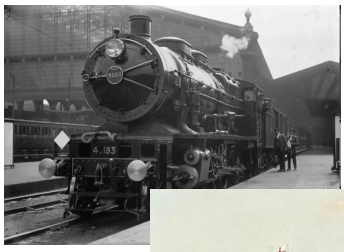
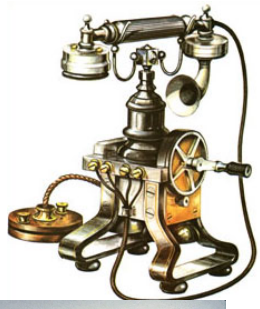
Elizabeth R. Griffin Program
Georgetown University Medical Center

All Appropriate Measures: Biosafety and Biosecurity in an Era of Global Health Threats

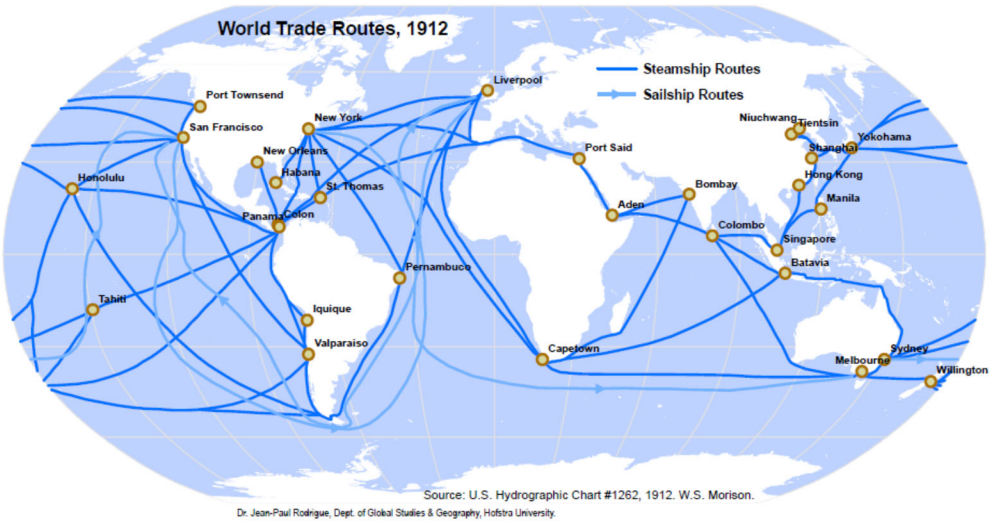
Griffin Lecture Award
Absa International 61st Annual Biological Safety Conference, 12-17 Oct 2018
Charleston, SC

Something Old





ERG
Safer Together



https://transportgeography.org/?page_id=1179

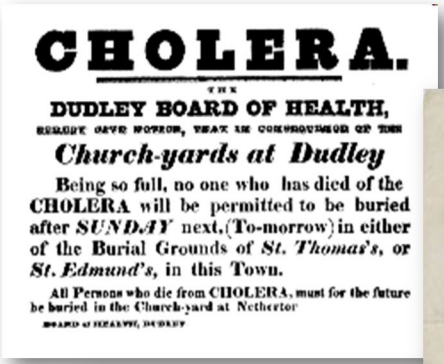
3

25 January 2012

Mystery and terror

"…(t)he cholera was something outlandish, unknown, monstrous; its tremendous ravages, so long foreseen and feared, so little to be explained, its insidious march over whole continents, its apparent defiance of all the known and conventional precautions against the spread of epidemic disease, invested it with a mystery and a terror which thoroughly took hold of the public mind, and seemed to recall the memory of the great epidemics of the middle ages."

– W. T. Gairdner, 1832



CHOLERA.

THE

DUDLEY BOARD OF HEALTH,

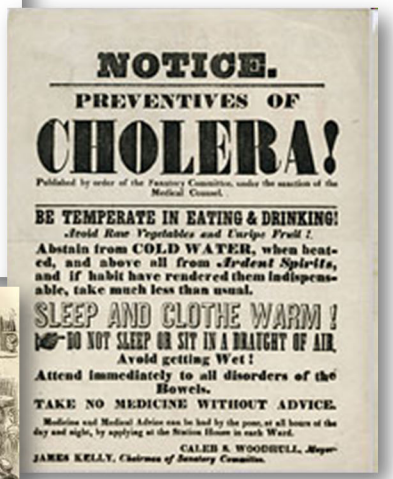
HEREBY GIVE NOTICE, THAT IN CONSEQUENCE OF THE

Church-yards at Dudley

Being so full, no one who has died of the **CHOLERA** will be permitted to be buried after ***SUNDAY*** next, (To-morrow) in either of the Burial Grounds of ***St. Thomas's***, or ***St. Edmund's***, in this Town.

