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

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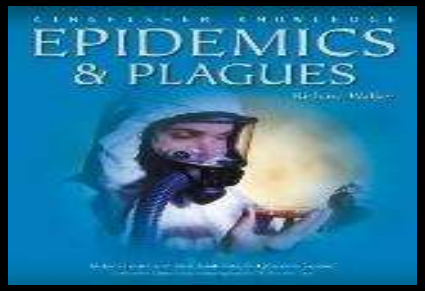
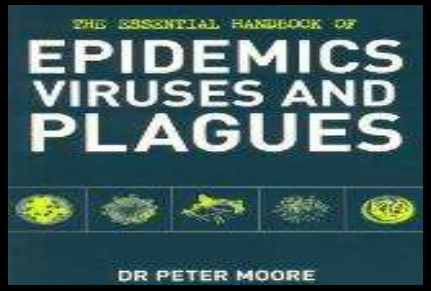
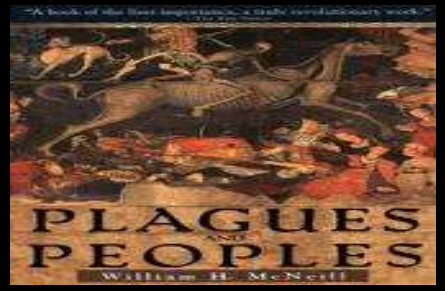
Biosecurity and Bioterrorism Response:
Surgery 222/Public Policy 122/222
Stanford University
March 8, 2017

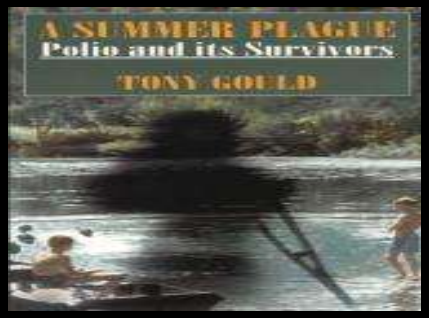
The Four Horsemen of the Apocalypse (Albrecht Durer)

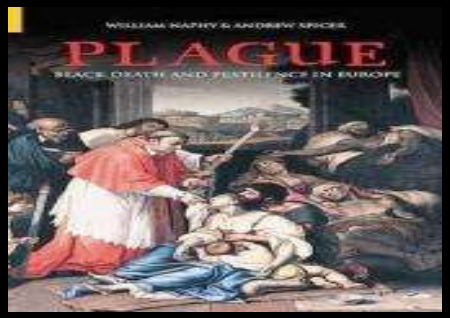
Infectious Diseases:
A Powerful Force in Human Evolution

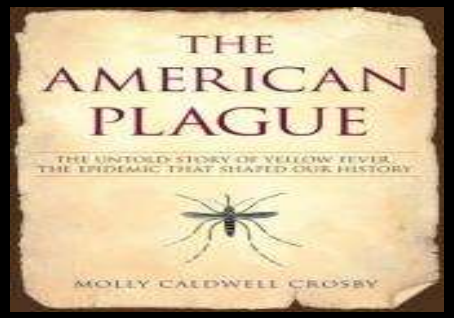


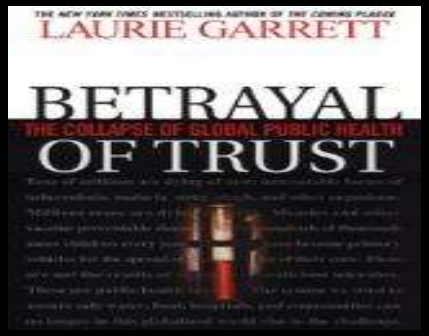


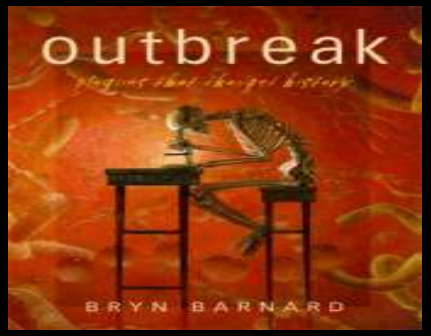


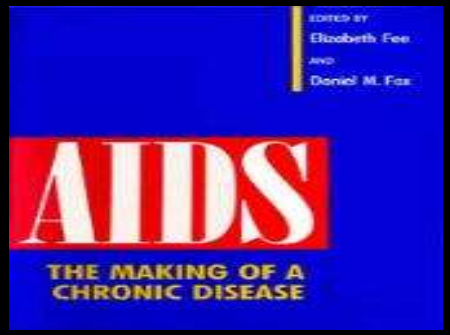




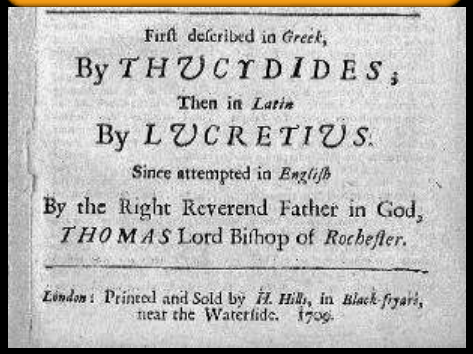








The Social, Economic and Political Impact of Epidemic and Epizootic Disease

Plague of Athens	Bubonic Plague	Small Pox	Pandemic Influenza
			
			
Foot and Mouth Disease	**Rinderpest**	**African Swine Fever**	**Rabies**

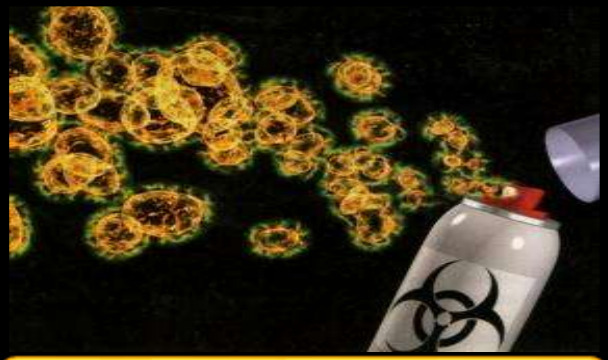
The Relentless Changing Dynamics of Infectious Diseases

old foes resurgent:
Rx – resistance

omnipresent
pandemic threats

new foes:
emerging infectious diseases

global connectivities



bioterrorism and
dual-use technologies

new technologies: genomics
and synthetic organisms

Anthropogenic Effects on Ecosystem Stability and Altered Patterns of Infectious Diseases

famine

contaminated water

desertification

depletion of natural resources

climate change and new vector ranges

new vulnerabilities

Biosecurity

Broad Term for the Full Spectrum of 'Biological' Threats Whether of Natural or Nefarious Origin

Natural Epidemics and Bioterrorism Share Same Features in Terms of Potential to Disrupt Society

Preparedness Capabilities Are Similar Irrespective of the Origin of the Biothreat

The VUCA World

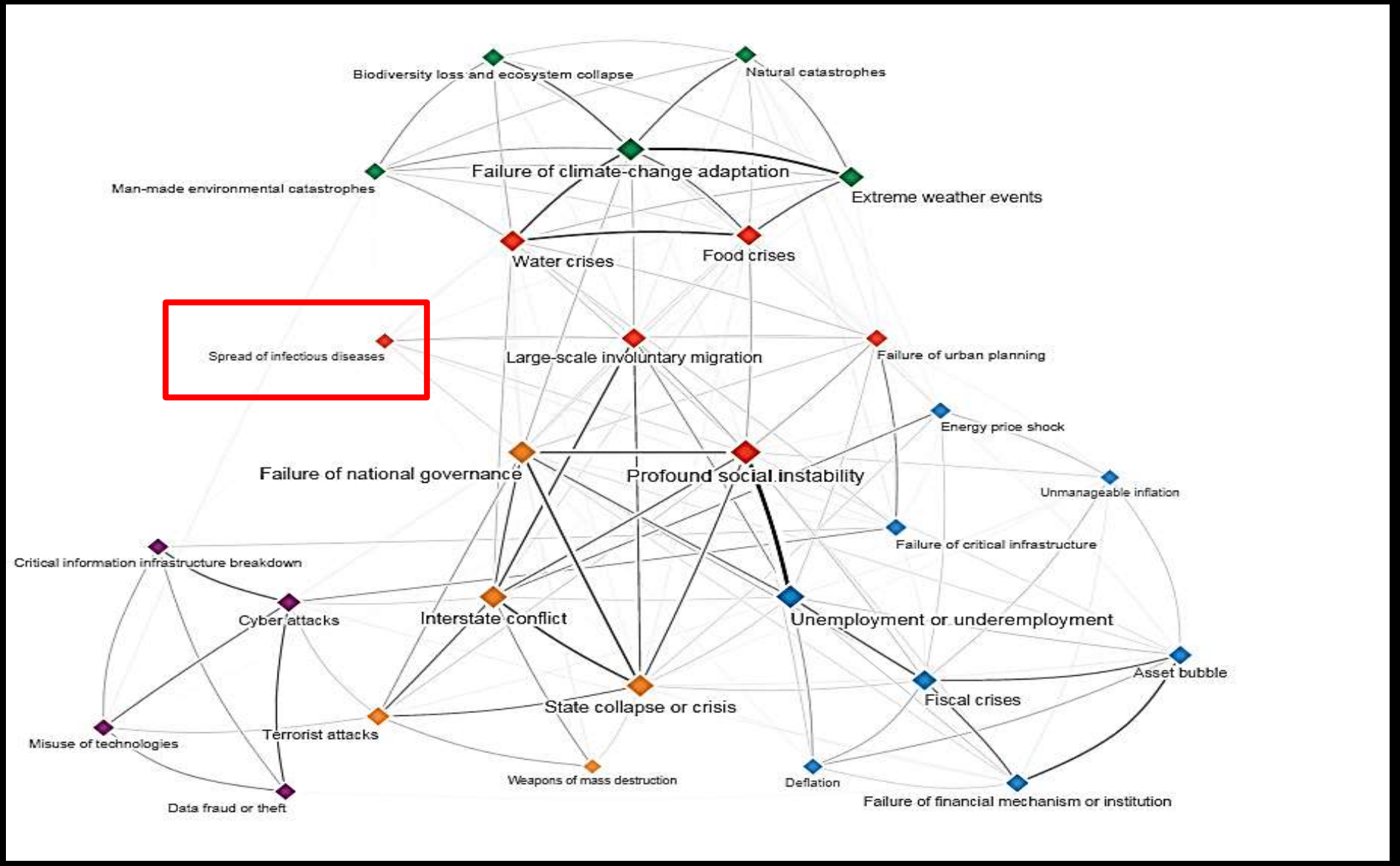
- **V**olatility
- **U**ncertainty
- **C**omplexity
- **A**mbiguity

CONNECTIVITY

SYSTEMS OF SYSTEMS

WORLD ECONOMIC FORUM

Global Risks 2015



Biosecurity

- understanding how changes in complex biological systems threaten health and societal stability
  - directly and indirectly
  - infectious disease, food production
  - ecosystem shifts and new patterns of disease
- risk of civil disorder in an unchecked major bio-incident
  - military and humanitarian missions
- fundamental but dangerously neglected component in national security

Every Local Event is a Potential Global Event

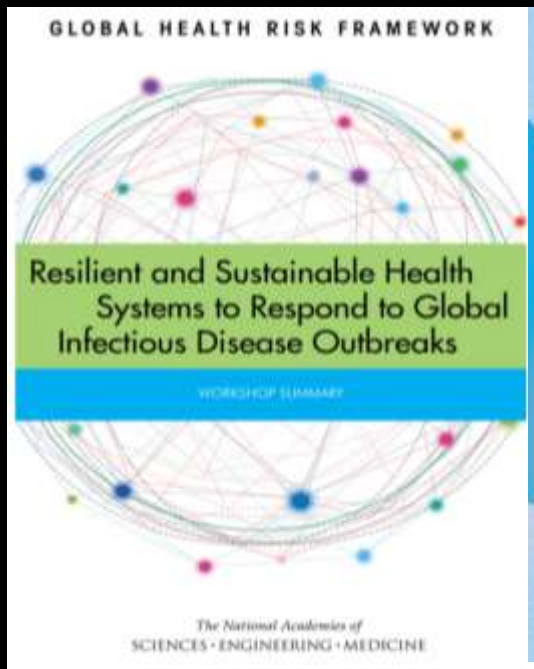
Super-Vectors

Billion Cross-Border Travelers/Year

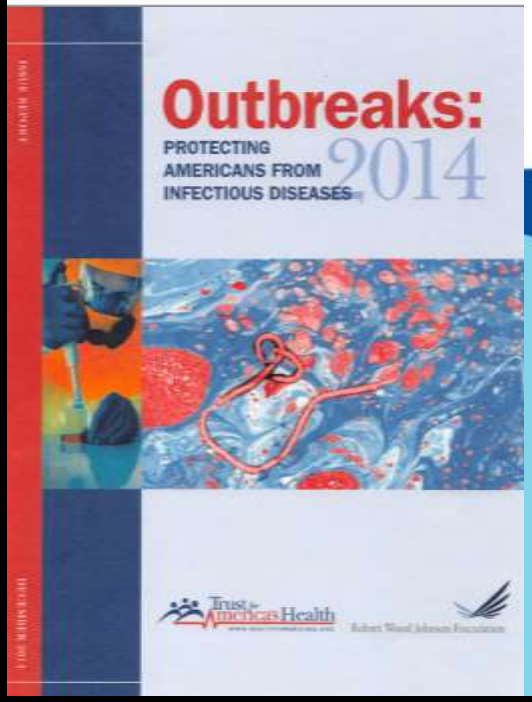
Rapid Global Spread: Zika, Chikungunya and Dengue

