Pandemic Preparedness and Response: Lessons from COVID-19

Anthony S. Fauci, M.D.

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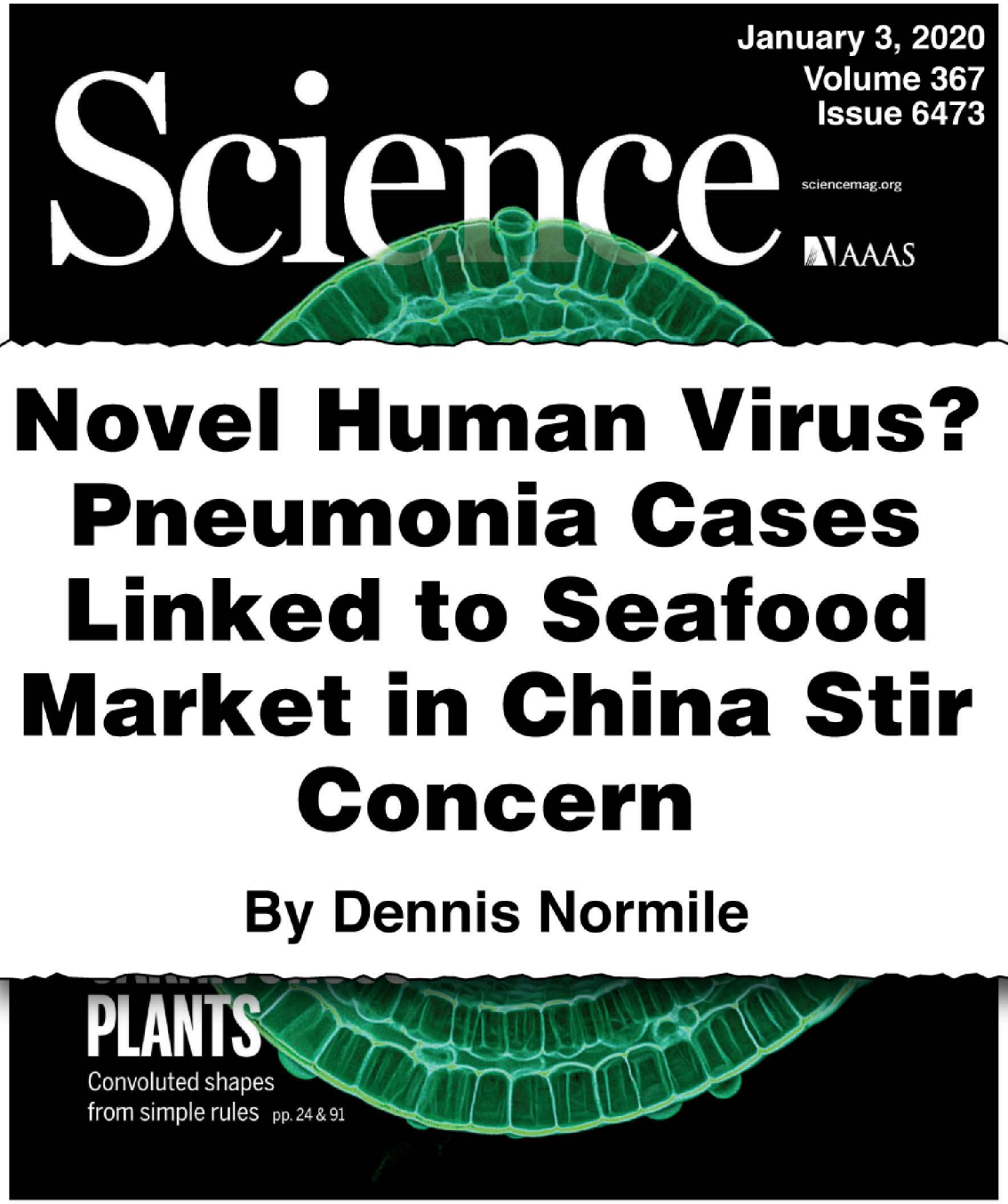
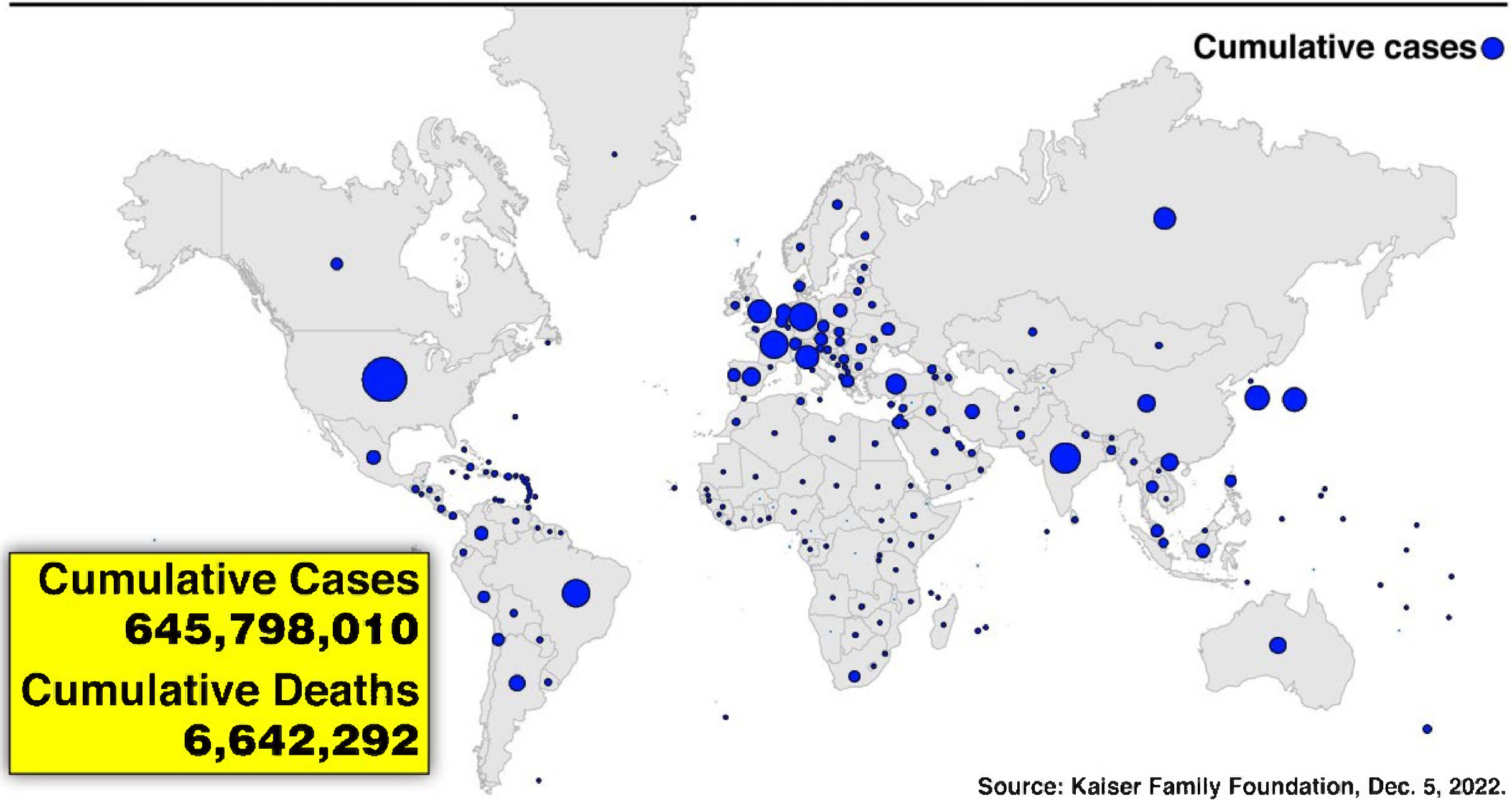
National Institutes of Health