All Persons who die from CHOLERA, must for the future be buried in the Church-yard at Netherton

BOARD of HEALTH, DUDLEY



NOTICE.

PREVENTIVES OF

CHOLERA!

Published by order of the Sanatory Committee, under the sanction of the Medical Counsel.

BE TEMPERATE IN EATING & DRINKING!

Avoid Raw Vegetables and Unripe Fruit!

Abstain from **COLD WATER**, when heated, and above all from ***Ardent Spirits***, and if habit have rendered them indispensable, take much less than usual.

SLEEP AND CLOTHE WARM!

DO NOT SLEEP OR SIT IN A DRAUGHT OF AIR.

Avoid getting Wet!

Attend immediately to all disorders of the Bowels.

TAKE NO MEDICINE WITHOUT ADVICE.

Medicine and Medical Advice can be had by the poor, at all hours of the day and night, by applying at the Station House in each Ward.

CALEB S. WOODHULL, *Mayor*

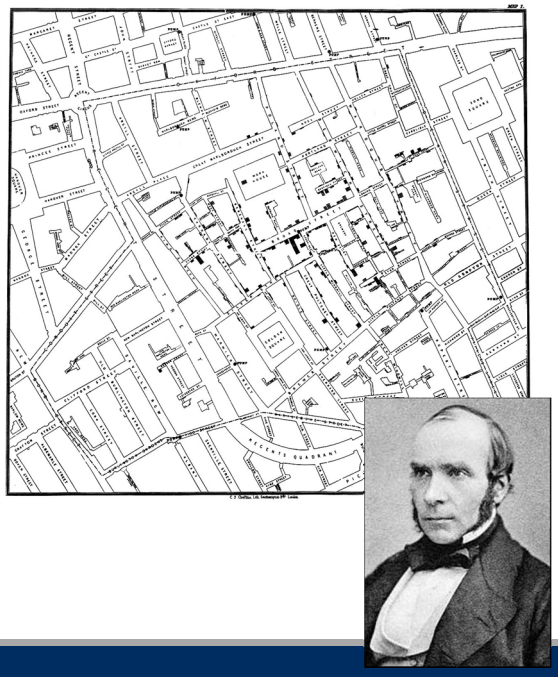
JAMES KELLY, *Chairman of Sanatory Committee.*

Chronology of the Liverpool Cholera Riots, 1832

Riot number	Date	Location	Details
1	Tuesday, May 29[1]	Perry Street and Toxteth Park	At 1800 h a woman is taken to hospital. Mob of mostly women and boys follow the palanquin and shout abuse at "medical men".
2	Friday, June 1[18]	Great Oxford Street North	Planquin taking patient to hospital is surrounded by a mob, and removal to hospital is prevented. Order is restored by a posse of policemen, and removal to hospital achieved.
3	Friday, June 1[18]	Lime Street and Islington	Woman leaving the Cholera Hospital is attacked by a mob. Mud is thrown at her and the mob call her a "Burker". She is chased to Islington and escapes into a joiner's yard.
4	Saturday, June 2[18]	Addison Street (near Vauxhall Road)	A doctor calls for a surgeon to attend a female cholera victim at home. Neighbours remove the woman to another house to "defeat the visit of the surgeon". When he arrives, the surgeon is sworn at, and they shout "the doctors merely want to get the poor into their clutches to Burke them". The surgeon is pursued to Rose Hill, and takes refuge in a shop. He is rescued by the police who disperse the mob.
5	Saturday, June 2[1]	Lime Street and Shaw's Brow	Crowds assemble on Saturday night in the region of the Cholera Hospital. Threats against doctors are made; they are accused of "giving patients stuff which killed them and made them turn blue". Doctors recognised and chased. Police eventually dispel the mob.
6	Wednesday, June 6[19]	Barter Street	Doctor calls for a palanquin for a cholera victim. The vehicle arrives followed by a mob who break it to pieces and attack the attendants.
7	Friday, June 8[20]	Vauxhall Road	"A disgraceful scene" as a mob follows a patient being removed to hospital.
8	Sunday, June 10[21]	Chisenhale Street and Great Howard Street	A palanquin is sent for a cholera victim in Chisenhale Street. On arrival, however, the patient and wife decide not to go to hospital. The returning palanquin is attacked in Great Howard Street by a mob of men and boys.

Note: In addition to the above riots, there were nightly gatherings of "hundreds of persons" in the vicinity of the Toxteth Park Hospital, on the evenings of Wednesday, May 30, Thursday, May 31, and Friday, June 1. There is no record of damage or injury, but they were said to have "every apparent disposition for mischief".[1] Also, on Saturday, June 3, a riot was averted in Lower Chisenhale Street when a "brutal mob" gathered around a patient being removed to hospital, and was dispersed by a strong police presence.[21]

Gill et al. *Lancet* 2001;358(9277):233-7.