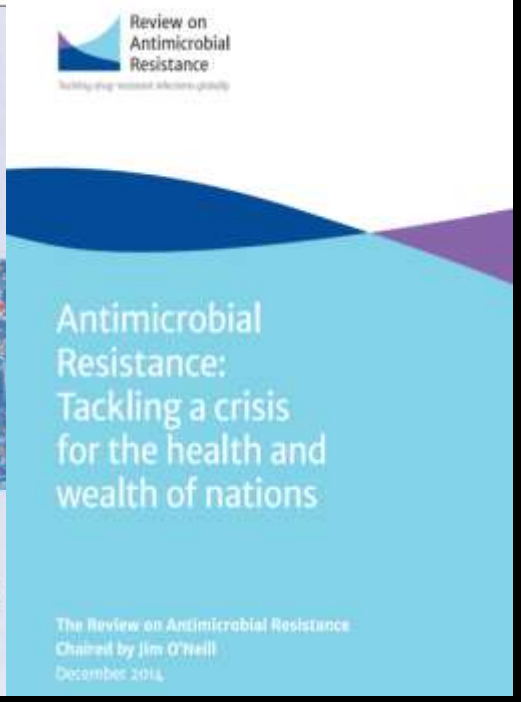
World Health Organization

Fragile Global Biosurveillance Infrastructure

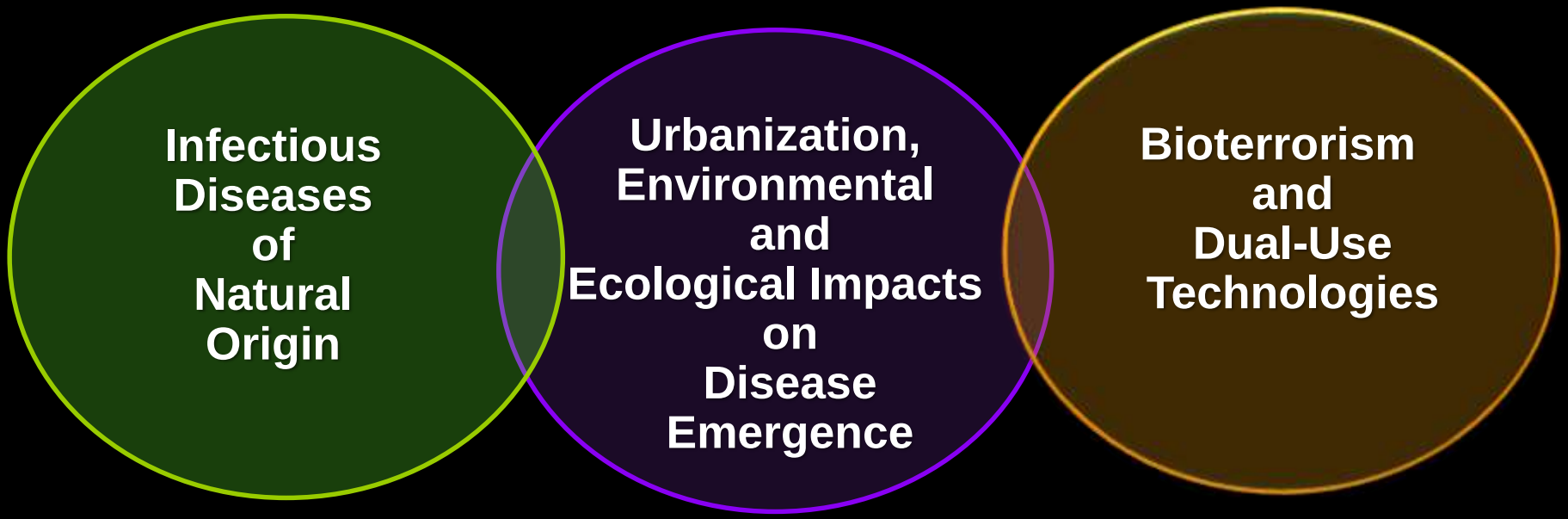

GLOBAL HEALTH RISK FRAMEWORK
Resilient and Sustainable Health Systems to Respond to Global Infectious Disease Outbreaks
WORKSHOP SUMMARY
The National Academies of
SCIENCES • ENGINEERING • MEDICINE


The Neglected Dimension of Global Security


Outbreaks:
PROTECTING AMERICANS FROM INFECTIOUS DISEASES
2014
Trust for America's Health
Robert Wood Johnson Foundation

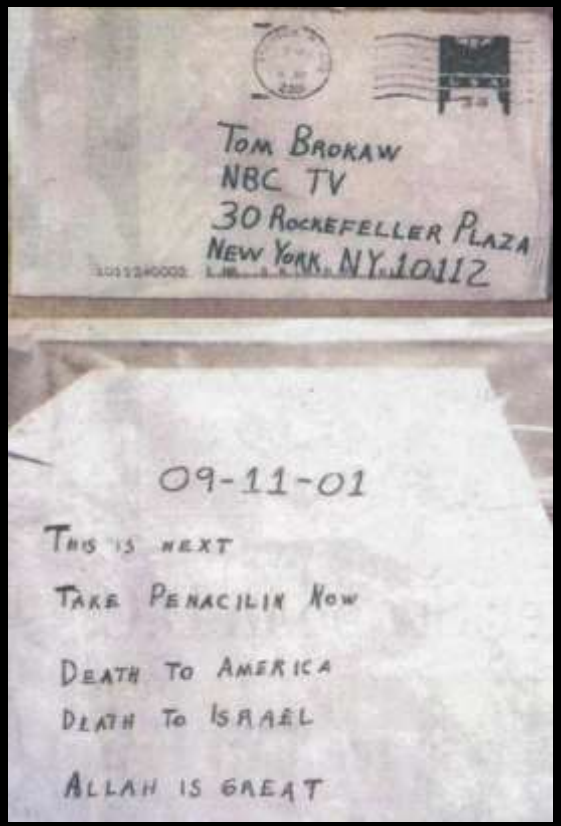

Review on Antimicrobial Resistance
Antimicrobial Resistance: Tackling a crisis for the health and wealth of nations
The Review on Antimicrobial Resistance
Chaired by Jim O'Neill
December 2014

The Biosecurity Triad



“Amerithrax” October 2001

“I will show you fear in a handful of dust”
-T.S. Elliot



The FSU Covert Biopreparat Program: Violation of 1972 BWC

Asymmetric Warfare and The Appeal of CBW to Terrorist Organizations

Tier 1 Select Agents As Bioterrorism Candidates

- ability to cause a mass casualty event or economic devastation
- communicability or dispensability
- low infectious dose
- history of adversarial interest in weaponization
- ability to circumvent known countermeasures
- persistence and ease of decontamination

Diversification of the Biosecurity Threat Spectrum

Time	Low Probability: High Consequence	High Probability: High Consequence
Today		
• bioterrorism	X	
• natural infectious diseases(pandemic)		X
2020(?)		
• bioterrorism		X?
• natural infectious diseases(pandemic)		X

Biosecurity: From Anthrax to Zika

diversification of threat spectrum

need for similar response and preparedness capabilities irrespective of whether threat is of natural or nefarious origin

complex multi-dimensional challenge requiring international cooperation

A Decade of New and Resurgent Viral Threats

SARS-CoV	MERS-CoV	West Nile	Yellow Fever
			
			
Dengue	Chikungunya	Ebola	Zika

Global Urbanization

- estimated 180,000 people migrate to cities every day (employment, conflict)
- unprecedented demands (stresses) on infrastructure and services by 2030
  - food (35%↑), water (40%↑), energy (50%↑)
  - new housing demands equal to entire worldwide construction to date
- susceptibility of megacities to extreme weather events/natural disasters
  - littoral locations of 8/10 top megacities
  - vulnerability of vertical structures and slum zones

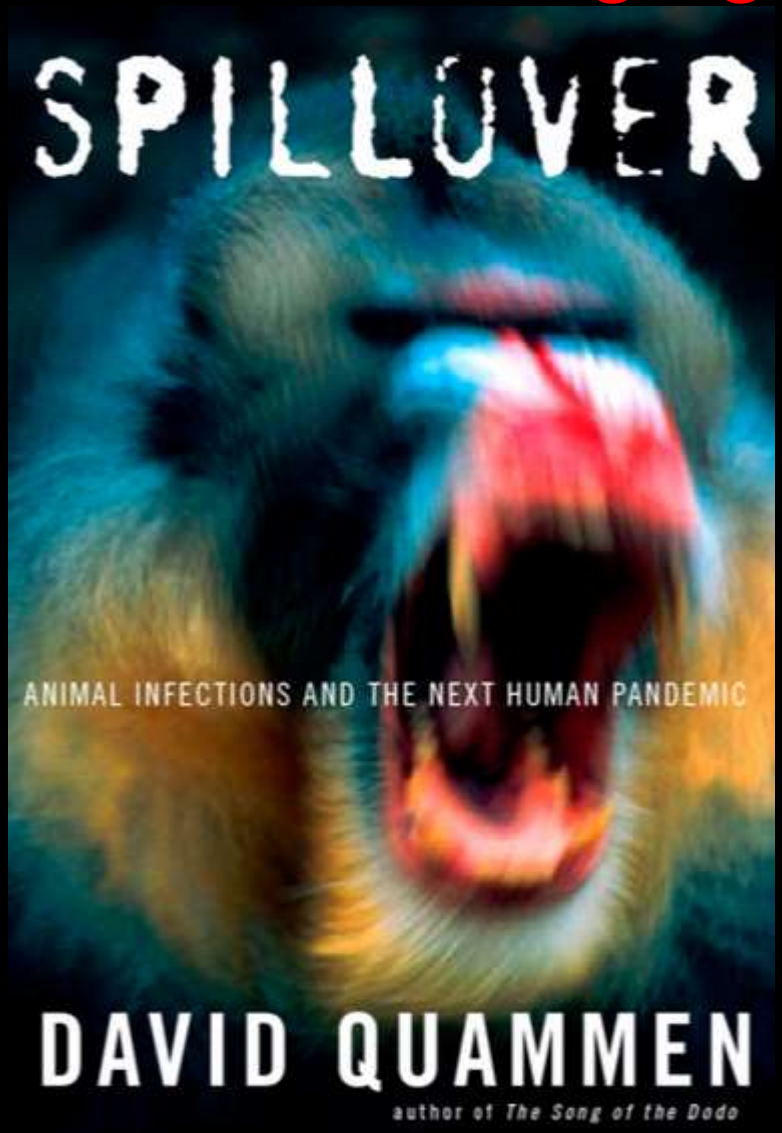
Urbanization and Mega-Cities in Developing Countries and the Increased Threat of Exotic Zoonotic Diseases

High Population Density With Inadequate Biosurveillance

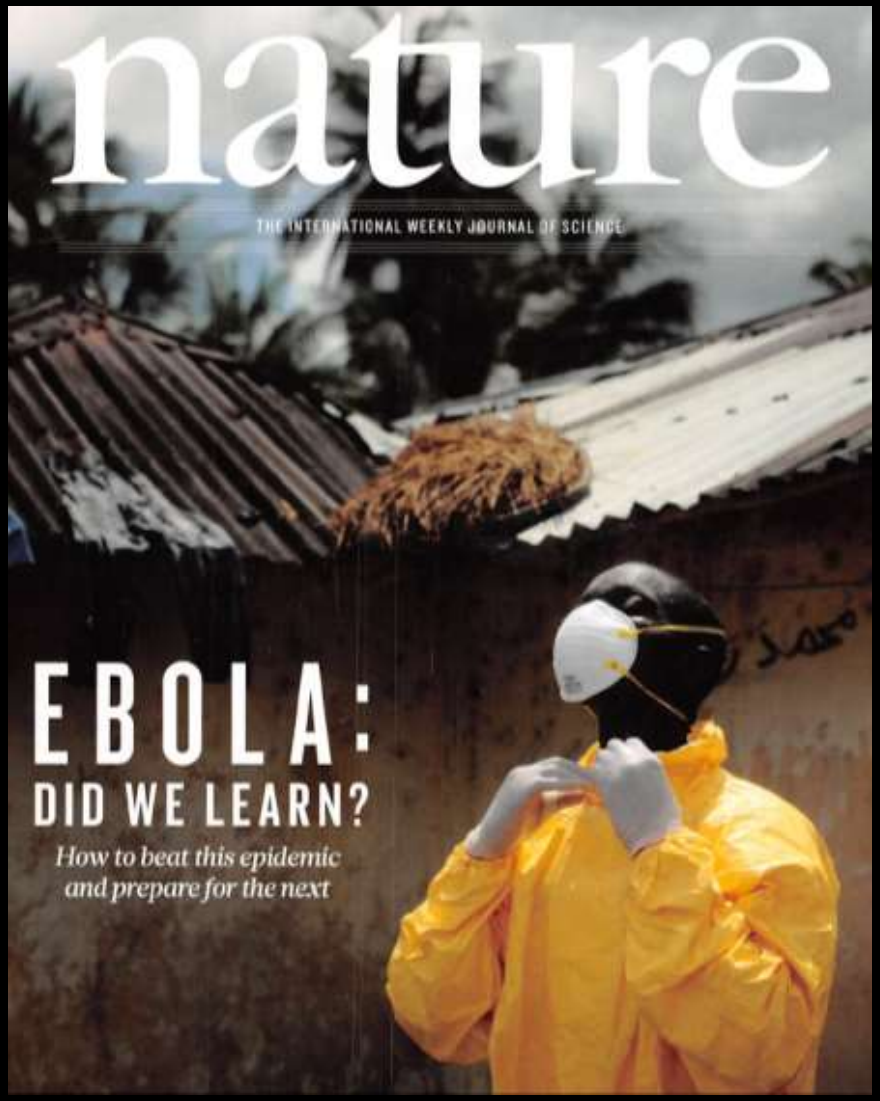
Major Gaps in Health Infrastructure and Disease Reporting

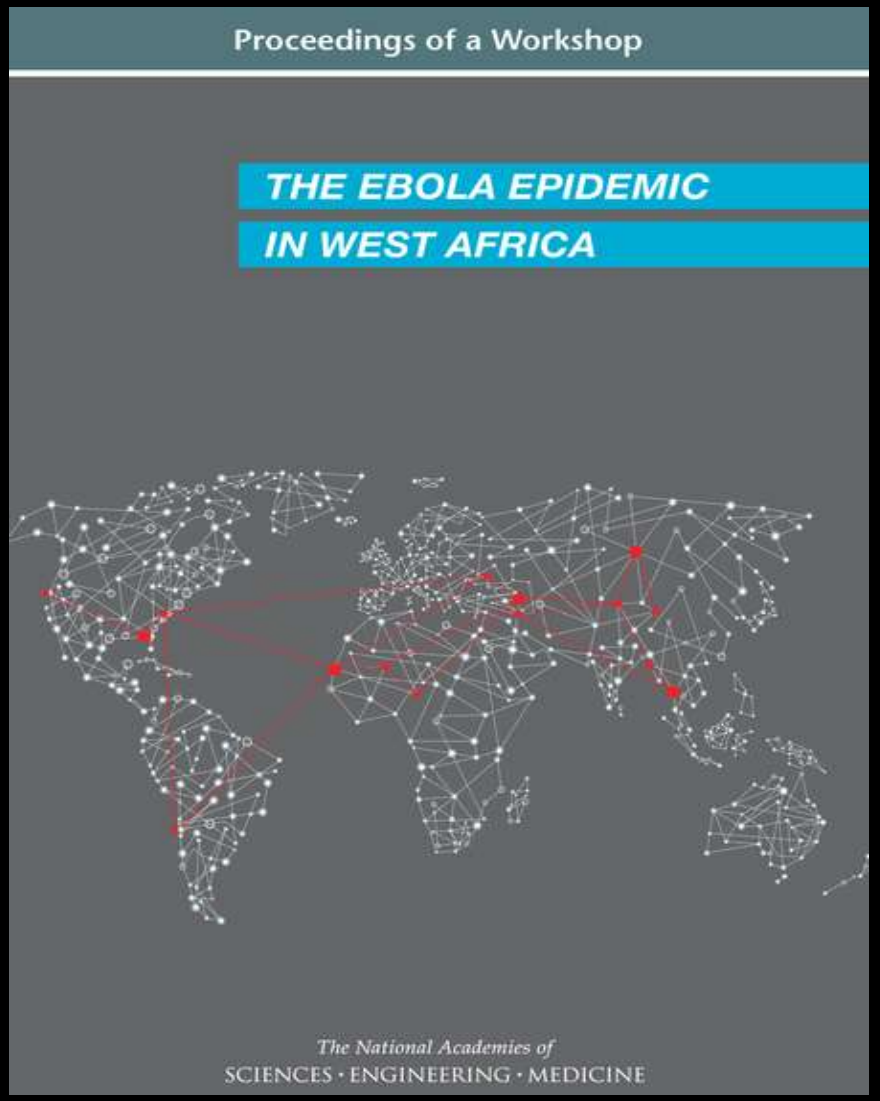
Expanded Eco-niches and New Zoonotic Exposures/Risks