The Washington Post
January 9, 2020

China Identifies New Strain of Coronavirus as Source of Pneumonia Outbreak

The Global COVID-19 Pandemic



Cumulative Cases
645,798,010

Cumulative Deaths
6,642,292

Source: Kaiser Family Foundation, Dec. 5, 2022.

Lessons From COVID-19

- Global information sharing and collaborations are essential
- Existing clinical trial infrastructure should be utilized
- Prior scientific advances enable rapid vaccine development
- Prototype and priority pathogen approaches enable pandemic preparedness
- Continued surveillance of the human/animal interface is critical
- Longstanding systemic health and social inequities drive pandemic disparities
- Misinformation is the enemy of pandemic control

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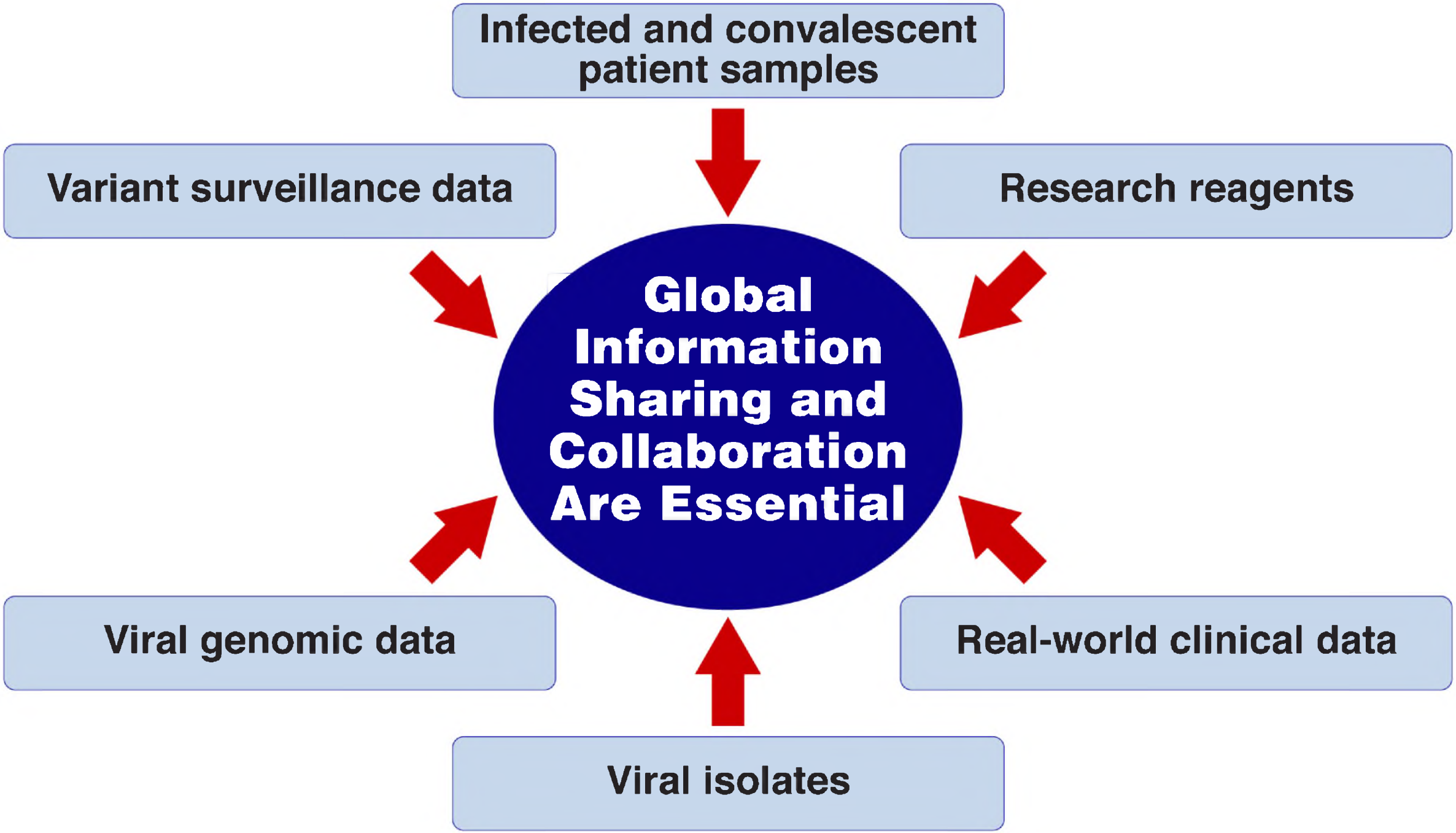
Infected and convalescent patient samples
Variant surveillance data
Research reagents
Global Information Sharing and Collaboration Are Essential
Viral genomic data
Real-world clinical data
Viral isolates

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National Institutes of Health
Turning Discovery Into Health

July 8, 2020

News Release

NIH Launches Clinical Trials Network to Test COVID-19 Vaccines and Other Prevention Tools

NIAID has established a new clinical trials network that aims to enroll thousands of volunteers in clinical trials testing investigational vaccines and monoclonal antibodies against COVID-19

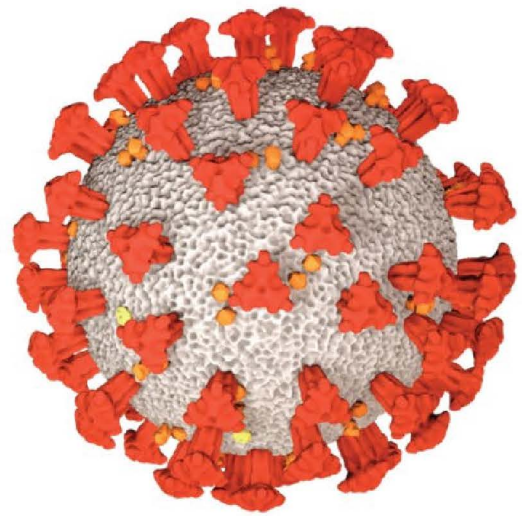
The COVID-19 Prevention Network (CoVPN) was established by merging four existing NIAID-funded clinical trials networks.

HIV VACCINE
TRIALS NETWORK

HPTN
HIV Prevention
Trials Network

IDCRC
Infectious Diseases Clinical Research Consortium

ACTG
AIDS CLINICAL TRIALS GROUP



COVID-19
Prevention Network

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April 9, 2021
Vol. 372, Issue 6538
Science

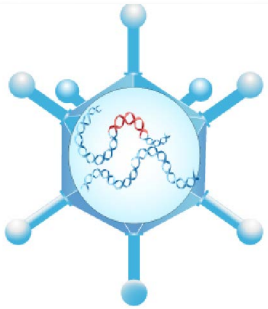
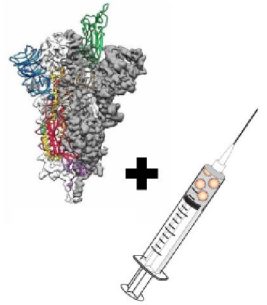
The Story Behind COVID-19 Vaccines

Anthony S. Fauci

"The speed and efficiency with which these highly efficacious vaccines were developed and their potential for saving millions of lives are due to an extraordinary multidisciplinary effort involving basic, preclinical, and clinical science that had been under way—out of the spotlight—for decades before the unfolding of the COVID-19 pandemic."

