UAE Climate and Health Declaration delivering breakthrough moment for health in climate talks

Mobilizing Global Commitments to Enhance Pandemic PRR Capabilities

- (re)build greater resilience in public health and healthcare infrastructure
- essential and welcome actions (assumes commitment to deliver)

BUT

- heavily weighted to protection of G20 populations
- focused almost exclusively on pandemic threats and communicable diseases versus threat-agnostic/disaster PR3
- still largely *'reactive'* focus on enhanced detection versus the more challenging task of *'proactive'* threat elimination at source

Mobilizing Global Commitments to Enhance Pandemic PRR Capabilities

- (re)build greater resilience in public health and healthcare infrastructure
- ess[illegible] delivery sustained com[illegible]
- hea[illegible]
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- still largely *'reactive'* focus on enhanced detection and more challengin[illegible] ion at source

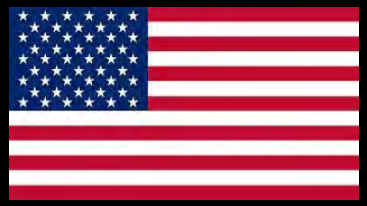
Collective Myopia and One Critical Omission

ONE HEALTH !

- **renewed focus and funding to strengthen global public health is necessary but not sufficient**
- **without adoption of One Health as a core principle in global biosecurity then laudable aspirations for human and planetary health will be:**
  - **undermined by continued cycles of emergent zoonotic EIDs**
  - **food insecurity and depletion of non-renewable natural resources and other ecosystem disruptions**
  - **socio – cultural – economic on stabilities and triggers of conflict**

Global Problems Require Global Solutions

- balancing growing tension between nation-focused economic and military competitiveness in advanced technologies with global cooperation in mitigation of shared threats

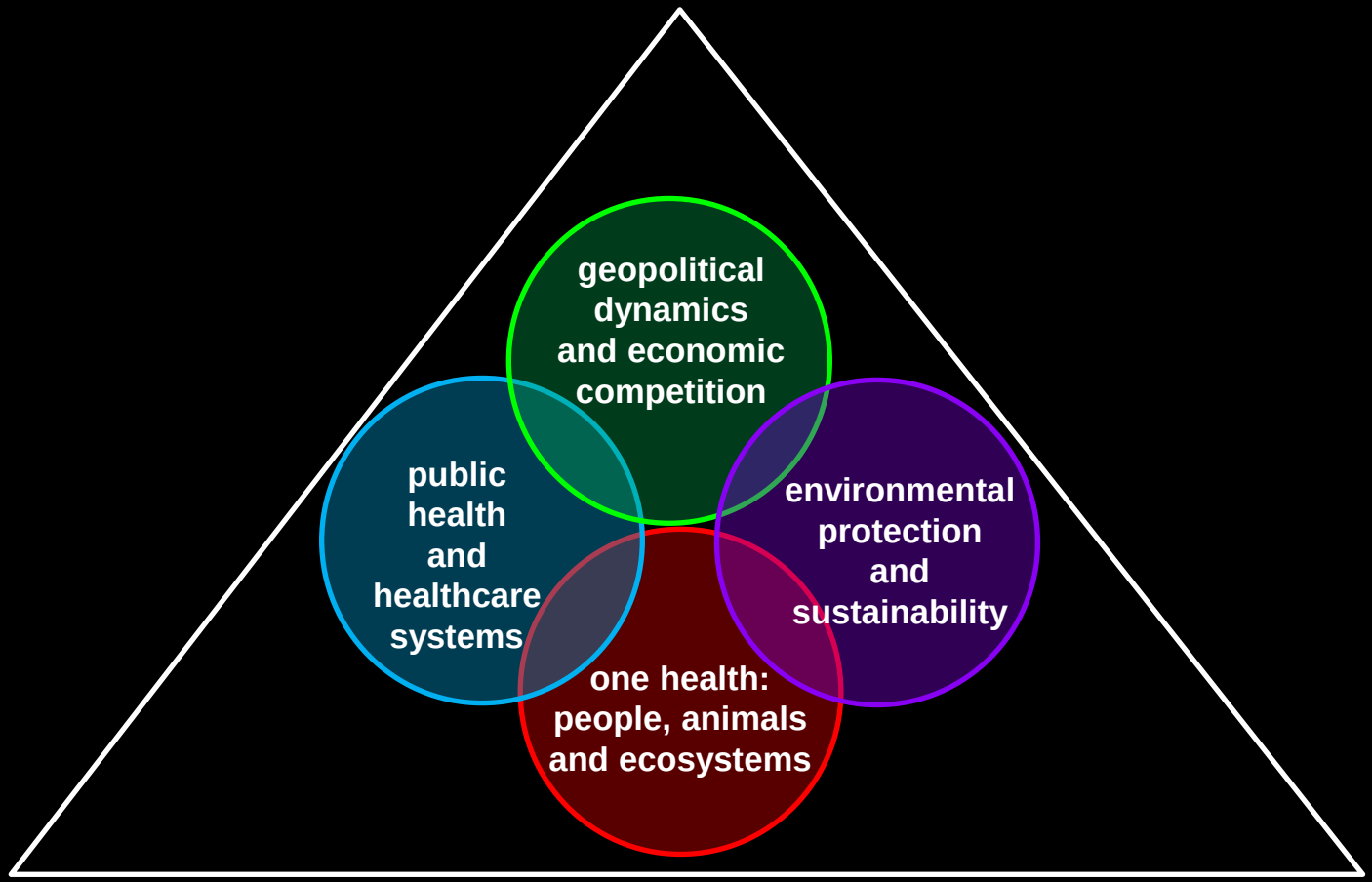


The Dangers of Escalating Geopolitical Tension and Uncoupling of the World's Two Largest Economies

- Taiwan
- trade practices
- espionage and intellectual property theft
- belt-and-road imperialism
- technology competition for future economic and military superiority
- rise of isolationist and authoritarian policies and xenophobia

Future Biosecurity Implications of Uncoupling

Biosecurity:
A Grand Challenge of Escalating Complexity and Urgency



expansion of dual-risk technologies

rapid global diffusion of technology innovation

technology acceleration and cross-disciplinary convergence

A New Senior Government Post Needed: The Secretary of Hard Truths

- Cabinet level appointment to integrate biosecurity policies nationally and internationally
- transcending short-termism and kicking the problem down the road
- forceful advocacy of the consequences of continued neglect and failure to act
- moving beyond the current media gotcha circus that drives political timidity and adoption of adults-in-the-room policies
- acknowledge complexity(ies) and where uncertainties exist
- the unavoidable need for painful choices

“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)

“Politics is the art of the possible,
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Slides available @ https://casi.asu.edu/presentations/

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