The Dominant Role of Zoonoses in Emerging Infectious Diseases

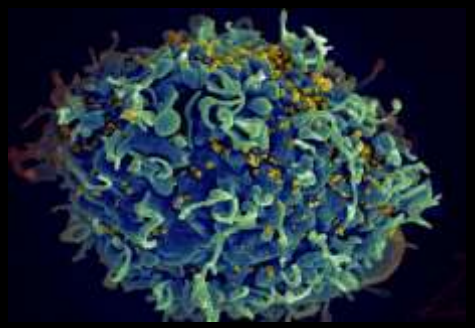
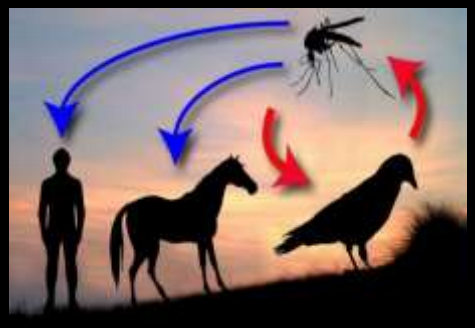
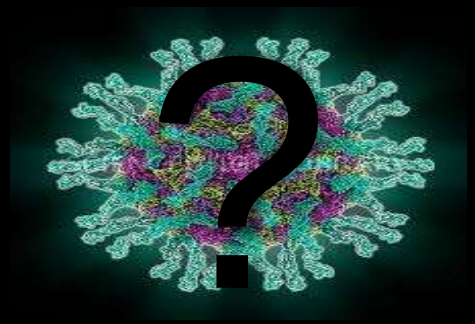


Bats as the Ebola Reservoir in W. Africa (2014)

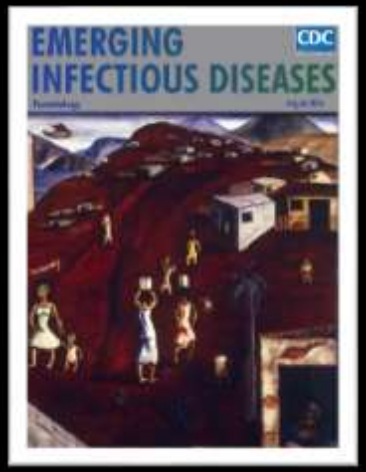

nature
THE INTERNATIONAL WEEKLY JOURNAL OF SCIENCE
EBOLA:
DID WE LEARN?
How to beat this epidemic
and prepare for the next

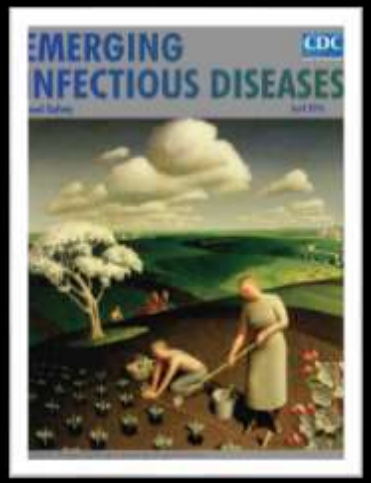

Proceedings of a Workshop
THE EBOLA EPIDEMIC
IN WEST AFRICA
The National Academies of
SCIENCES · ENGINEERING · MEDICINE

One Health:
Recognition of the Importance of Zoonotic Diseases as Human Health Threats

pandemic (avian) influenza	HIV	West Nile virus	MERS- CoV
			
			
Ebola virus	bush meat food chain	Zika virus	what's out there?

What's Out There!





Enteroviruses D68, A71

Marburg

Arenaviruses

Crimean-Congo Hemorrhagic Fever

Parechovirus

Rift Valley Fever

Japanese Encephalitis

Hantavirus

Lassa Fever

Hepatitis E

Lujo Virus

Pegivirus

O'nyong-Nyong

Monkeypox

Poliovirus

Norovirus

Henipavirus

Measles

Polyoma Virus

Mayaro Virus

Chatanga Virus

Venezuelan Equine Encephalitis

Senecavirus A

Phleboviruses

Bunyaviruses

Thogotovirus

Inkoo Virus

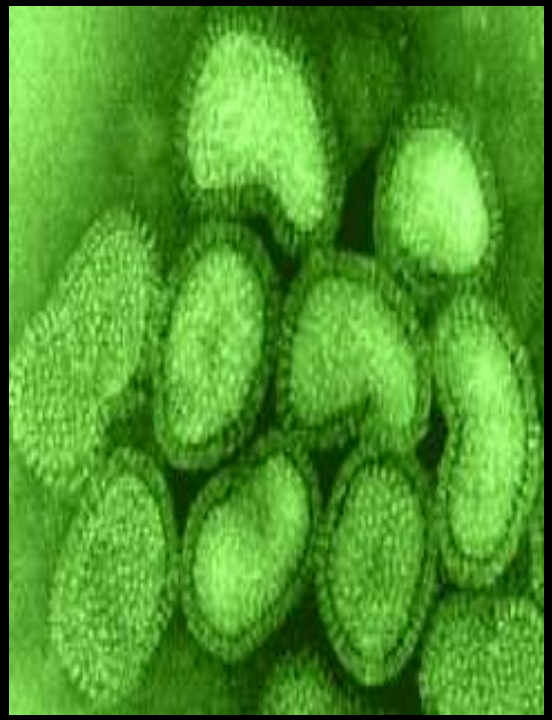
37 Viruses With Known Human Transmission Risk But To Date Exhibit Short Transmission Chains or Self–Limiting Outbreaks

- single-strand RNA(antisense)
  - arena viruses (8), bunyaviruses (6)
- single-strand RNA(positive strand)
  - flaviviruses (3), coronaviruses (1), togaviruses (5)
- single-strand RNA(negative strand)
  - filoviruses (3), paramyxoviruses (1), rhabdoviruses (2)
- double-strand RNA
  - reoviruses (2)
- double-strand DNA
  - adenoviruses (1), herpes viruses (1), polyomaviruses (1), poxviruses (3)

Threat Assessment: Traits Relevant for Disease Causation

- host range, reservoir and frequency/nature of human interactions
- pathogen virulence
- transmission route
- host restriction factors
- herd immunity (natural or vaccination)
- susceptibility/resistance to available Rx

The #1 Global Pandemic Threat?
The Omnipresent Risk of Pandemic Influenza



The Evolution of Pandemic Influenza Strains: The Bird → Pig → Human Transmission Chain

Avian Reservoirs and Global Flyways

Sporadic Transmission to Mammalian Hosts

Episodic Zoonotic Human Infections

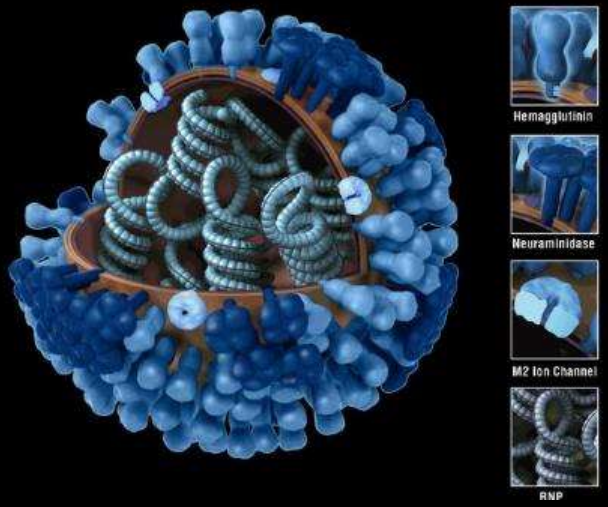
Biosecurity Implications of the Rise of Intensive Agriculture in BRIC Countries

- consumer desire for animal protein (versus plant protein)
- diversion of grain to animal feed, disruption of global food chains and increased famine risk

- juxtaposition of large numbers of birds(ducks/chickens) and pigs in same production center
- increased influenza zoonotic risk and genetic recombination(s) with pandemic potential

The Evolution of Pandemic Influenza Strains by Continuous Mutation and Genetic Reassortment

High Frequency Mutation and Genetic Reassortment in Zoonotic Strains



high virulence

x

low transmissibility

high virulence

x

high transmissibility

H7N9 Avian Influenza Human Infections China 2016 - 2017 (to 2/20/17)

- 2016
  - 918 laboratory-confirmed cases, 359 deaths
- January, 2017
  - 192 cases, 79 deaths
- February, 2017
  - 77 cases, 8 deaths

Preparedness:
The “All Hazards” Challenge
and
Building Resilient Systems

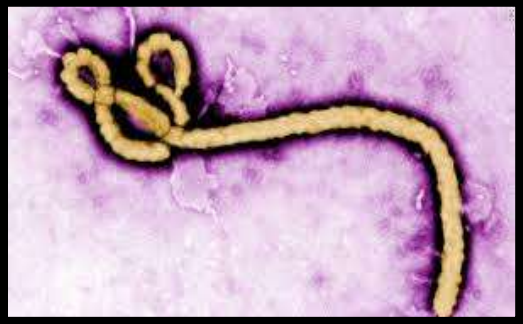
The Core Triad in Combating Infectious Diseases

threat spectrum	robust public health capabilities	counter-measures

Faster Detection and Diagnosis Saves Lives

- speed and agility matter!
- respond on epidemic/epizootic time not bureaucrat time

Ebola in West Africa 2013: Underinvestment and Bureaucratic Sclerosis of International Public Health Responses to New Threats



26 December 2013

- index case zero
- Emile Ouamouno (Meliandou, Guinea)

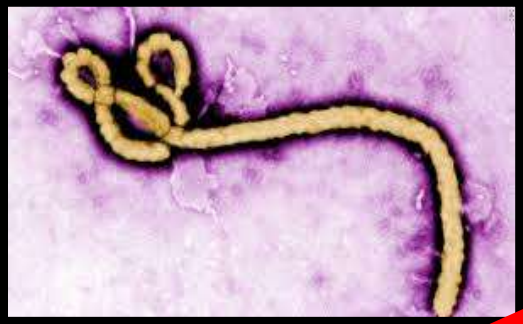
21 March 2014

- first report by WHO-AFRO region

8 August 2014

- WHO declaration of Public Health Emergency of International Concern

Ebola in West Africa 2013: Underinvestment and Bureaucratic Sclerosis of International Public Health Responses to New Threats



Over 10,000 Deaths

26 December 2013

- index c
- (Meliandou, Guinea)

2014

- first report by WHO-AFRO region

8 August 2014

- WHO declaration of Public Health Emergency of International Concern

Reporting Time for Emerging Infectious Disease Outbreaks (1996-2014)

Region	# Outbreaks	Median # Days to Discovery	Median # Days to Public Communication
All	342	20	32
Africa	175	27	43
Americas	31	18	23
E. Mediterranean	39	26	39
Europe	25	20	31
S.E. Asia	24	13	15
W. Pacific	47	5	19

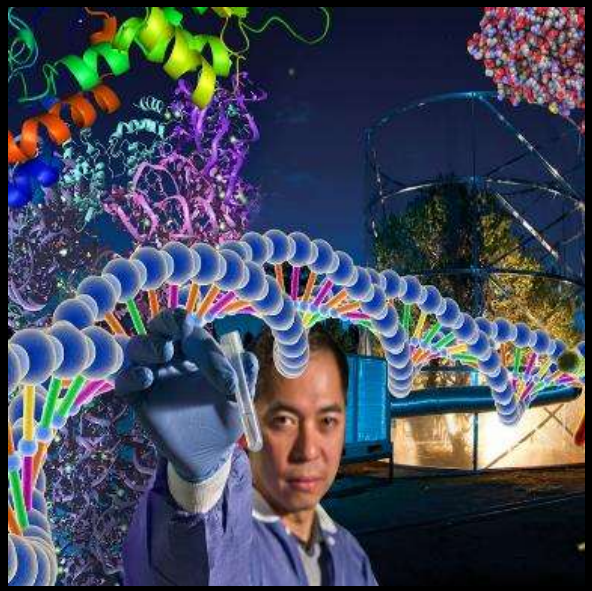
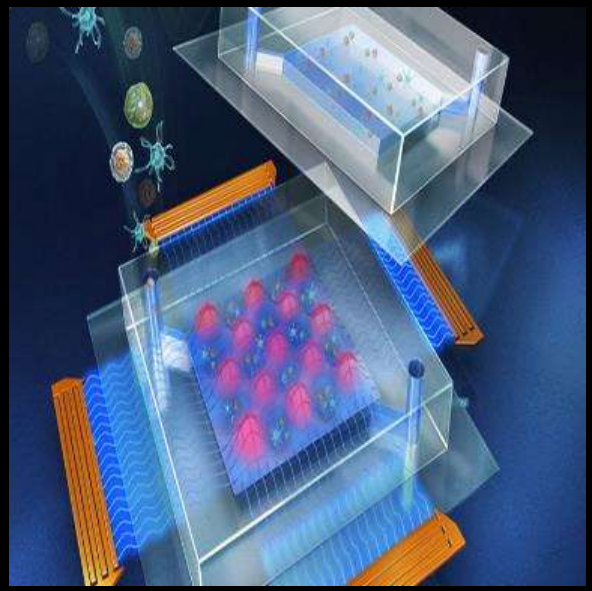
S. A. Klunberg, et al. (2016) Emerg. Inf. Dis. 22 eid 2210.151956

World Health Organization

Dr. Peter Salama,
Director

- **Emerging Diseases Clinical Assessment and Response Network (EDCARN): June 2016**
- **uncertain funding status**
- **unproven operational capabilities and coordination frameworks**

Faster Diagnosis Saves Lives: The Primacy of Early Detection and Preparedness Mobilization

Profile	Detect	Act
		
Genetic Signatures of Infectious Agents	Rapid Automated PON/POC Diagnostics	Real-time Situation Awareness and Decision Authority