Science's Breakthrough of the Year 2020: COVID-19 Vaccines

COVID-19 Vaccines in U.S. Government Development Portfolio

Platform	Immunogen		Developer	Status
Nucleic Acid (mRNA)	S2P		moderna	BLA (Age 18+); EUA (Age 6 mo-17)
	S2P		BIONTECH Pfizer	BLA (Age 16+); EUA (Age 6 mo-15)
Adenovirus Vector	S2P		Johnson&Johnson	EUA (Age 18+)
	Wild-type spike		AstraZeneca	EUA/BLA TBD
Recombinant Protein and Adjuvant	S2P		gsk SANOFI	EUA request 2/2022
	S2P		NOVAVAX Creating Tomorrow's Vaccines Today	EUA (Age 12+)

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Vaccine Development for Emerging Infectious Diseases

- Priority pathogen approach
- Prototype pathogen approach

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- Priority pathogen approach

- Prototype pathogen approach

WHO R&D Blueprint: Priority Diseases

- Ebola virus disease and Marburg virus disease
- Lassa fever
- Crimean-Congo haemorrhagic fever (CCHF)
- Nipah and henipaviral diseases
- Rift Valley fever (RVF)
- Zika
- Middle East respiratory syndrome coronavirus (MERS-CoV) and severe acute respiratory syndrome (SARS)
- Disease X
- COVID-19