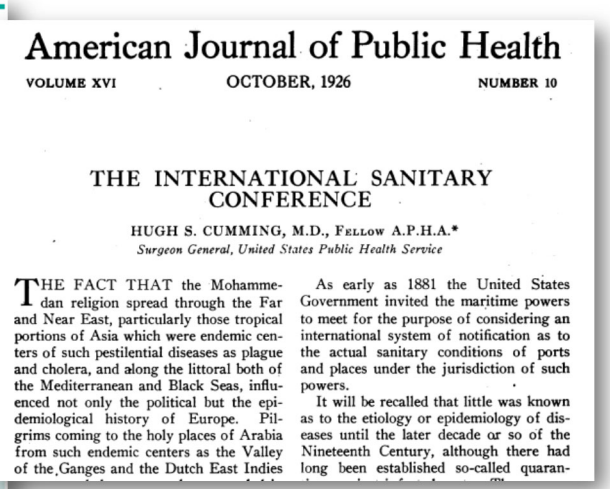


"There are certain circumstances, however, connected with the progress of cholera, which may be stated in a general way. It travels along the great tracks of human intercourse, never going faster than people travel, and generally much more slowly."

On the Mode of Communication of Cholera
John Snow, MD (1855)
http://www.ph.ucla.edu/epi/snow/snowbook.html

Table 1. **Treaties dealing with infectious diseases, 1892–1951**

Year	Treaty
1892	International Sanitary Convention
1893	International Sanitary Convention
1894	International Sanitary Convention
1897	International Sanitary Convention
1903	International Sanitary Convention replacing the 1892, 1893, 1894 and 1897 International Sanitary Conventions
1905	Inter-American Sanitary Convention
1912	International Sanitary Convention, replacing the 1903 International Sanitary Convention
1924	Pan American Sanitary Code
1924	Agreement Respecting Facilities to be Given to Merchant Seaman for the Treatment of Venereal Disease
1926	International Sanitary Convention, modifying the 1912 International Sanitary Convention
1927	Additional Protocol to the Pan American Sanitary Convention
1928	Pan American Sanitary Convention for Aerial Navigation
1930	Convention Concerning Anti-Diphtheritic Serum
1930	Agreement Regarding Measures to be Taken Against Dengue
1933	International Sanitary Convention for Aerial Navigation
1934	International Convention for Mutual Protection Against Dengue Fever
1938	International Sanitary Convention, amending the 1926 International Sanitary Convention
1944	International Sanitary Convention, modifying the 1926 International Sanitary Convention
1944	International Sanitary Convention for Aerial Navigation, modifying the 1933 International Sanitary Convention for Aerial Navigation
1946	Protocols to Prolong the 1944 International Sanitary Conventions
1951	International Sanitary Regulations



American Journal of Public Health

VOLUME XVI OCTOBER, 1926 NUMBER 10

THE INTERNATIONAL SANITARY CONFERENCE

HUGH S. CUMMING, M.D., Fellow A.P.H.A.*
Surgeon General, United States Public Health Service

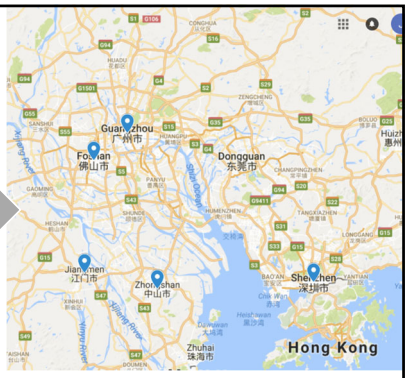
THE FACT THAT the Mohammedan religion spread through the Far and Near East, particularly those tropical portions of Asia which were endemic centers of such pestilential diseases as plague and cholera, and along the littoral both of the Mediterranean and Black Seas, influenced not only the political but the epidemiological history of Europe. Pilgrims coming to the holy places of Arabia from such endemic centers as the Valley of the Ganges and the Dutch East Indies

As early as 1881 the United States Government invited the maritime powers to meet for the purpose of considering an international system of notification as to the actual sanitary conditions of ports and places under the jurisdiction of such powers.

It will be recalled that little was known as to the etiology or epidemiology of diseases until the later decade or so of the Nineteenth Century, although there had long been established so-called quaran-

Fidler, *Bull WHO* 2001; 79(9):842.