Geodemographic Information Systems (GIS): Ground Zero Data

Comprehensive Front Line Sampling of Sentinel Species

Real-time Intelligence and Faster Preparedness

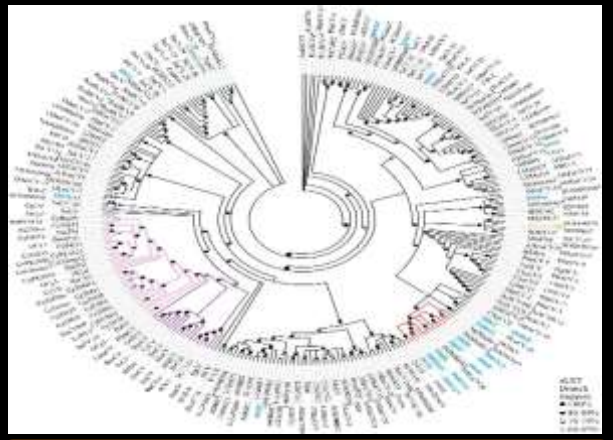
Microsoft

Project Premonition

bio-inspired capture

CO_2 or odorant lure and IR beam break

drone deployment for remote access

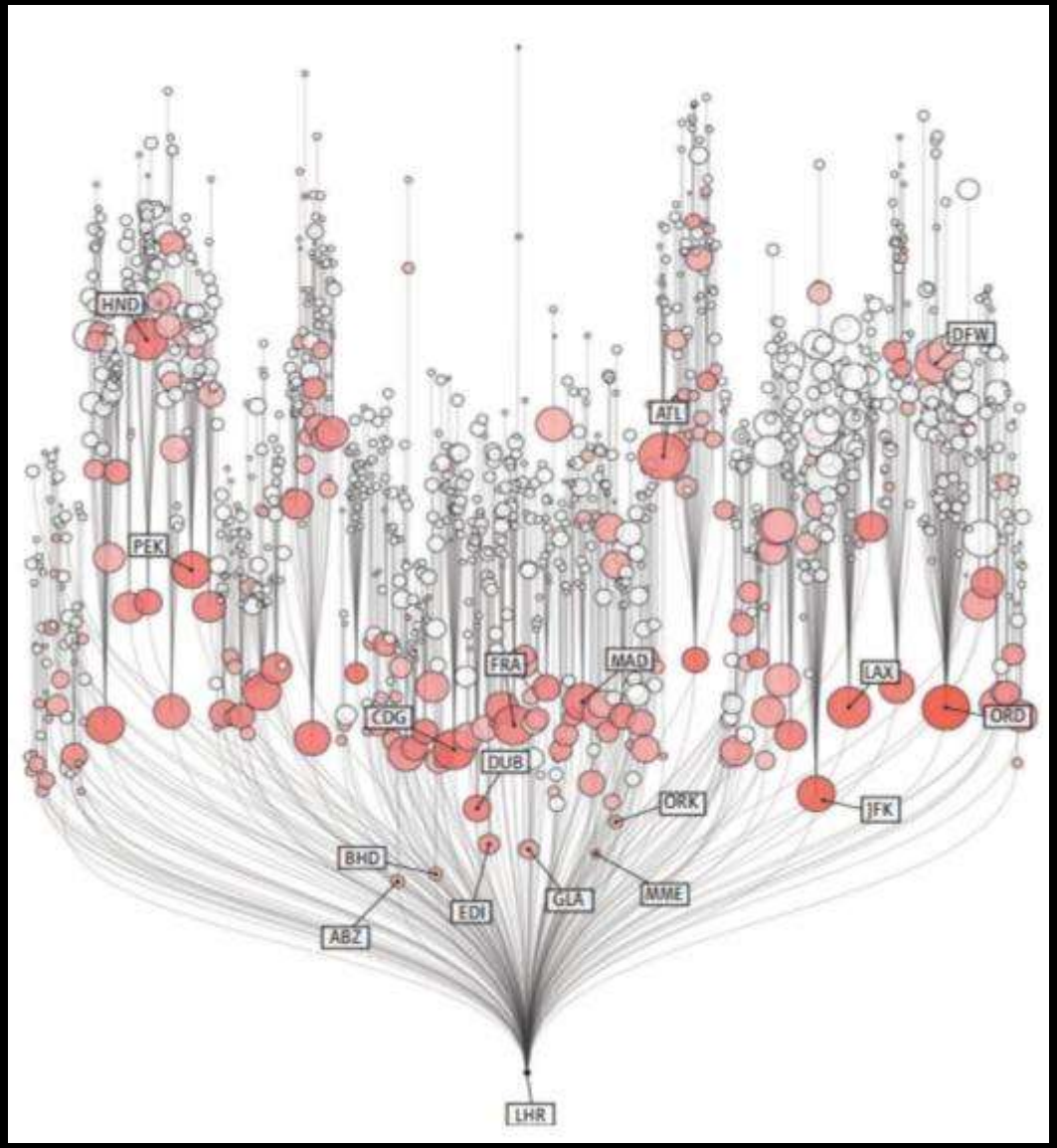


species identification by IR beam detection of different wing beat frequencies

metagenomic pathogen identification

Mobile Devices, Disease Tracking, Contact-Tracing and Education

Coming to an Airport Near You:



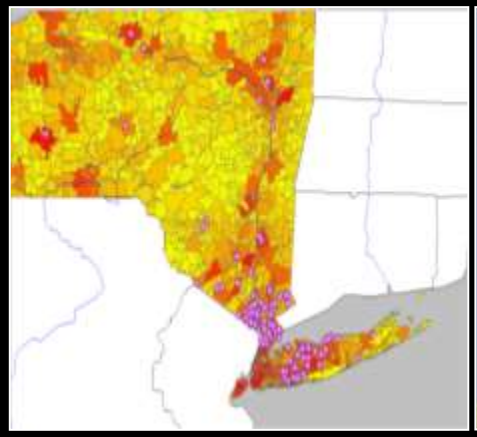
Modeling Airport Connectivities, Traffic and Distance Relationships and Implications for Epidemic Spread via the Global Aviation Network

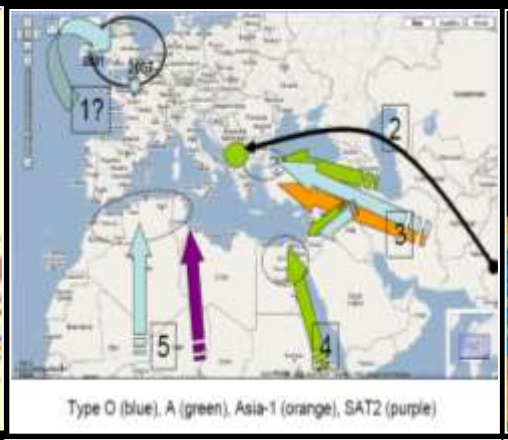
From: A. R. McLean (2013) Science 342, 1330

Geodemographic Information Systems(GIS): Mapping Disease Patterns and Modeling Trends

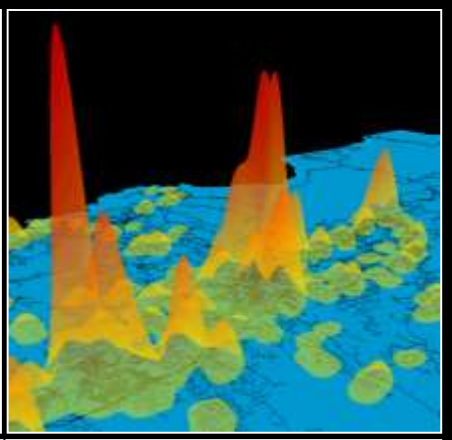
Anomaly Detection and Early Alert

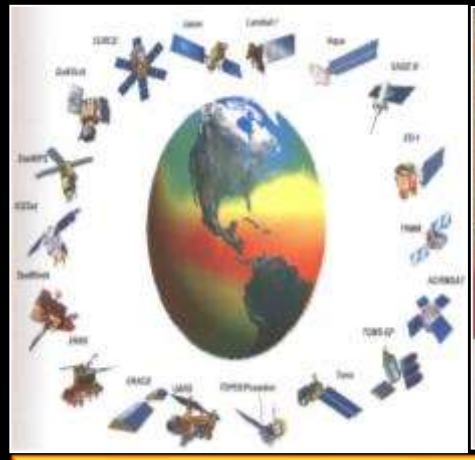
Disease Progression

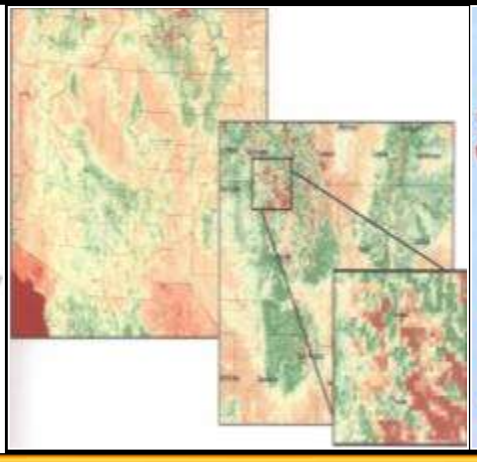


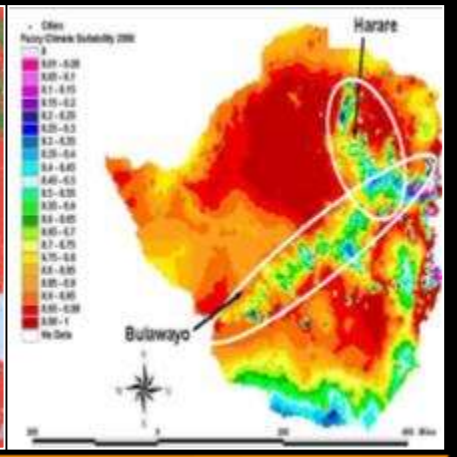


Type O (blue), A (green), Asia-1 (orange), SAT2 (purple)









Satellite Surveillance and Predictive Modeling of Disease Trends

Proceedings of a Workshop

BIG DATA AND ANALYTICS FOR INFECTIOUS DISEASE RESEARCH, OPERATIONS, AND POLICY

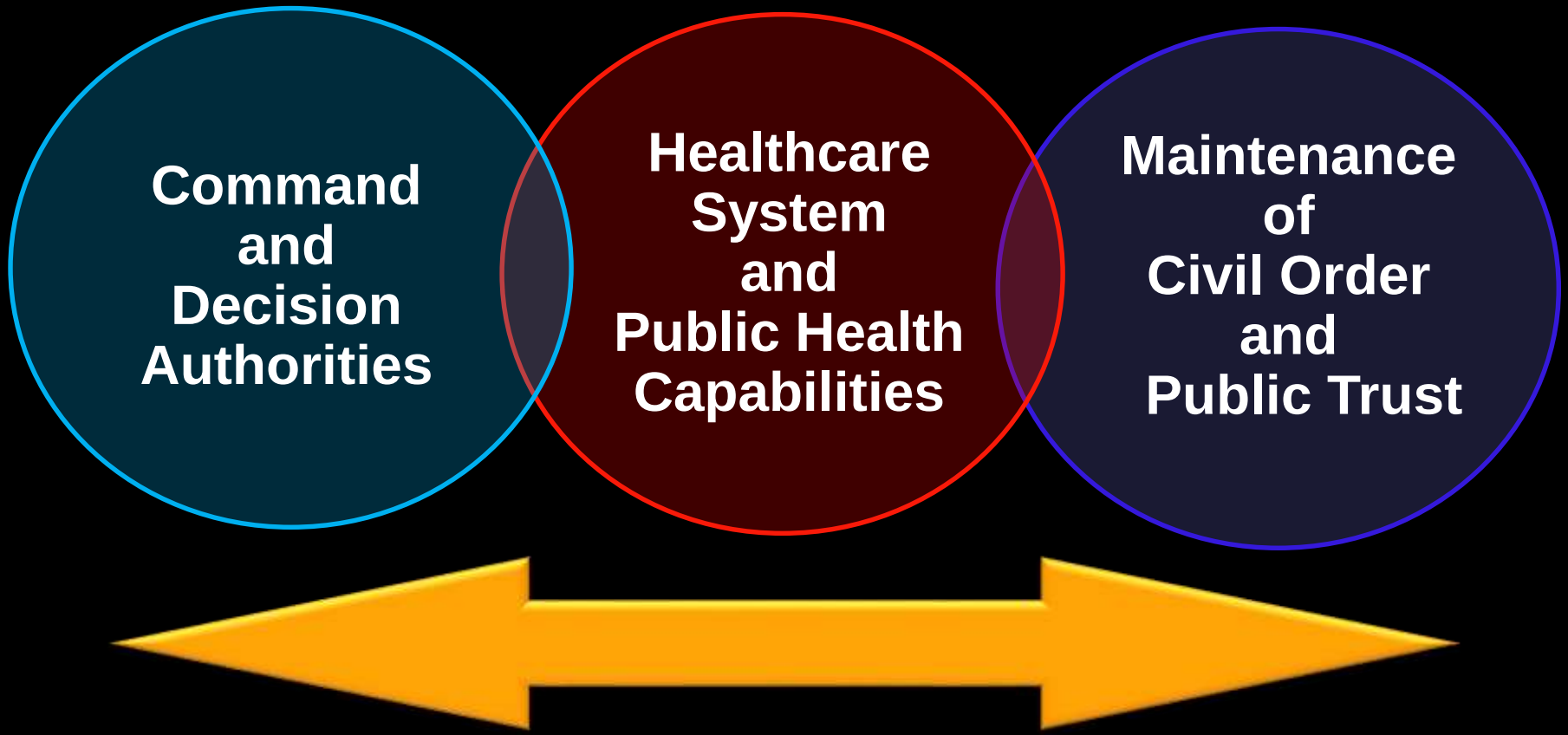
The National Academies of
SCIENCES · ENGINEERING · MEDICINE

Detection and Management of a Major Bioincident

Trade and Transport Make Every ‘Local’ Event a Potential ‘Global’ Risk

Need for Similar Response Capabilities Irrespective of Whether Incident is of Natural of Nefarious Origin (Terrorism)

The Three Core Components of Bioincident Management



- robust inter-operable communication networks for real-time situational awareness and rapid actions
- managing the media and the ‘worried well’
- transparency, credibility and public trust

Building Resilience: Complex Systems-Based Integration of Diverse Functions and Organization

Medical Consequence Management of Major Bioincidents

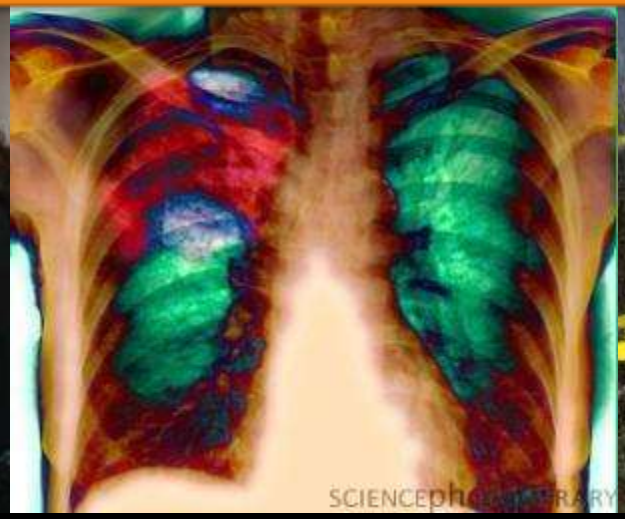
Key Success Factors

- tested incident management plan
- responder training and education
- command structure
  - demarcated roles, responsibilities, authority
  - robust communication channels
- single source POC for key interfaces
  - ground zero staff (multiple ground zeros in CBW)
  - emergency services and first responders
  - medical/public health
  - politicians and inter-agency coordination
  - conventional media and social media