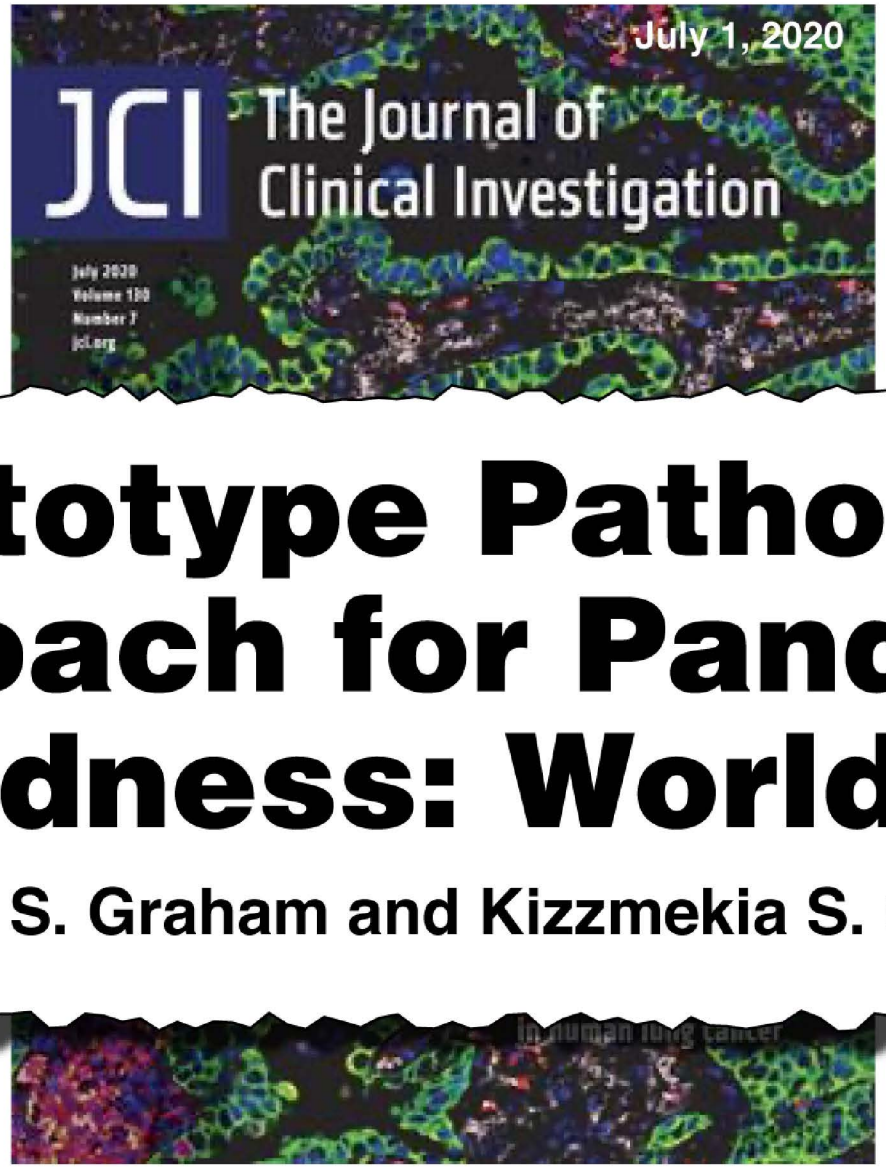
Source: WHO

Vaccine Development for Emerging Infectious Diseases

- Priority pathogen approach

- Prototype pathogen approach

NIH Prototype Pathogen Approach



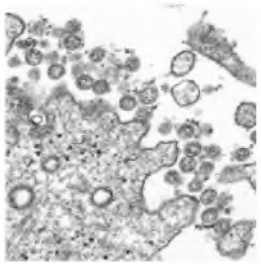
Prototype Pathogen Approach for Pandemic Preparedness: World on Fire

Barney S. Graham and Kizzmekia S. Corbett

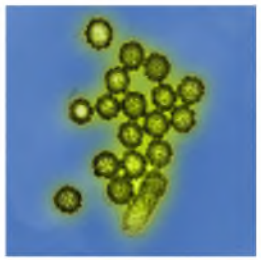
Prototype Pathogen Approach To Vaccine Development

Build on Prior Experiences

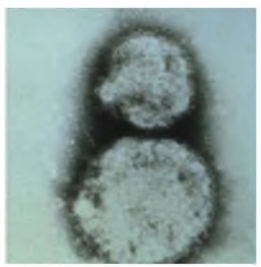
Viral Families/Orders of Concern



Coronaviridae
e.g., SARS, MERS



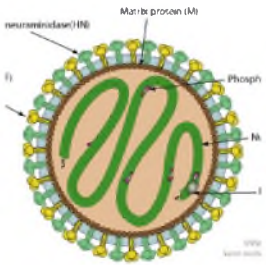
Orthomyxoviridae
e.g., Influenza viruses



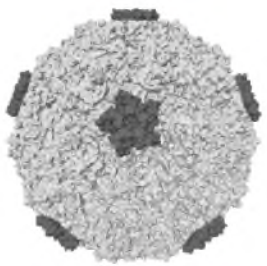
Bunyavirales
e.g., Hemorrhagic fevers, Hantavirus, Lassa fever

Filoviridae
e.g., Ebola, Marburg

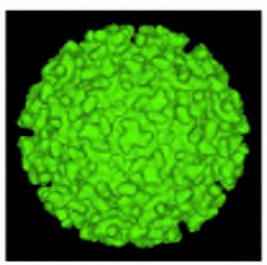
Flaviviridae
e.g., West Nile, Dengue



Paramyxoviridae
e.g., Nipah, RSV



Picornaviridae
e.g., Enterovirus D68



Togaviridae
e.g., Chikungunya

Applying Strategies and Tools from One Virus to Inform Vaccine Design for Related Viruses

- Basic virology (e.g., neutralization mechanisms)
- Assays for preclinical and clinical settings
- Animal models
- Antigenic targets
- Optimal platforms
- Potential immune correlates
- Manufacturing strategies

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Cell

September 3, 2020

Emerging Infectious Diseases: How We Got to COVID-19

DM Morens and AS Fauci

"The COVID-19 pandemic is yet another reminder, added to the rapidly growing archive of historical reminders, that in a human-dominated world, in which our human activities represent aggressive, damaging, and unbalanced interactions with nature, we will increasingly provoke new disease emergences."