China/Hong Kong (2002-3)



Nov 2002

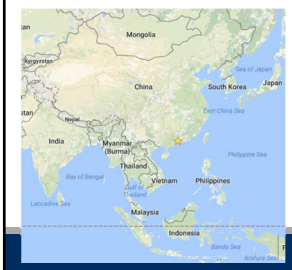
- Atypical pneumonia case treated in Foshan City, Guangdong Province, China

Dec 2002- Jan 2003

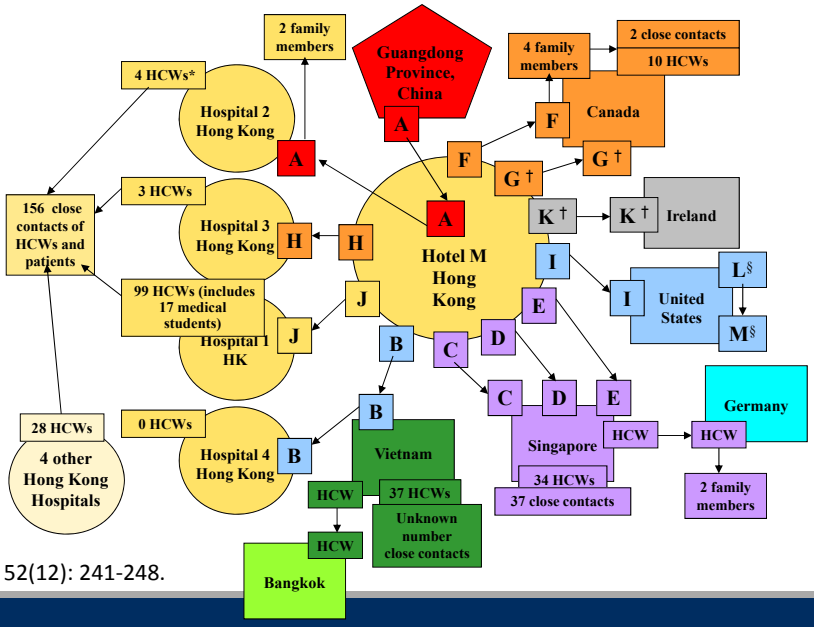
- Additional cases - histories of preparing exotic game meats, family contacts, health workers (30%)

Feb 2003

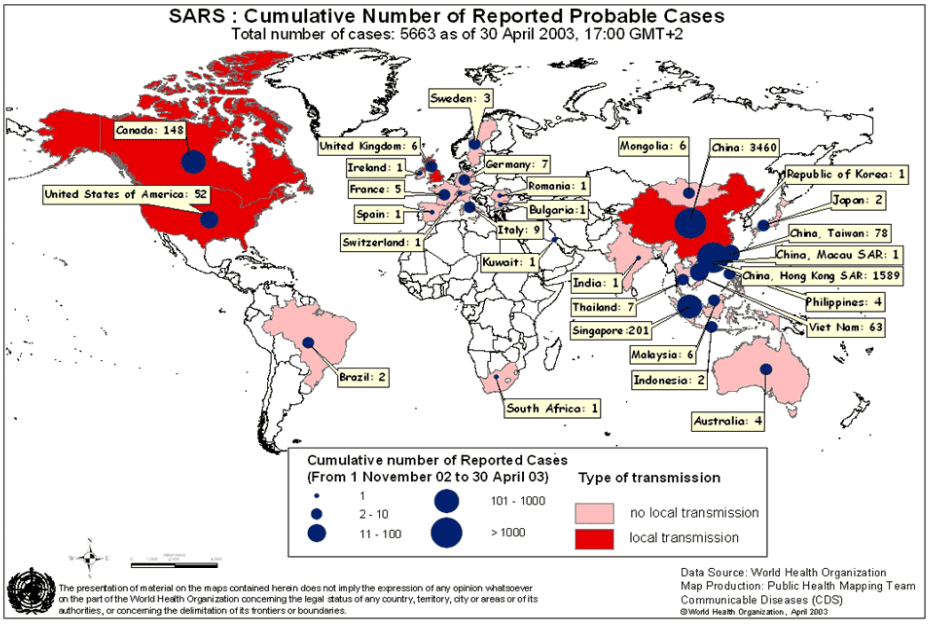
- Chinese MOH reports 305 cases of respiratory disease to WHO
- Doctor who had treated atypical pneumonia cases travels from Guangdong Province to Hong Kong
- After a day of sightseeing, the doctor is hospitalized with respiratory failure