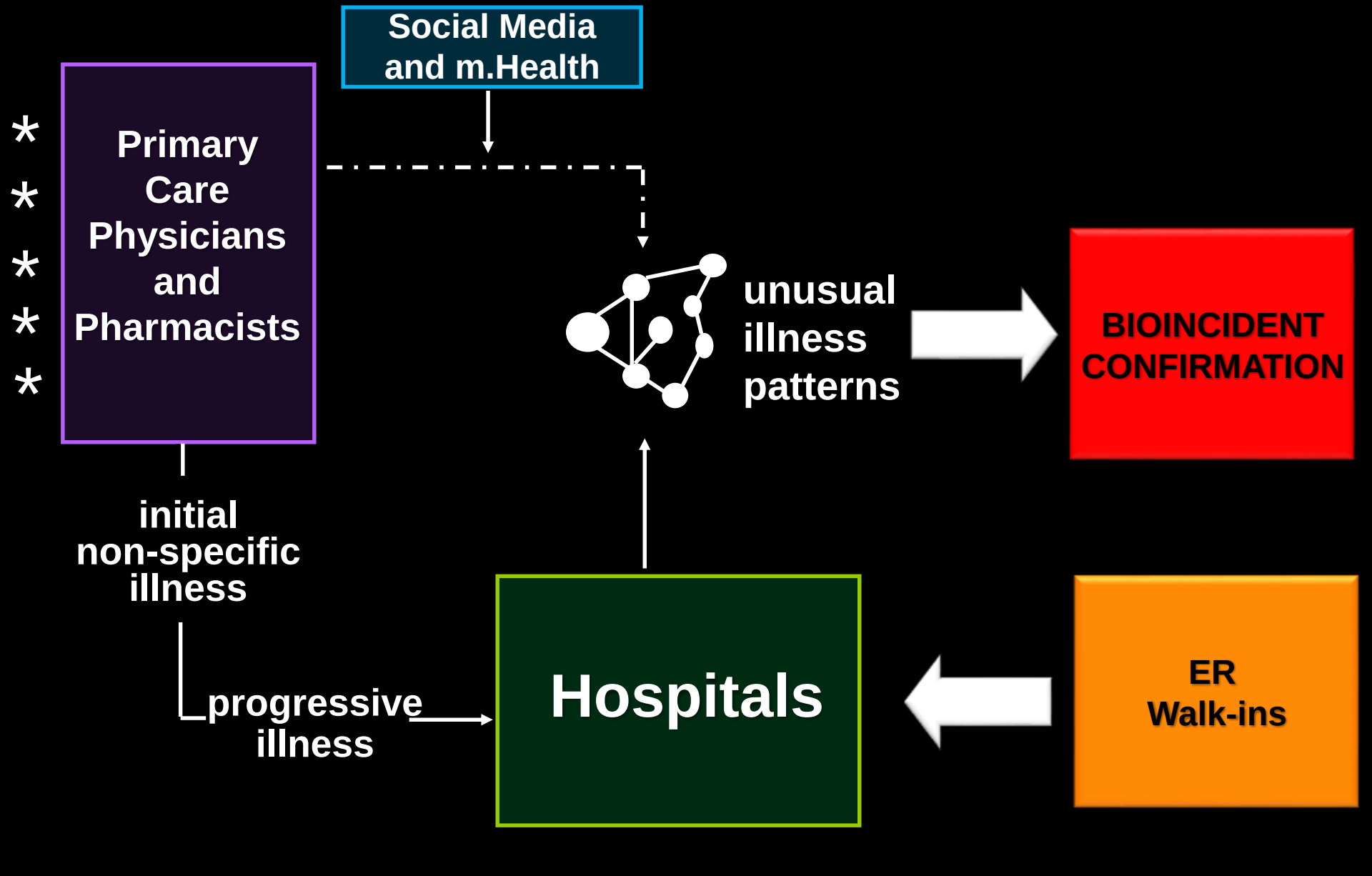
Detection of Infectious Disease Threats:

Not A Hazmat or Wide Area Sensor Network Solution

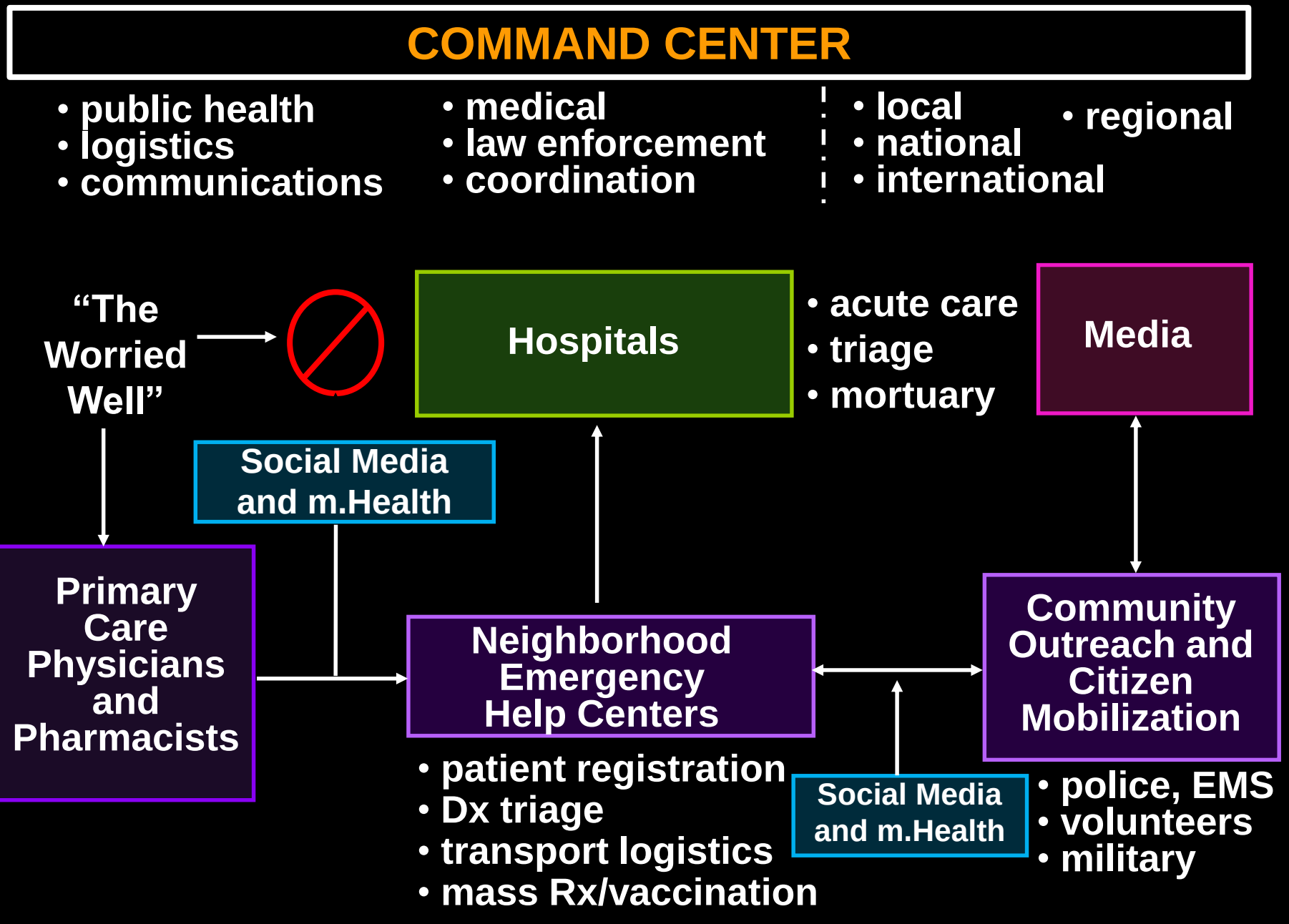
Emergency Rooms and Farms Will be the Front Line



The Lag Phase in Bioincident Detection



Consequence and Crisis Control in a Bioincident



Medical Consequence Management of a Major Bioincident

Logistics

- modular emergency services
  - expansion options and ‘surge’ resources
- non-healthcare sites for massive casualty management
- isolation and quarantine locations
- housing and welfare of staff (+ families)
- transfer of hospitalized patients to intermediate care facilities
- sites for distribution of medicines, food, water to public
- control of transport routes and supply chain logistics

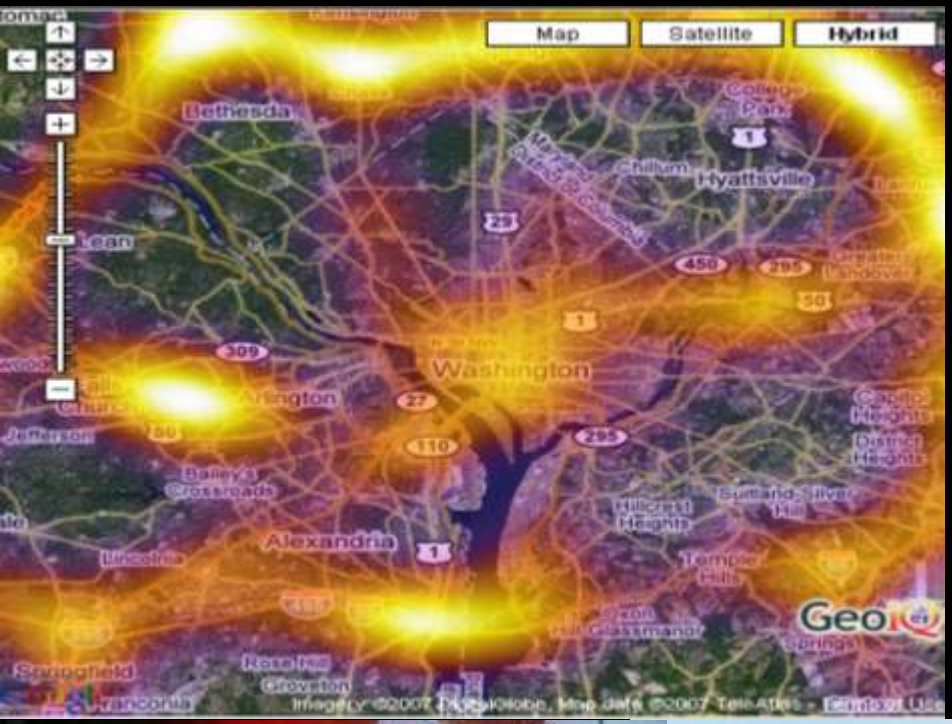
The Logistical Complexity of Large Scale Disinfection and Decontamination

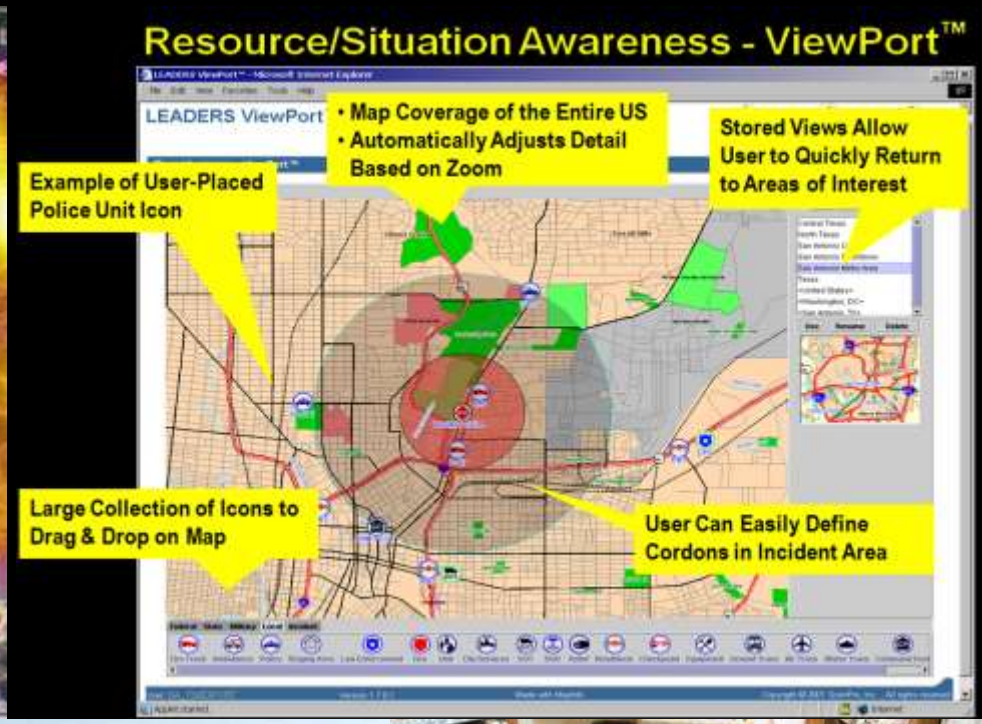
How do you go from decontaminating a few ambulatory, protected responders…

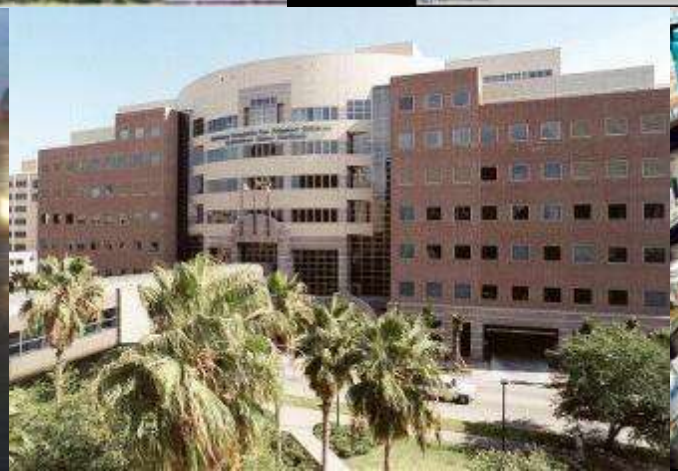
…to hundreds of incapacitated, unprotected civilians?

The Challenge of Vector Control

Use of GIS for Management of Population Movement, Healthcare Facilities and Supply Chains for Optimum Bioincident Control





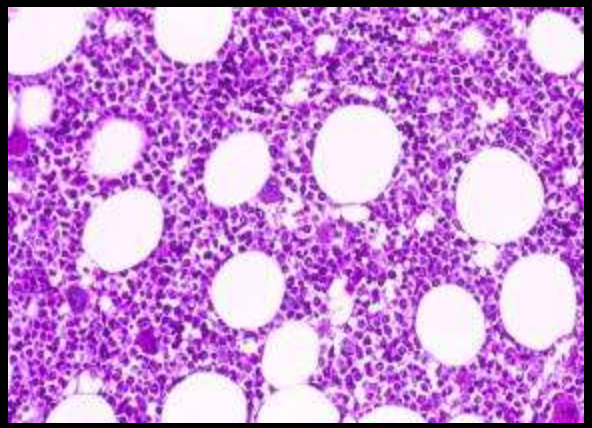


Vulnerability of Global, National and Local Supply Chains in a Major Epidemic/Pandemic

Medicines

- "just-in-time" supply networks
  - major hospitals 2 or 3 deliveries per day
- out-patient prescription drugs
  - insurance company limits on prescription volume (USA)
- majority of drug intermediates, excipients and final products sourced off-shore
- 95% generic drugs used in US (80% of total Rx) are made off-shore, primarily in PRC and India
- no national stockpile for routine prescriptions

Medical Countermeasures (MCMs) for Special Populations: Emergency Use Authorization

Children	Pregnant	Aged
		
		
Immunosuppressed	**Impaired Major Organ Function**	**ICU-Critical Care**

“For most of us design is invisible until it fails”
Bruce Mau

Who’s In Charge?

Who's In Charge?