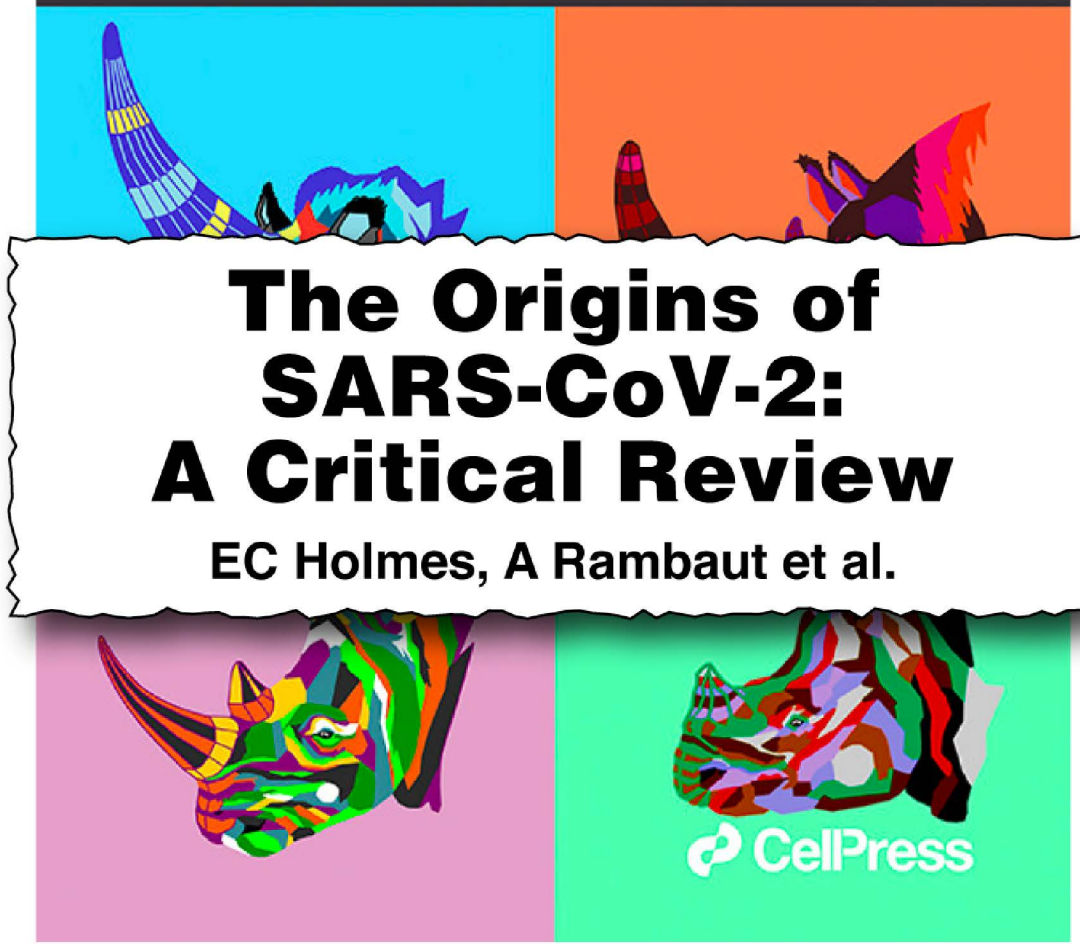
The One Health Approach

- Emerging and re-emerging zoonotic infectious diseases are a perpetual challenge

- Human health is connected to the health of animals and our shared environment

Source: CDC

Cell
September 16, 2021
Vol. 184 Issue 19



The Origins of SARS-CoV-2: A Critical Review

EC Holmes, A Rambaut et al.

What "sea fireflies" signal about evolution p. 914 | Cognitive processing during dreams pp. 919 & 999 | Perfecting the absorption of light pp. 924 & 995

August 26, 2022
Vol. 377 Issue 6609

Science
AAAS

The Huanan Seafood Wholesale Market in Wuhan Was the Early Epicenter of the COVID-19 Pandemic

M Worobey, KG Andersen et al.

The Molecular Epidemiology of Multiple Zoonotic Origins of SARS-CoV-2

JE Pekar, JO Wertheim et al.

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JAMA
The Journal of the American Medical Association
June 23, 2020
Volume 323 No 24

Viewpoint

COVID-19 and Racial/Ethnic Disparities

MW Hooper, AM Nápoles and EJ Pérez-Stable

"The most pervasive disparities are observed among African American and Latino individuals, and where data exist, American Indian, Alaska Native, and Pacific Islander populations."

Longstanding Systemic Health and Social Inequities Drive COVID-19 Disparities

- **Discrimination**
- **Limited healthcare access and use**
- **Occupation** – disproportionately in essential work settings where remote work or physical distancing is impossible
- **Educational, income, and wealth gaps**
- **Housing** – some people living in crowded conditions; hard to follow prevention strategies

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CNBC

October 1, 2021

Why the Covid vaccines can't contain a tracking microchip or make you magnetic

POLITIFACT

January 28, 2022

"Johnson wrong on claim that COVID vaccines are killing athletes on the playing field"

JAMA Network

February 22, 2022

Widespread Misinformation About Infertility Continues to Create COVID-19 Vaccine Hesitancy

FDA U.S. FOOD & DRUG ADMINISTRATION

For Consumers

March 30, 2022

Fraudulent Coronavirus Disease 2019 (COVID-19) Products

McGill | Office for Science and Society

Separating Sense from Nonsense

April 16, 2021

The Anti-Vaccine Propaganda of Robert F. Kennedy, Jr.