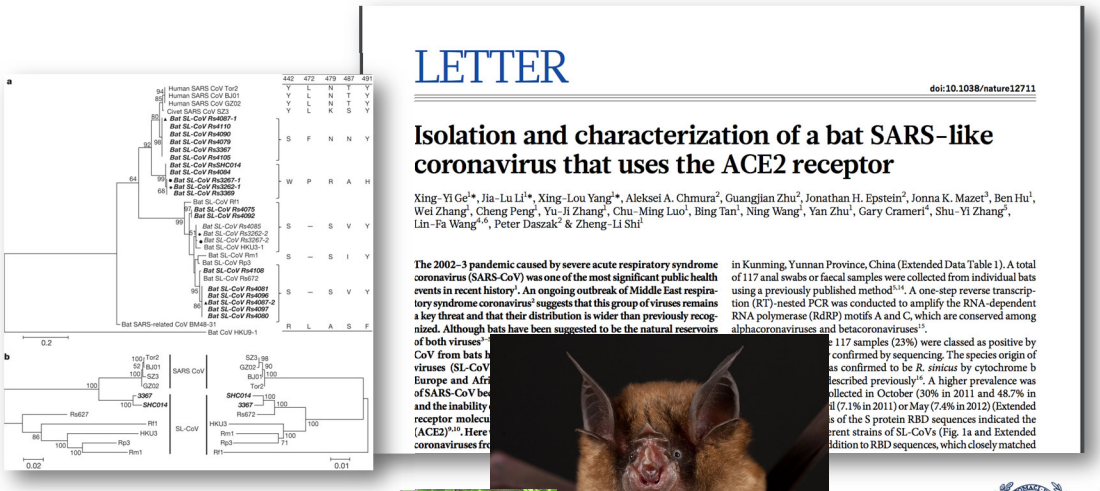


Chain of transmission among guests at Hotel M—Hong Kong, 2003



Source: *MMWR* 2003; 52(12): 241-248.





LETTER

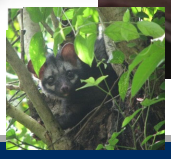
doi:10.1038/nature12711

Isolation and characterization of a bat SARS-like coronavirus that uses the ACE2 receptor

Xing-Yi Ge[1]*, Jia-Lu Li[1]*, Xing-Lou Yang[1]*, Aleksei A. Chmura[2], Guangjian Zhu[2], Jonathan H. Epstein[2], Jonna K. Mazet[3], Ben Hu[1], Wei Zhang[1], Cheng Peng[1], Yu-Ji Zhang[1], Chu-Ming Luo[1], Bing Tan[1], Ning Wang[1], Yan Zhu[1], Gary Crameri[4], Shu-Yi Zhang[5], Lin-Fa Wang[4,6], Peter Daszak[2] & Zheng-Li Shi[1]

The 2002–3 pandemic caused by severe acute respiratory syndrome coronavirus (SARS-CoV) was one of the most significant public health events in recent history[1]. An ongoing outbreak of Middle East respiratory syndrome coronavirus[2] suggests that this group of viruses remains a key threat and that their distribution is wider than previously recognized. Although bats have been suggested to be the natural reservoirs of both viruses[3–

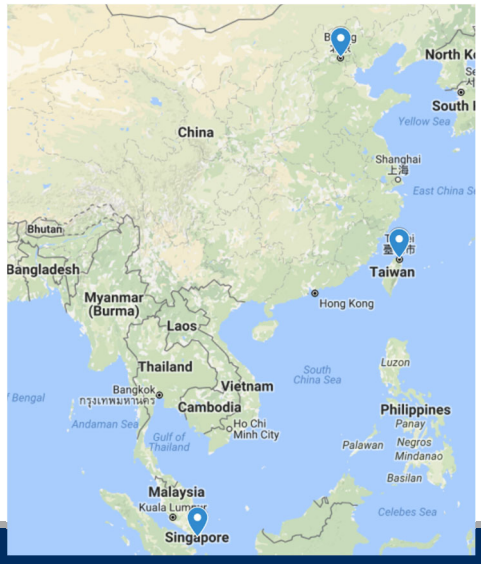
in Kunming, Yunnan Province, China (Extended Data Table 1). A total of 117 anal swabs or faecal samples were collected from individual bats using a previously published method[5,14]. A one-step reverse transcription (RT)-nested PCR was conducted to amplify the RNA-dependent RNA polymerase (RdRP) motifs A and C, which are conserved among alphacoronaviruses and betacoronaviruses[15].



XY Ge et al. *Nature* 2013; 503: 535–538.

J Infect Dev Countries 2013; 7(4):302-307.

Coda: laboratory-acquired SARS (2004)

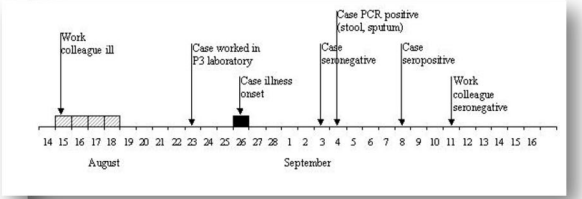


- Institute of Preventive Medicine, National Defence University, Taipei (1)
- National Institute of Virology Laboratory, Beijing (2 direct, 8 linked)
- Environmental Health Institute, Singapore (1)

Biosafety and SARS Incident in Singapore September 2003

Report of the Review Panel on New SARS Case and Biosafety

From the results of the epidemiologic investigation surrounding the recent case of SARS, it appears that inappropriate laboratory standards and a cross contamination of West Nile virus samples with SARS coronavirus in the laboratory led to the infection of the doctoral student. No evidence could be found of any other source of the infection. West Nile virus and SARS coronavirus were detected in the virus samples handled in the laboratory. There is no evidence of secondary transmission and this is an isolated case of SARS.