- ill-defined responsibilities and accountabilities lead to operational confusion and dangerous neglect
- delusional to believe that optimum disaster response is a physician/health system-centric process
- crucial medical component but multi-disciplinary, multi-sector 'bigger picture' complexities require sophisticated integration of diverse expertise and proficient large scale logistics

The Fragmented Silos of USG: A Dangerous Vulnerability

DOD and Epidemic/Pandemic Disease

Risk in the Homeland

Posse Comitatus Applies But DOD as the Only USG Agency with the Logistical Resources to Coordinate a Robust Response to a Major Bioincident


OFFICE OF THE DIRECTOR OF NATIONAL INTELLIGENCE
UNITED STATES OF AMERICA


National Security Council


U.S. DEPARTMENT OF HOMELAND SECURITY


DEPARTMENT OF DEFENSE
UNITED STATES OF AMERICA

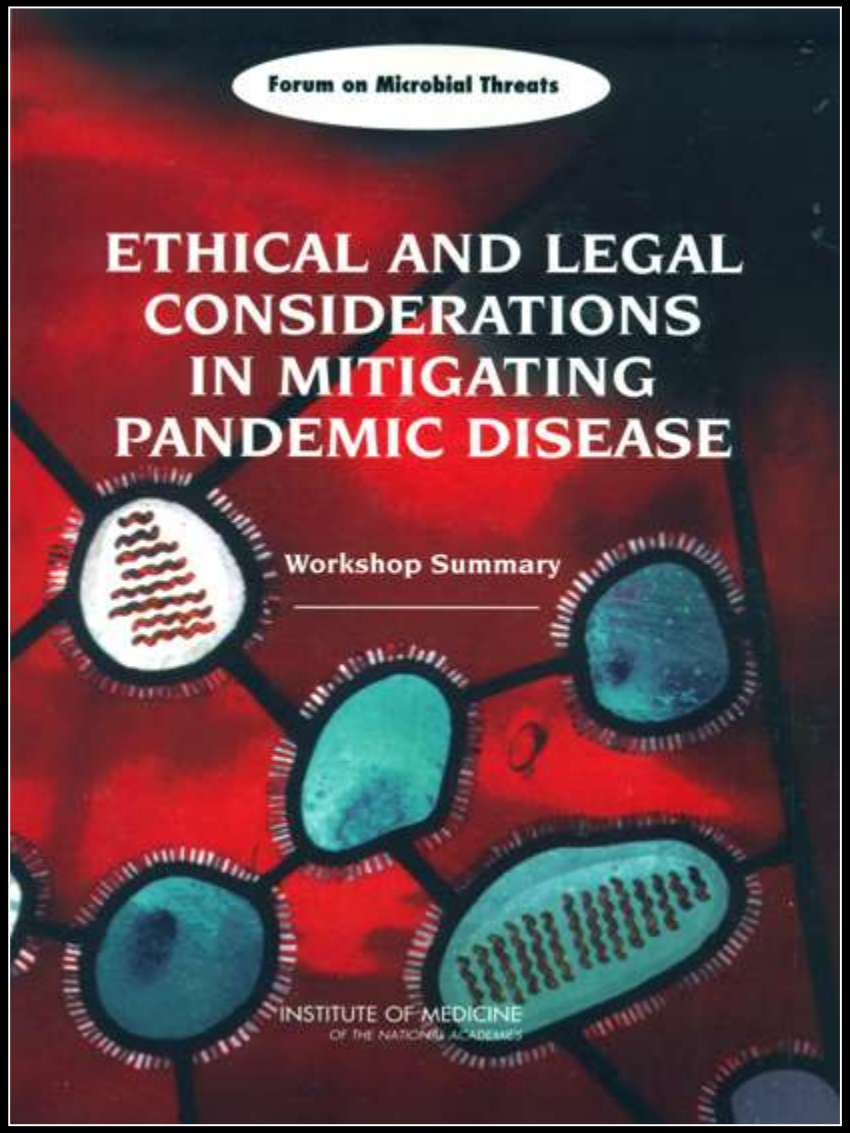

DEPARTMENT OF JUSTICE
FEDERAL BUREAU OF INVESTIGATION


DEPARTMENT OF HEALTH & HUMAN SERVICES
USA


Central Intelligence Agency
Top
Secret


NO
ENTRY

Legal Aspects of Public Health and Counter-Terrorism Actions to Contain Bioincidents

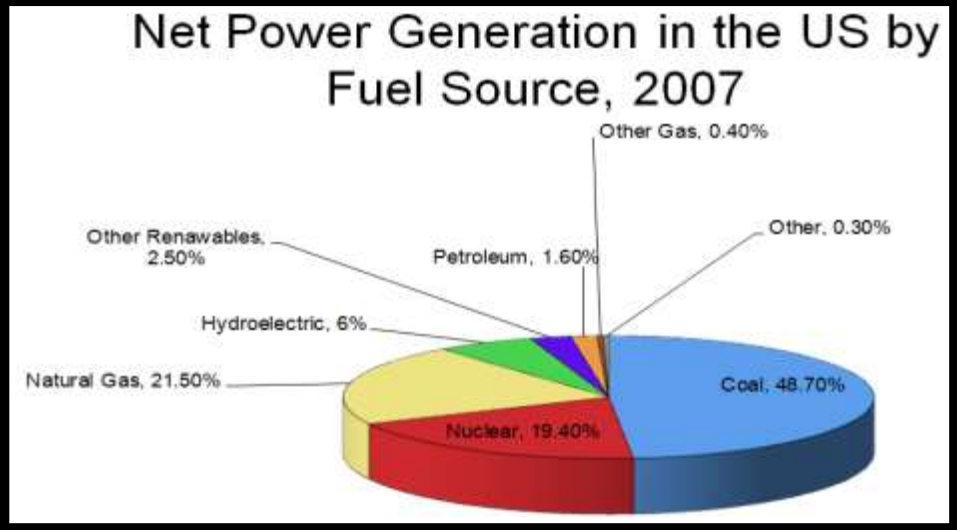


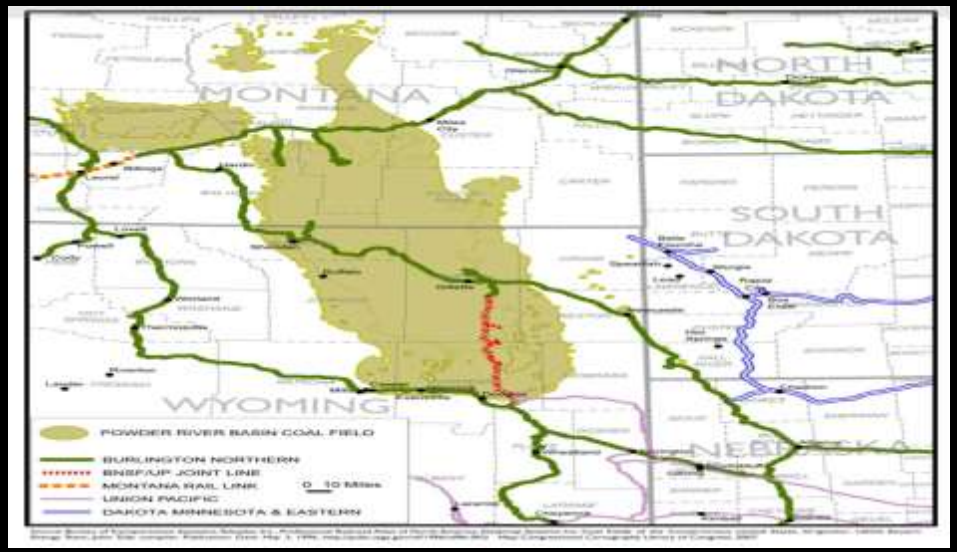
- suspension of civil liberties
- imposition of quarantine
- triage decisions and rationing
- mandatory medical examination and treatment
- mandatory treatment with unapproved drugs and vaccines
  - informed consent
  - indemnification
  - special populations

Sustaining Critical Systems and Infrastructure

Vulnerability of Global, National and Local Supply Chains in a Major Epidemic/Pandemic

Energy



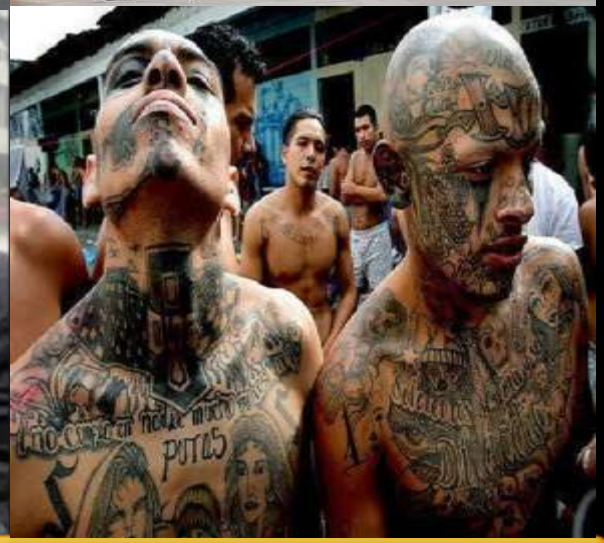


Control of Population Movement and Supply Chain Networks

DOD Mobilization in Ebola Virus Epidemic: West Africa 2014

Breakdown of Civil Order and Incident Management

Constrained Mobility



Constrained Access

The Critical Role of Communication in a Major Bioincident

- Managing the “Worried Well”
- Authoritative and Timely Information
- Trust

“Aliens Have Landed”

Fear and Distrust:
Proliferation of Myth and Misinformation

- deliberate spread by Governments
  - delay elections
  - genocidal assault on Kissi tribe
- deliberate spread by healthcare workers (HCW)
- treatment centers as organ harvesting operations for western countries
- attacks on HCW and contact tracers

Amplifying Fears and Resentment

forceful capture of individual who fled from treatment center

military enforcement of quarantine zone and public hostility

Political Media Sensationalism, Public Fear and Irrational Populist Decisions by Political Leadership

Informing the Public: A Critical and Unenviable Challenge

- media sensationalism and public panic
- pressure on governments to make illogical but politically expedient decisions
- in a severe outbreak the shock factor from any major level of fatalities will be unprecedented in modern peace times with unpredictable consequences for public responses
- unpredictable unilateral decisions by other governments, restricting trade, travel and shipment of goods
- extended supply chains might break down completely

The News Was Fake but the Regret Is Real Over a Movie's Ad Campaign

Trump Orders CDC to Remove all Vaccination Related Information from Website - Salt Lake City Guardian

According to sources, the Trump administration has instructed the CDC (Centers for Disease Control and Prevention) to remove all vaccination related material…

SALTLAKECITYGUARDIAN.COM | BY SAM EDISON

The New York Times Business FEB. 17, 2017

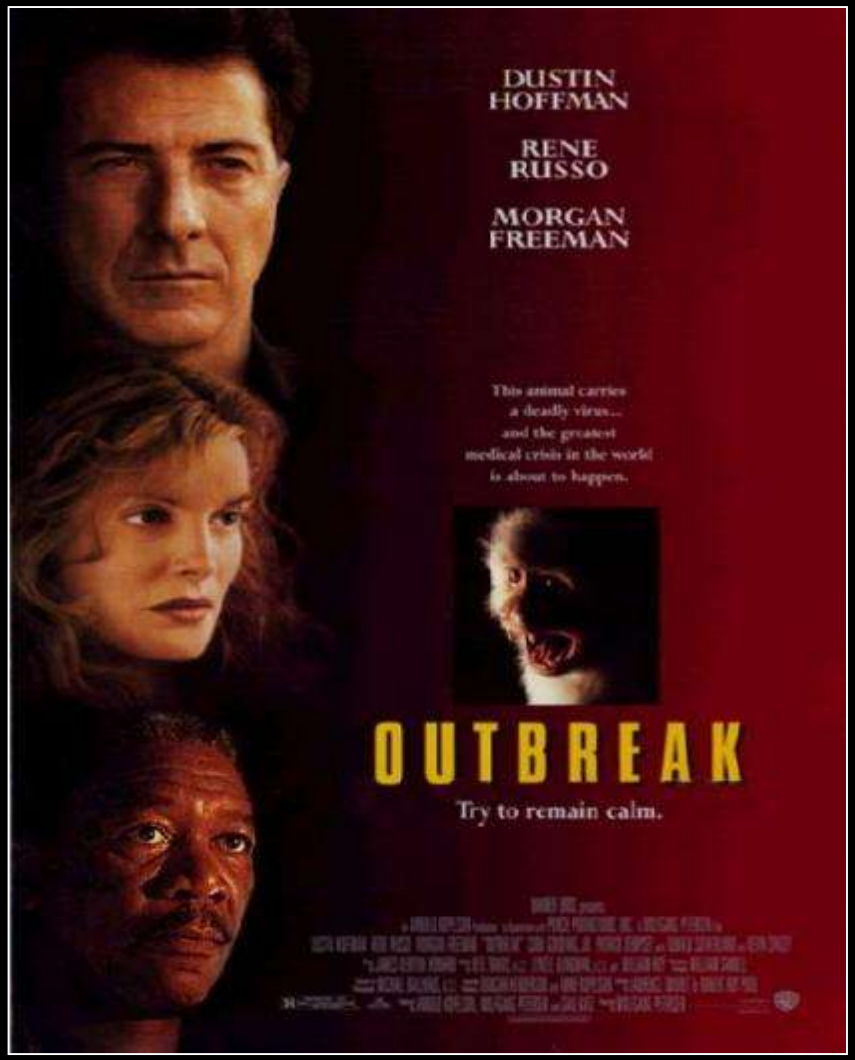
Containing Epidemics Without Effective Drugs or Vaccines

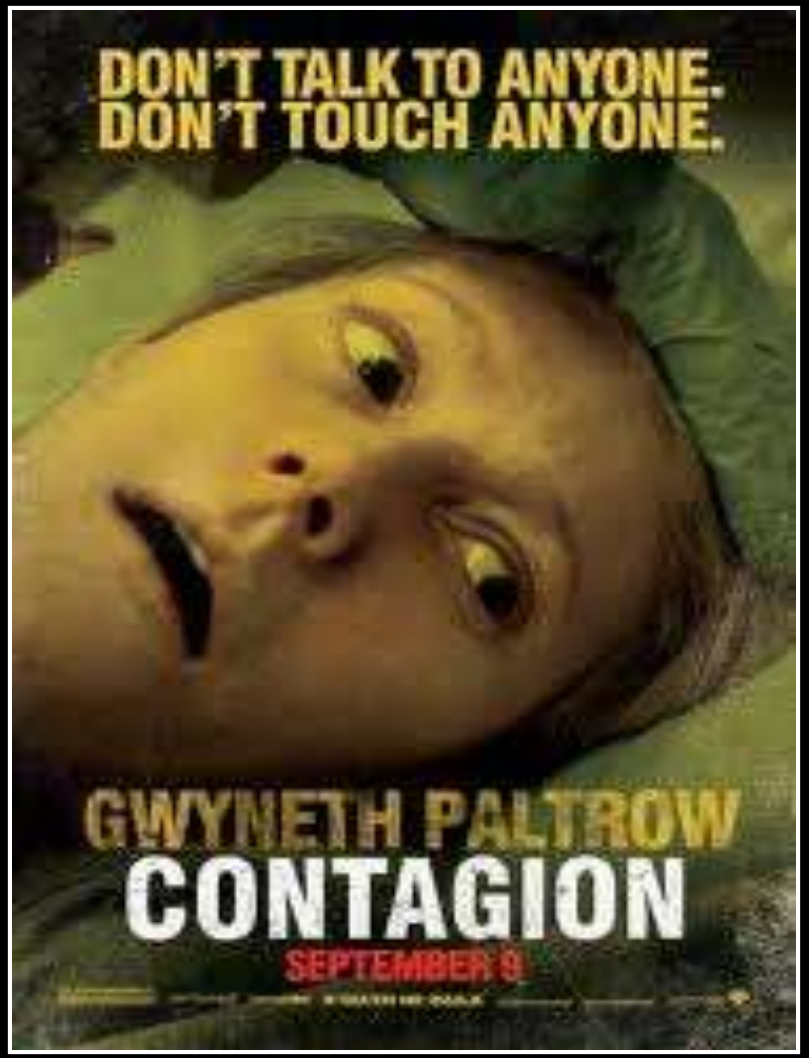
Notice the Resemblance?
Hygiene and Quarantine as the Only Controls
Absent Drugs or Vaccines

Bubonic Plague Physician 15th Century	Ebola, Liberia 21st Century
	

Bad Bugs
and
Few New Drugs

Hollywood Doesn't Live in the Real World (Really?)