REUTERS

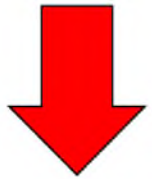
June 29, 2021

Fact Check: COVID-19 Is Not a Hoax to Eliminate Trump

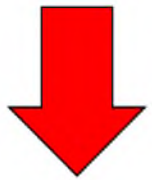
COVID-19

The End Game for 2022 and Beyond

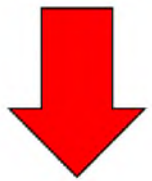
Pandemic Phase



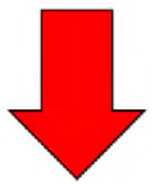
Deceleration of New Cases



Control

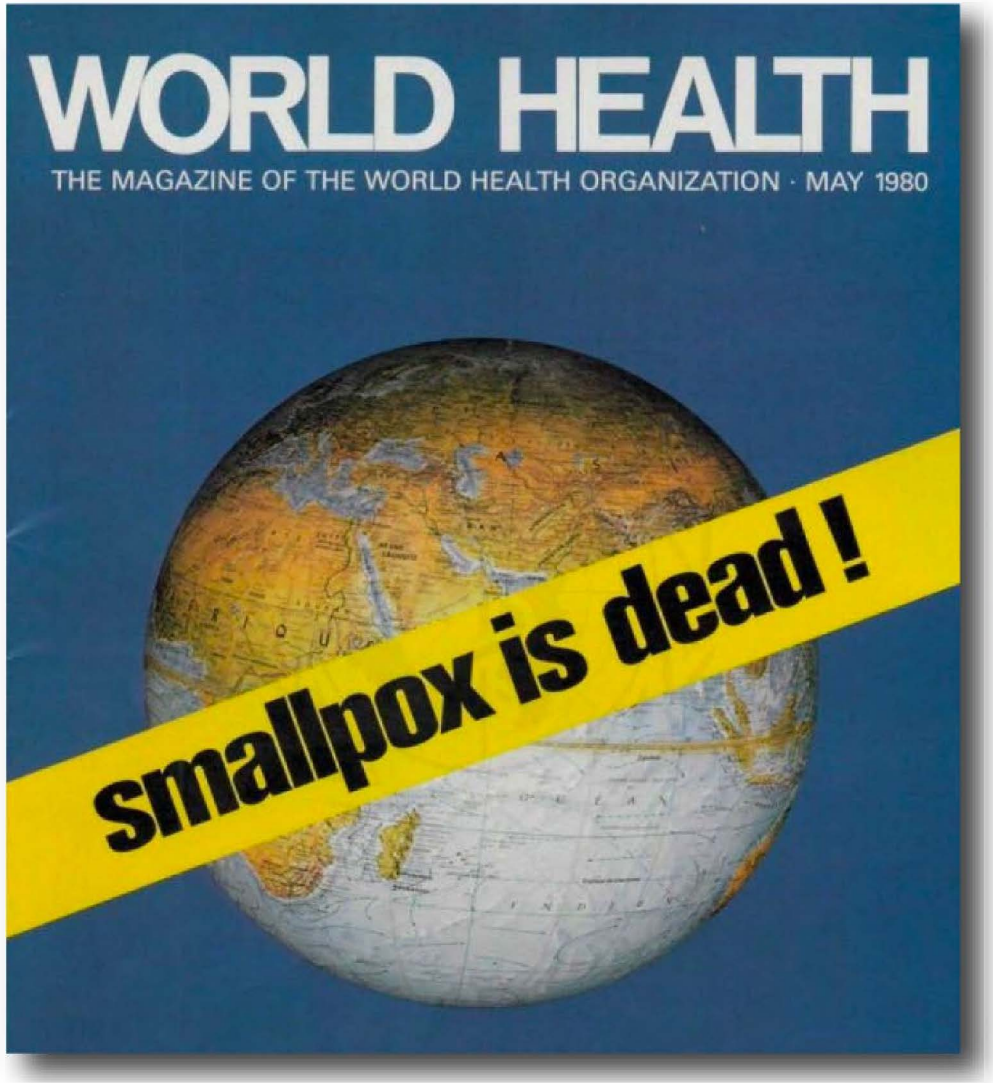


Elimination



Eradication

Smallpox Eradication



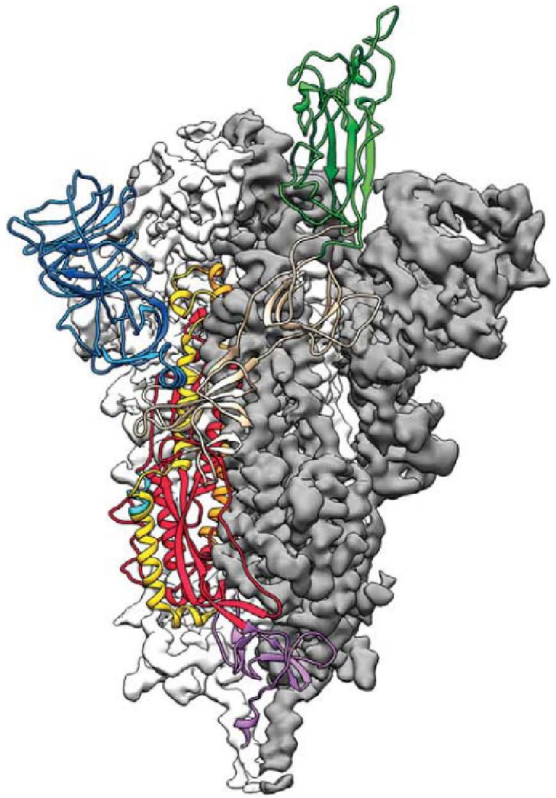
- Lack of animal reservoir
- Phenotypically stable virus
- Widely accepted global vaccination campaign
- Durability of vaccine- and infection-induced immunity