ERG Safer Together

"Two of the recently reported cases were conducting research at the laboratory: a 26-year-old female postgraduate student from Anhui Province, and a 31-year-old man. The dates of symptom onset in the two cases are widely separated (23 days), suggesting that more than one opportunity for exposure may have occurred in the laboratory from mid-March through early April.

Authorities have closed the virology institute and placed its more than 200 employees under medical observation. Numerous environmental samples from the laboratory have been taken to help assess possible sources of contamination, and these samples will be shared with WHO."

http://www.who.int/csr/sars/archive/en/

washingtonpost.com > Health

SARS Cases in Asia Show Labs' Risks

As Scientists Battle Diseases, Accidents Can Infect Public

By David Brown
Washington Post Staff Writer
Saturday, May 29, 2004; Page A01

Scientists still do not fully understand exactly where or how SARS emerged 18 months ago. But it is now clear that the most threatening source of the deadly virus today may be places they know intimately -- their own laboratories.

▼ADVERTISING The recent announcement of nine cases of severe acute respiratory syndrome linked to China's National Institute of Virology brings to three the number of lab outbreaks of the disease in the past eight months. The three events -- including one in Singapore in September and another in Taiwan in December -- account for all but four of the known SARS cases since last year's epidemic was brought under control.

The Beijing incident, unlike the others, led to person-to-person transmission of the virus outside the lab. It caused one death and required quarantining about 200 people in two provinces to stop the virus from spreading. It was an epidemic "near-miss" and has led to calls for greater international monitoring of labs working on a virus that caused more than 8,000 illnesses and 774 deaths last year.

Together, the three SARS outbreaks have highlighted the unique hazards to public health that arise from accidental laboratory releases of germs that no longer exist -- or barely exist -- in the wild.

Such an event happened 26 years ago when the last cases of smallpox -- the only human disease ever eradicated -- occurred after a laboratory accident. Another one may have happened in 1977, when an influenza virus not seen for 27 years inexplicably reappeared and circulated worldwide. Leaders of the campaign to wipe out polio are working to ensure that such a thing never happens with that disease. They are already inventorying and urging destruction of global stocks of polio virus.

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Enlarge This Photo
Bottles are taken from a Chinese lab where investigators suspect two cases SARS originated this spring. Neither infected worker had handled the virus. (China Photos Via Reuters)

FAQ on SARS
- A Guide to Origins, Symptoms and Precautions You Can Take

More on SARS
- China Moves Against SARS as Millions Head for Vacation (The Washington Post, May 1, 2004)
- WORLD IN BRIEF (The Washington Post, Apr 27, 2004)
- China Reports SARS Cases, 1 Death (The Washington Post, Apr 24, 2004)
- Full Coverage

More About Smallpox
- Judge Sees Little Evidence to Support Anthrax Vaccine (The Washington Post, May 26, 2004)
- Senate Approves Bioterror Provisions (The Washington Post, May 20, 2004)

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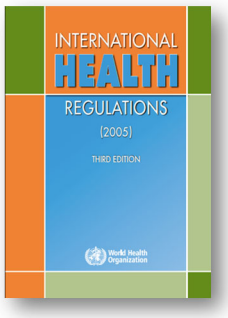


The International Health Regulations (IHR)

The IHR (2005) - a legally binding commitment among 196 States Parties to achieve early detection and rapid response

- The IHR entered into force in 2007, beginning a period of cooperative capacity-building

What did States Parties agree to do?

(Articles 4, 5, 13, 44 and Annex 1)

Communications	• Designate a National IHR Focal Point
Core Capacities	• Meet minimum requirements to detect, assess, report, and respond to public health events
Points of Entry	• Support disease detection and control at designated ports and borders
Notification	• Develop a framework for notifying WHO within 24 hours of a potential PHEIC
Collaboration and assistance	• Provide technical, logistical, or financial support to facilitate implementation
Evaluate status	• Conduct self-assessments and report to WHO

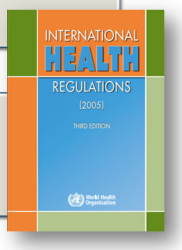
Annex 1 defines IHR core capacity requirements

National
- Detect unexpected disease or deaths
- Assess reports within 48 hours
- Notify WHO
- Support or implement control measures

Intermediate
- Detect unexpected disease or deaths
- Assess and confirm reported events
- Report to national level
- Support or implement control measures

Local
- Detect unexpected disease or deaths
- Assess events immediately
- Report essential information to appropriate level
- Implement preliminary control measures

- Epidemiological, laboratory, logistical support
- Containment and control measures
- Coordination with other ministries
- Information sharing
- Operational national public health emergency response plan
- Deployable rapid response teams