….. and then a technical miracle cure occurs with dramatic rapidity

….. and always created by an individual scientific genius

Drug Discovery and Development: One of the Most Complex Intellectual and Logistical Exercises Undertaken by Modern Industry

- $750 million to $2 billion R&D cost/drug
- 9-15 year R&D cycle
- market incentives
  - vaccines vs. Viagra
  - antibiotics vs. alopecia
  - diseases of the developing world
  - EIDs of epi(pan)demic potential

Drug Discovery and Development: One of the Most Complex Intellectual and Logistical Exercises Undertaken by Modern Industry

"Fewer countries have discovered, developed and registered drugs to an international standard, than have developed atomic bombs"

- Chris Hentshel

Medicines for Malaria Venture: Lancet (2004) 363, 2198

NO ESKAPE!: Resistant Bugs and Few New Drugs

- increasing resistance in G^+ and G^- pathogens in hospital and community settings

- the **ESKAPE** pathogens
  - ***E**nterococcus faecium*
  - ***S**taphylococcus aureus*
  - ***K**lebsiella pneumoniae*
  - ***A**cinetobacter baumanii*
  - ***P**seudomonas aeruginosa*
  - ***E**nterobacter species*

Responding to Agent-X:

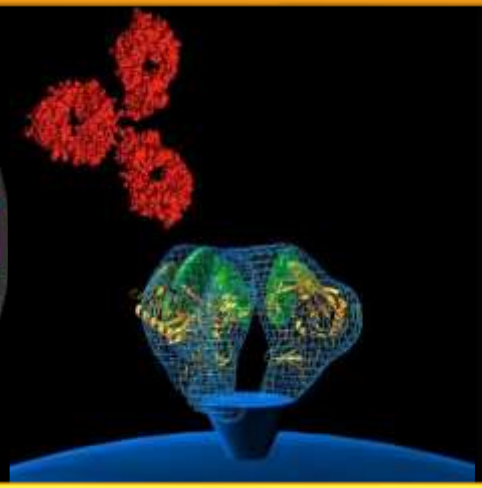
The Imperative for New Technology Approaches to Vaccine Development

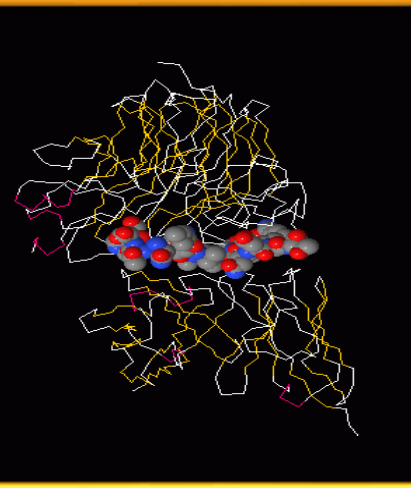
Speed: Reduce Vaccine Development Cycle from Years to Weeks

Scalability: From Millions of Doses to Billions

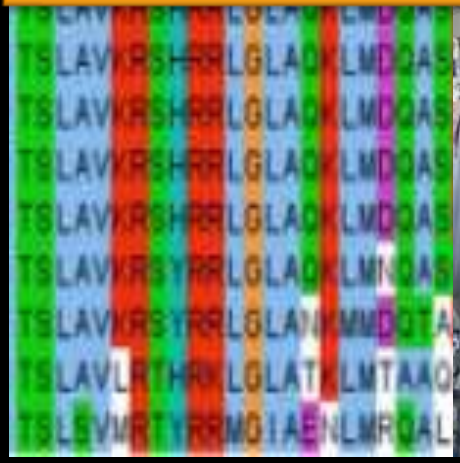
Combating Agent –X:
Agile Adaptive Manufacturing for Rapid Preparedness Against Novel Infectious Agents

From Pasteur to Computationally Predicted Epitopes





From Biological to Chemical Vaccines



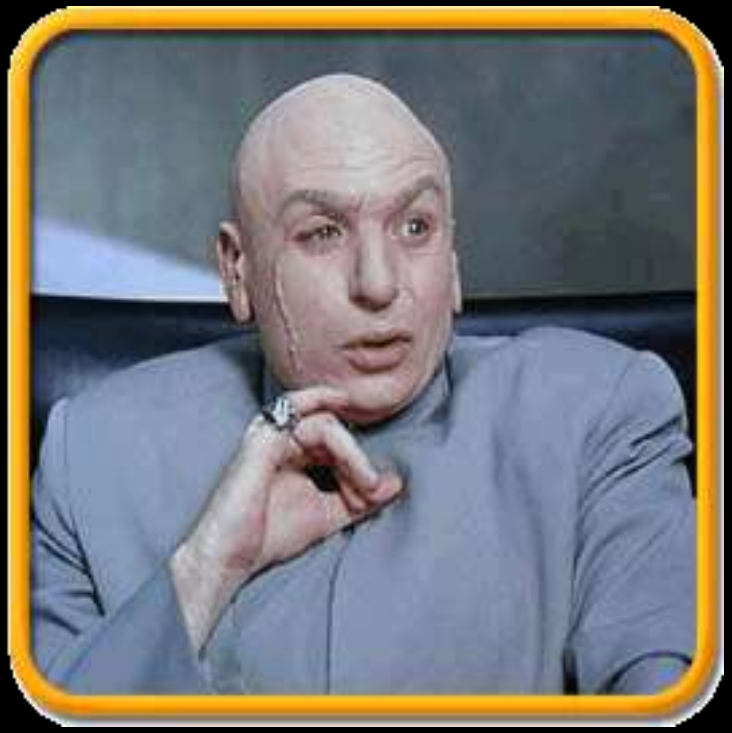
Who Pays for Preparedness?

The Obligate Role of Private-Public Partnerships in Biosecurity Policy

The Coalition for Epidemic Preparedness Innovations (CEPI)

- launched at WEF, Davos, January 2017
- 200 organizations
- develop 4-6 candidate vaccines to end of Phase 2 by 2021
  - non-Zaire strains(s) of Ebola
  - Lassa Fever
  - MERS-CoV
  - Nipah
- preclinical status of candidate vaccines
  - Lassa (7), Nipah (20), MERS-CoV (8 plus 8 in Phase 1)

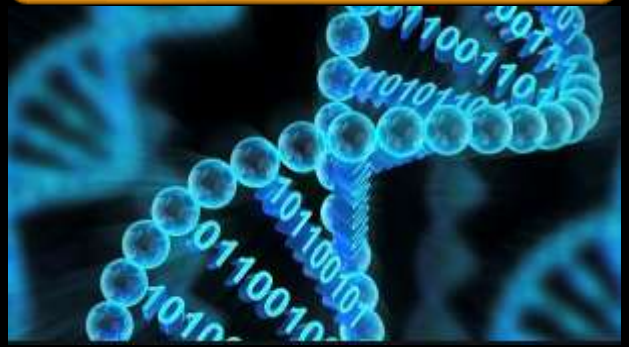
Future Trajectory Trends and Threat Expansion



New ‘Dual-Use’ Technologies and Engineered Biothreats

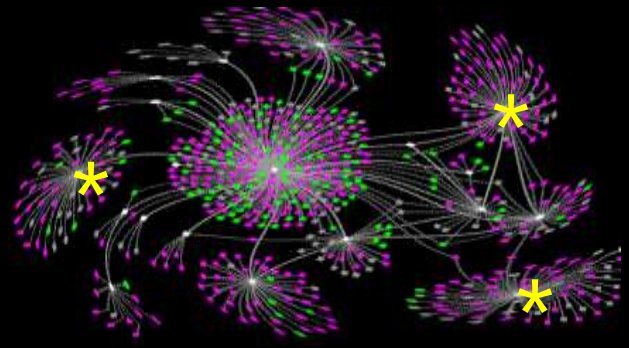
New Technologies and Increased Complexity of Dual-Use Issues in Biosecurity: Synthetic Biology, Genome Editing and Manipulation of Biological Circuits

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 circuit in any organ

mapping neural circuitry and brain – machine interfaces

accelerating technological diffusion

Dual-Use Research of Concern (DURC)

Nature (2012) 482, 153

COMMENT

INFLUENZA Further explanation of the NSABB recommendations p.158

PRIMATES Imitation and social learning in apes p.159

HISTORY John Dee's swerving of scientific magic in the Elizabethan court p.160

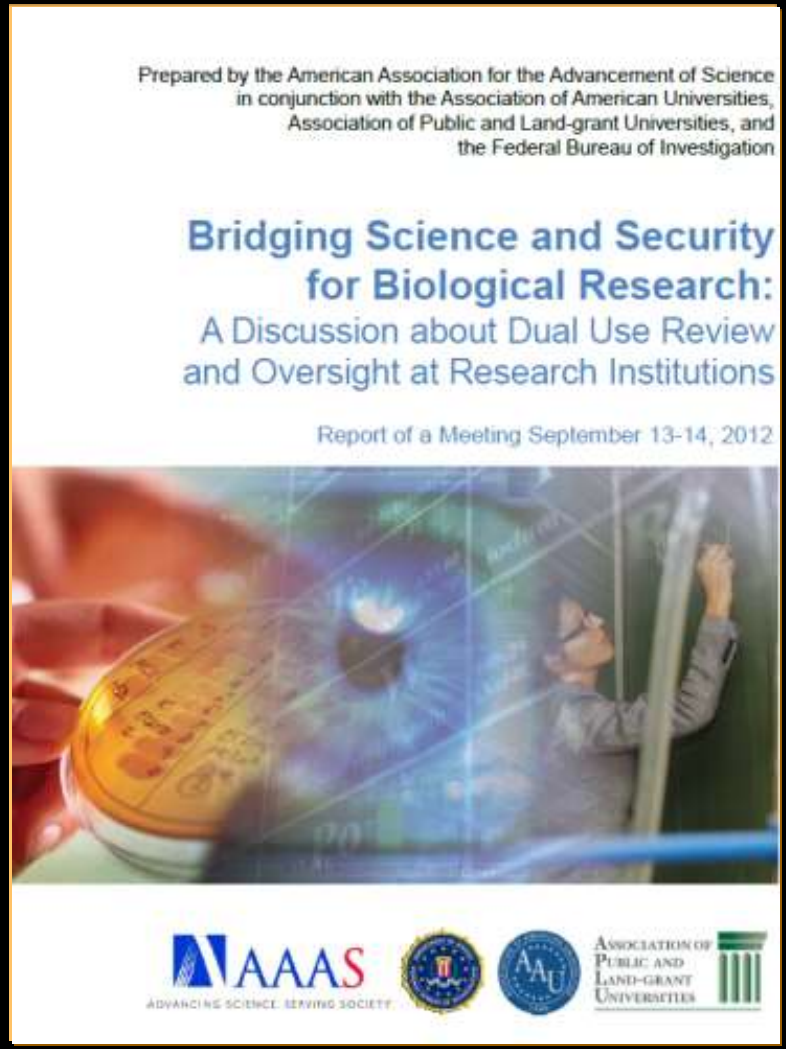
CONSERVATION Trade in whale 'quotas' may be insufficient protection p.162

M. COSTANTINI/NATURE

Pathogenic H5N1 avian influenza has led to the culling of hundreds of millions of birds. A human-transmissible form could have much worse consequences.

Adaptations of avian flu virus are a cause for concern

Members of the US National Science Advisory Board for Biosecurity explain its recommendations on the communication of experimental work on H5N1 influenza.



Prepared by the American Association for the Advancement of Science in conjunction with the Association of American Universities, Association of Public and Land-grant Universities, and the Federal Bureau of Investigation

Bridging Science and Security for Biological Research:

A Discussion about Dual Use Review and Oversight at Research Institutions

Report of a Meeting September 13-14, 2012

AAAS ADVANCING SCIENCE, SERVING SOCIETY

Association of Public and Land-grant Universities

Dual Use Research of Concern(DURC) With Pathogenic Microorganisms

- increase virulence
- increase agent transmissibility/dissemination/ persistence
- engineer resistance to countermeasures
- evasion of detection/diagnosis systems
- compromise host immunity and increase susceptibility
- alter host range and/or tissue tropism
- reconstitute eradicated or extinct agent
- de novo design of synthetic organisms with these traits

Synthetic Biology, Genome Editing and National Security: The Ultimate Dual-Use Technology for Modification of Biological Systems?

Statement for the Record

Worldwide Threat Assessment
of the
US Intelligence Community

Senate Select Committee on Intelligence

James R. Clapper

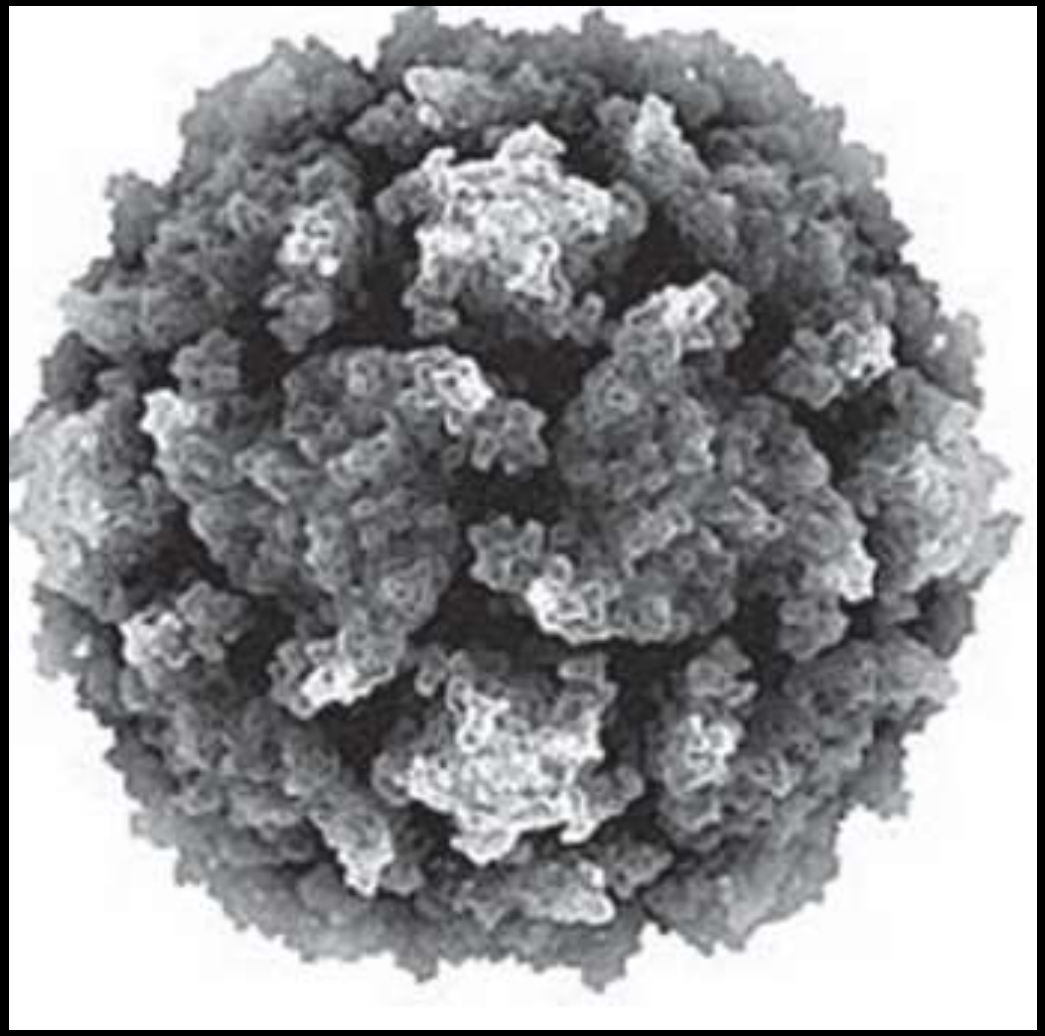
Director of National Intelligence

February 9, 2016

Technology Diffusion, Automation, Simplification and Cost Reduction

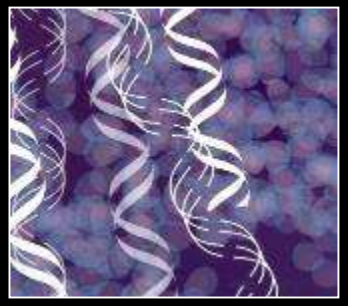
New Oversight Mechanisms and International Harmonization