Elimination of Polio and Measles in the United States

Polio elimination: 1979

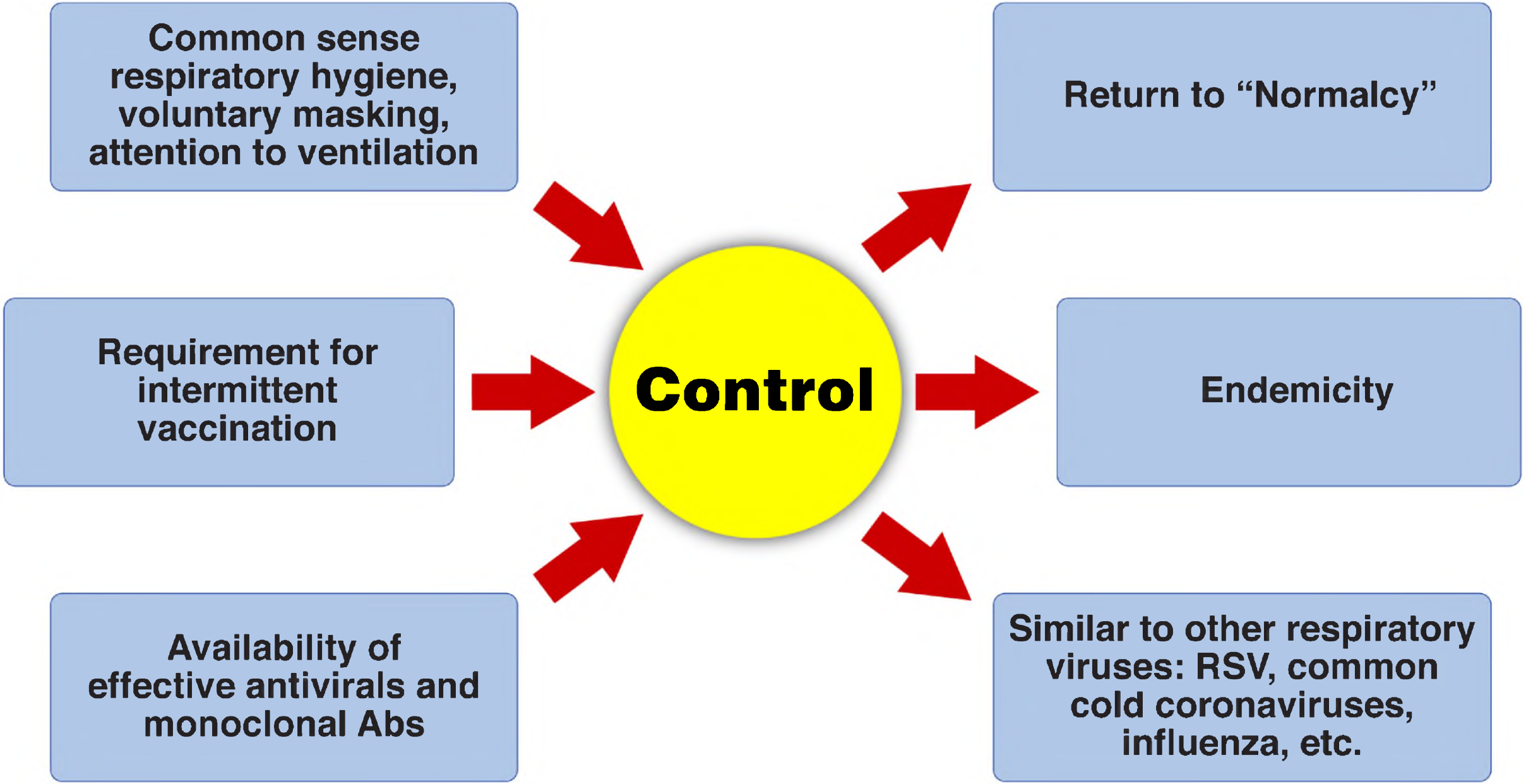
Measles elimination: 2000

- Lack of animal reservoir
- Phenotypically stable virus
- Widely accepted national vaccination campaign
- Durability of vaccine- and infection-induced immunity



SARS-CoV-2 (Spike Protein)

- Established animal reservoirs
- Evolution of genotypically and phenotypically diverse variants
- Lack of a wide acceptance of safe and effective vaccines
- Waning of vaccine- and infection-induced immunity


Common sense respiratory hygiene, voluntary masking, attention to ventilation
Requirement for intermittent vaccination
Availability of effective antivirals and monoclonal Abs
Control
Return to "Normalcy"
Endemicity
Similar to other respiratory viruses: RSV, common cold coronaviruses, influenza, etc.

THE LANCET
Infectious Diseases
Volume 8, Issue 11 November 2008

Emerging Infections: A Perpetual Challenge

DM Morens, GK Folkers, and AS Fauci