ERG
Safer Together

Trends and drivers of disease emergence

Environmental	• Climate changes • Weather/extreme weather events • Wildlife biodiversity • Pathogen and vector ecology
Geopolitical	• Legal/regulatory frameworks • War and conflict • Governance • Technology/industry
Socioeconomic	• Population density • Population mobility • Agricultural practices • Markets and trade • Land use • Antimicrobial use

Something New

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https://www.wilsoncenter.org/publication/us-trends-synthetic-biology-research-funding

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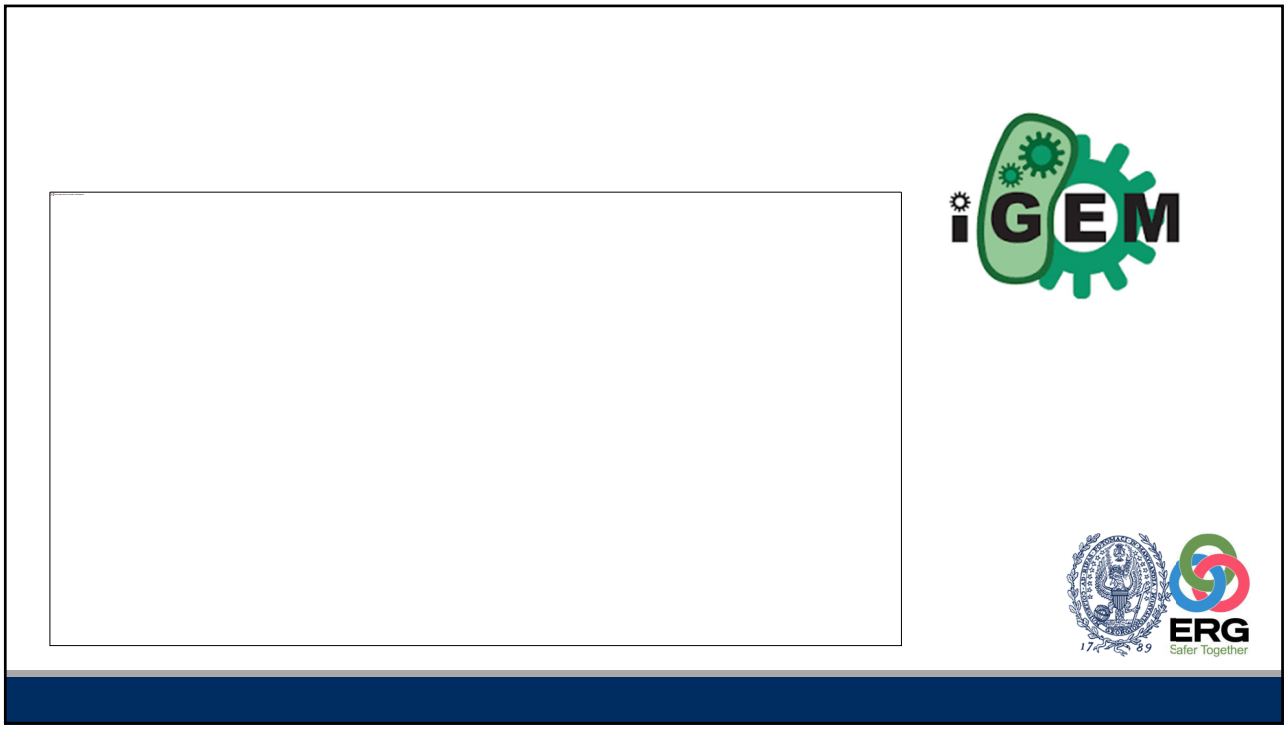
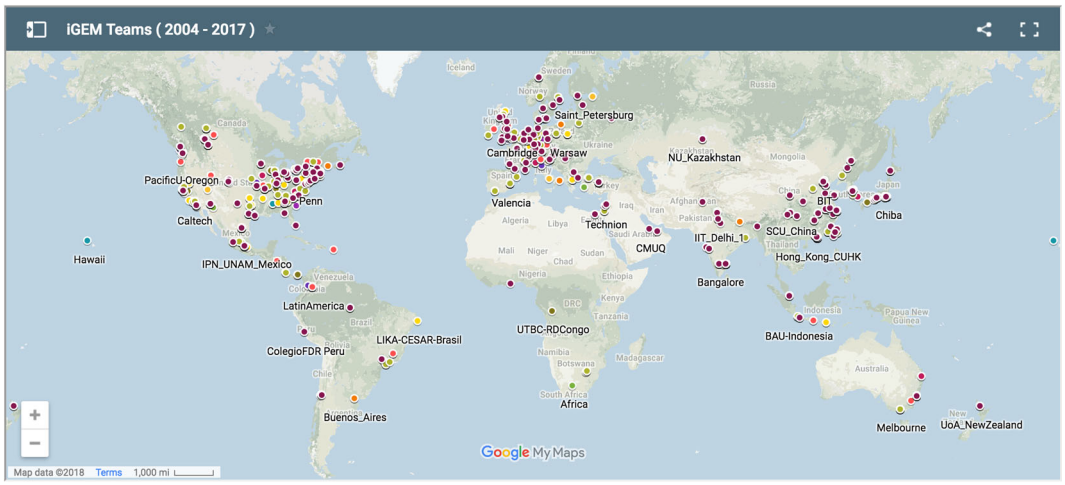