C332,652; H492, 388; N98, 245; O131, 196 P7, 501; S2,340
(a.k.a. poliovirus)



ATTGACTGCAA ……(design specifications)

The Expanded Dimension of the ‘Bio’ Challenge

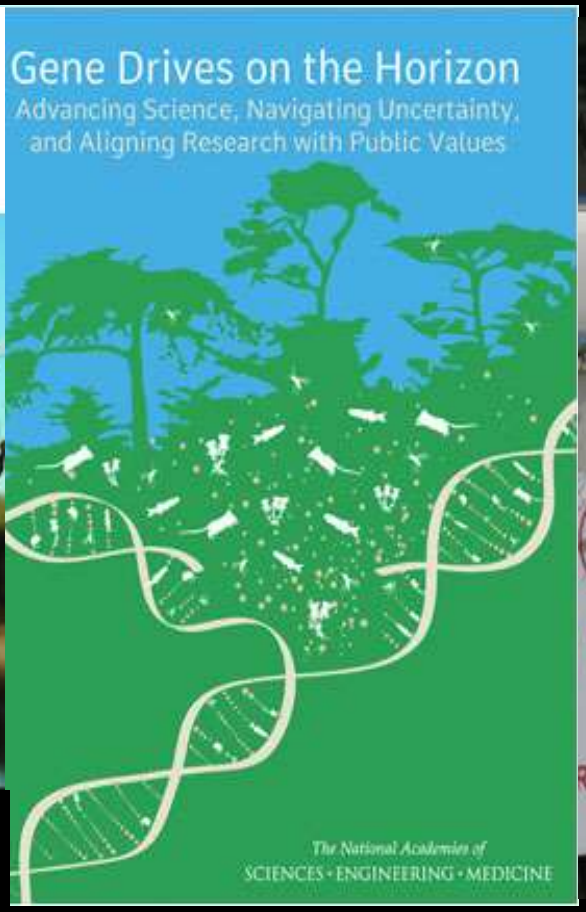


- thinking beyond ‘bio’ as just infectious agents
- systems biology
  - targeted disruption of ANY body function
  - novel C and B threats
- synthetic biology
  - exploring biospace: designing new life forms
  - designer organisms to attack materials/infrastructure

Dual-Use Research of Concern (DURC): National Science Advisory Board for Biosecurity (NSABB)

- covers only US federally funded research
- corporate and philanthropic research not covered
- confined to research on select agents
- limited to 7 types of experiments (cf. Fink report 2004)
- most journals and universities lack stringent oversight review
- many academics lack training in translational science and risk stratification


nature
REVIEWS
March 2018 volume 17 no. 3
www.nature.com/reviews
GENETICS
DRIVEN TO DESTRUCTION
Gene drive systems for controlling insect populations


Gene Drives on the Horizon
Advancing Science, Navigating Uncertainty, and Aligning Research with Public Values
The National Academies of
SCIENCES • ENGINEERING • MEDICINE

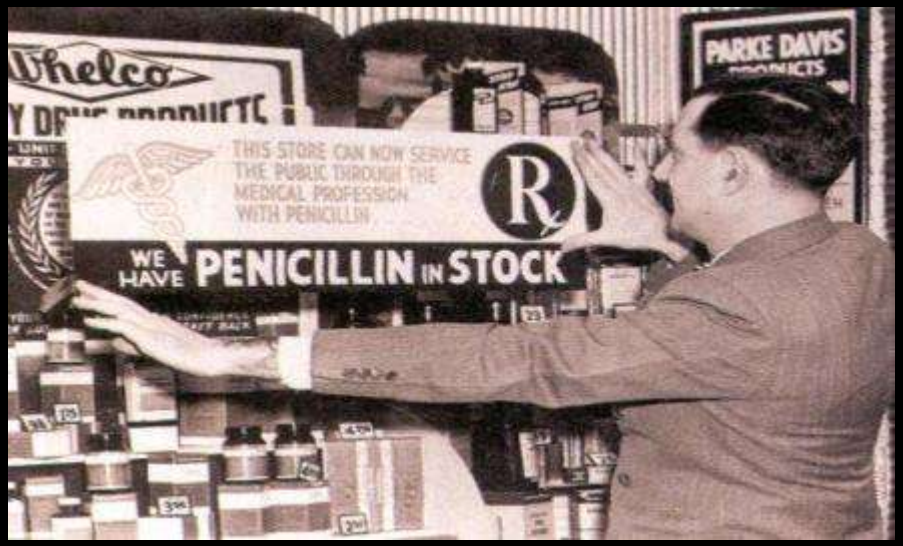

WE ARE
NOT
YOUR
EXPERIMENT
NO
CONSENT
TO
RELEASE OF GENETICALLY
MODIFIED MOSQUITOES

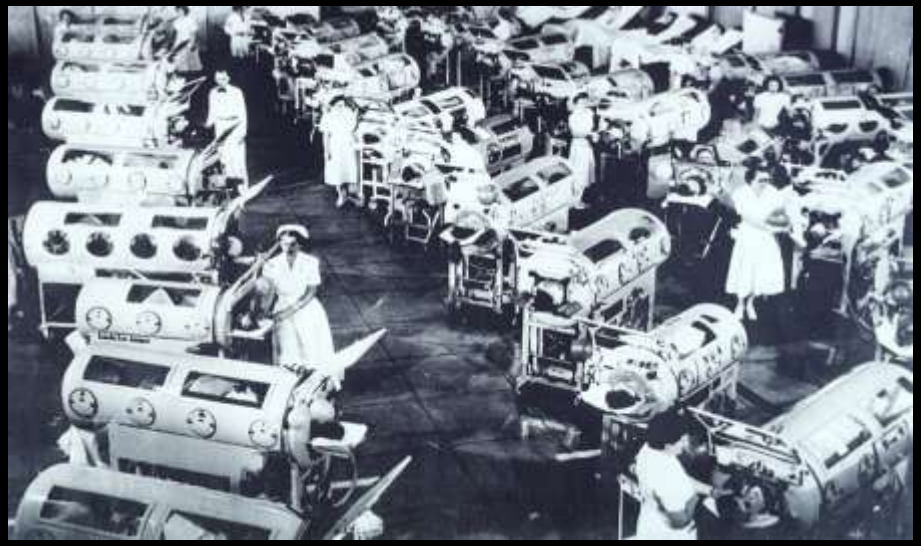
Out of Sight: Out of Mind!

The Cocoon of Protection: How Quickly We Forget Past Epidemics and Their Toll

Reduced Investment in Public Health and Biosecurity: A False Economic Gain

Comfort and Complacency: The Enemies of Vigilance and Preparedness





A NATIONAL BLUEPRINT FOR BIODEFENSE:

LEADERSHIP AND MAJOR REFORM NEEDED TO OPTIMIZE EFFORTS

BIPARTISAN REPORT OF THE BLUE RIBBON STUDY PANEL ON BIODEFENSE

October 2015

Institutional Sponsors: Hudson Institute — Inter-University Center for Terrorism Studies

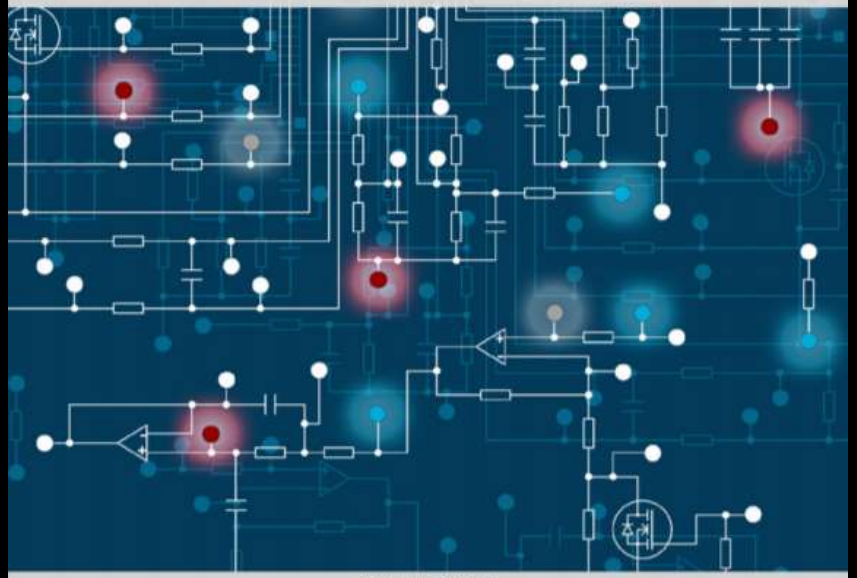
BIODEFENSE INDICATORS

BLUE RIBBON STUDY PANEL ON BIODEFENSE

ONE YEAR LATER, EVENTS OUTPACING FEDERAL EFFORTS TO DEFEND THE NATION

A Bipartisan Report of the Blue Ribbon Study Panel on Biodefense

December 2016



Institutional Sponsors

Hudson Institute — Potomac Institute for Policy Studies — Inter-University Center for Terrorism Studies

Building Robust Biosecurity Preparedness Capabilities

- major vulnerabilities exist across the full spectrum of biosecurity
  - pre-emptive detection and interdiction
  - rapid diagnosis at point-of-need
  - healthcare resources for mass casualty management
  - drug and vaccine coverage (spectrum, quantity, protracted manufacturing cycle)
  - outdated public health laws (national/international)
  - emergency control of media/commerce

“Is global health intended to improve population to health, or to be a diplomatic tool for countries to exert their soft power?

The securitization of global health
is little more than fear mongering.
…..(and) justifies government violations
of human rights in the name of health.”

Andre Heller Perache
Head of Programmes, MSF
cited in Lancet 2017 389, 892

The Curse of Contemporary Governance: 'Quick Fixes' and the Retreat from Complexity

- society increasingly "cocooned" from complexity and risk
- pervasive and dangerous scientific illiteracy among legislative and policy makers about biosecurity
- "quick fixes": unidimensional, short term policies that do not address long term, multidimensional complexity
- public policy defined increasingly by length of legislative terms
- influence of media in shaping public policy priorities and potential compromise of operational preparedness

Munich Security Conference 2017

Building Robust Defenses for Biosecurity

- governments must accord higher priority to ‘biosecurity’ as a integral component of national security and foreign policy

- (re)building a national and international infrastructure for the surveillance, diagnosis and containment of infectious diseases is fundamental to future protection against major instabilities triggered by infectious agents, whether of natural or malevolent origins

Biosecurity

one health:
humans
animals
ecosystems

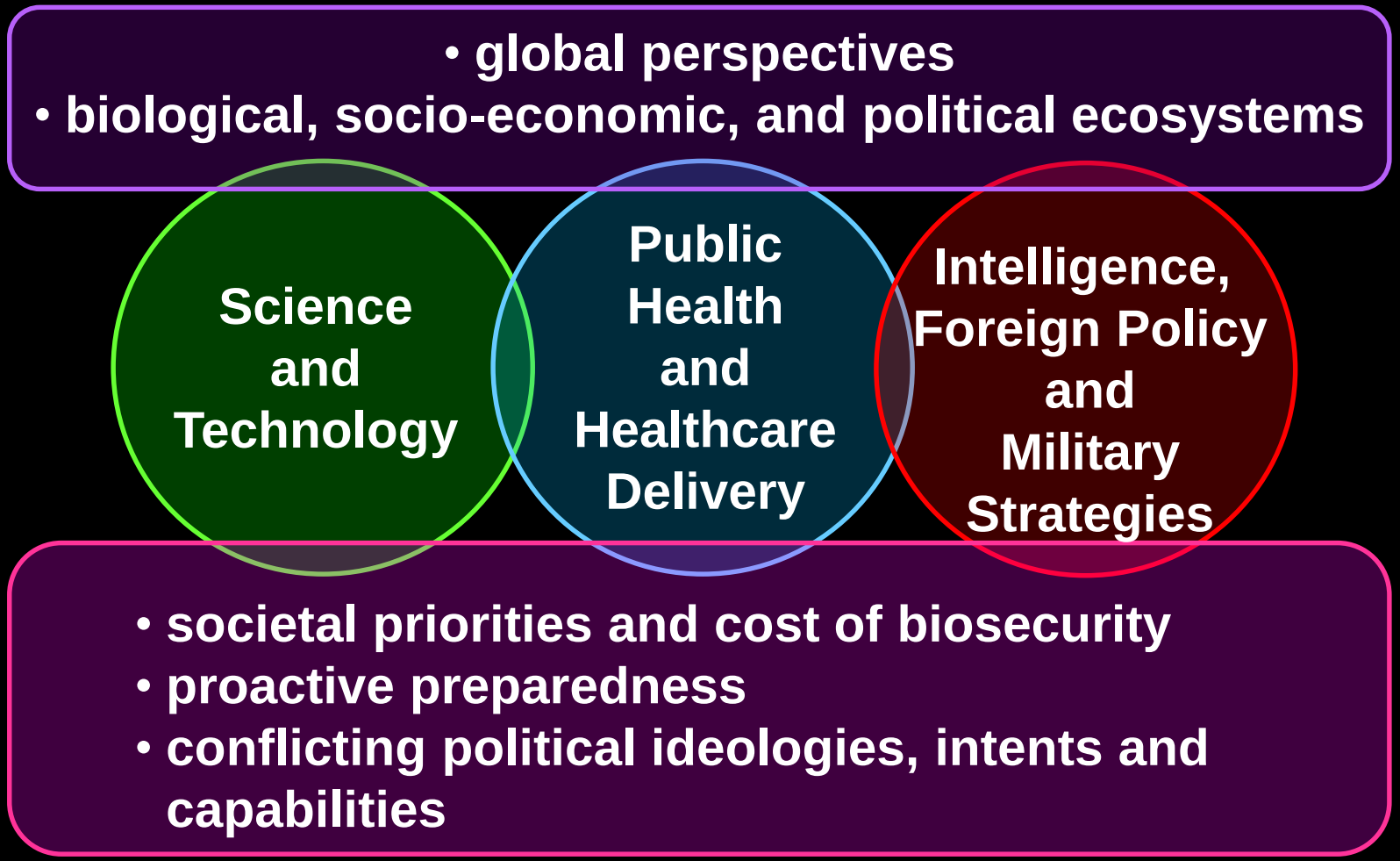
urbanization,
environmental
sustainability
and
depletion of
non-renewable
resources

economic
and
political
instabilities
and
escalating
conflict risk

terrorism
and
international
security

**International Engagement,
Commitment and Political Resolve**

Biosecurity:
A Classic Complex System of Systems Challenge



“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)

Slides available @ http://casi.asu.edu/