Figure. Framework of The Herb Tasters


iGEM Teams (2004 - 2017)
Saint_Petersburg
Cambridge
Warsaw
NU_Kazakhstan
PacificU-Oregon
Penn
Caltech
Valencia
Technion
BIT
Chiba
SCU_China
IIT_Delhi_1
CMUQ
Hong_Kong_CUHK
Hawaii
IPN_UNAM_Mexico
Bangalore
LatinAmerica
UTBC-RDCongo
BAU-Indonesia
LIKA-CESAR-Brasil
ColegioFDR Peru
Africa
Buenos_Aires
Melbourne
UoA_NewZealand
Google My Maps
Map data ©2018 Terms 1,000 mi


Science alert
Trending
(Paul E. Alers/NASA)
HUMANS
Stephen Hawking Warned of Future 'Superhumans' Threatening The End of Humanity
A grim prediction from beyond the grave.
PETER DOCKRILL 15 OCT 2018
It's been several months since the late Stephen Hawking passed away, but posthumous writings by the groundbreaking scientist show the great man still had much more to tell us.
Just days after Hawking's final academic paper was published online, the

Something Borrowed

- Every index case is a daughter, son, sister, brother, mother, or father.
- Every incident is, at the least, a sleepless night.
- Most lessons learned were learned the hard way – but we only we learn and act when we believe.

Global Health Security Agenda (GHSA) launched in February 2014

- Accelerate implementation of IHR and other health security frameworks
- Advance progress toward a world safe and secure from infectious disease threats
- Bring together nations to make new, concrete commitments to capacity building
- Elevate global health security as a priority for leaders worldwide

GHSA member countries

February 2018

Governments

International organizations

Non-governmental stakeholders

GHSA Action Packages

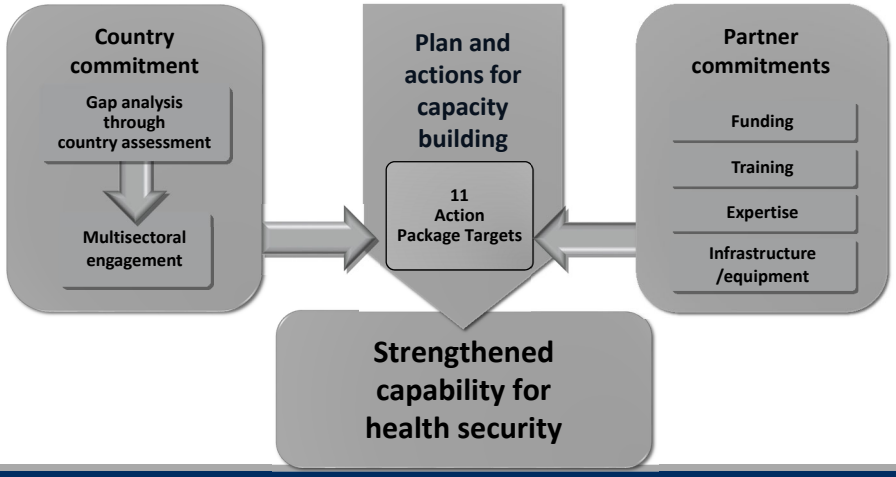
PREVENT	DETECT	RESPOND

GHSA Action Package – Prevent-3

Five-Year Target: A whole-of-government national biosafety and biosecurity system is in place, ensuring that especially dangerous pathogens are identified, held, secured and monitored in a minimal number of facilities according to best practices; biological risk management training and educational outreach are conducted to promote a shared culture of responsibility, reduce dual use risks, mitigate biological proliferation and deliberate use threats, and ensure safe transfer of biological agents; and country-specific biosafety and biosecurity legislation, laboratory licensing, and pathogen control measures are in place as appropriate.

Leading	Contributing	International organizations
• Canada, Denmark, Kenya, Peru, Portugal, Spain	• Azerbaijan, Bangladesh, Cote d'Ivoire, Finland, Germany, Ghana, Jordan, Republic of Korea, Saudi Arabia, Singapore, United Kingdom, United States	• FAO, IAEA, INTERPOL, OIE, WHO

GHSA country commitments



Something Blue

What comes next?

Proactive → Partnering → Patience

Our Family

Julie E. Fischer, PhD
Director, Elizabeth R. Griffin Program

Georgetown University Medical Center
3rd Floor, Medical-Dental Building
3900 Reservoir Road, NW
Washington D.C. 20057-1440

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