

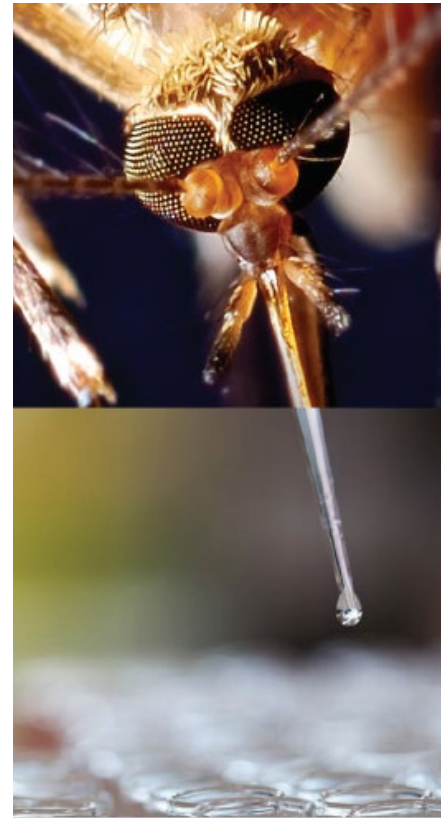
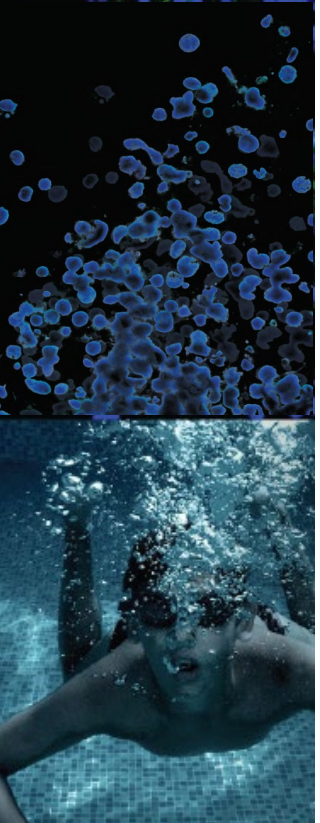


# Why Biological Collections Are Essential: Responding to Public Health Threats through Global Biological Resource Programs

World Microbe Forum  
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Credible Leads to Incredible™



# About ATCC

An established partner to researchers around the world

- Non-profit founded in 1925, providing the world's scientific community with high quality biomaterials (e.g., cells, bacteria, viruses), laboratory services, and repository operations
- World's largest, most diverse biological materials and information resource for authenticated cell lines, microorganisms, and molecular standards
- Sales and distribution in >150 countries, 19 international distributors
- 450+ employees including scientists, subject matter experts, and certified program managers who provide innovative solutions to facilitate disease research and surveillance
- R&D and scientific support to federal government programs for >50 years focused on global health, clinical study support, and biodefense
  - Expertise in microorganism/biomaterial production, characterization, and authentication; medical countermeasure development; testing, and assay development
  - Clients include NIAID, BARDA, CDC, NCI, FDA, DoD, USDA, DHS





# BEI Resources

Biodefense and Emerging Infections Resources  
Funded by the National Institute of Allergy and Infectious  
Diseases (NIAID)

## History

The National Institute of Allergy and Infectious Diseases (NIAID) awarded the initial BEI Resources contract to ATCC in 2003. The program scope has expanded through several contract awards and includes rapid response to public health needs.

## Mission of BEI Resources

Provide NIAID with a central bioresource program for the acquisition, authentication, production, preservation, storage, and distribution of a broad range of unique and quality-assured research materials for the infectious disease research community that will aid in the development and evaluation of vaccines, therapeutics, and diagnostics.

## Scope

Reagents, tools and information covering NIAID's Category A, B, and C priority pathogens, emerging infectious disease agents, non-pathogenic microbes, and other microbiological materials of relevance to the research community.



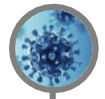


# Reference Standards and Materials

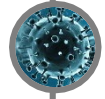
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- Both ATCC and BEI Resources provide critical reference standards and materials to the research community.
  - The ATCC collection contains a diverse collection of microorganisms.
  - BEI Resources focuses on human pathogens and surrogates, including CDC and USDA Select Agents.
  - Researchers are encouraged to utilize the resources available in these catalogs in order to find organisms and reagents relevant to their research.

# Major Outbreaks and Responses



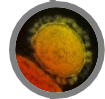
SARS-CoV (2002-2004)



Influenza A, H1N1 (2009)



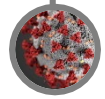
Ebolavirus (2013-2016)



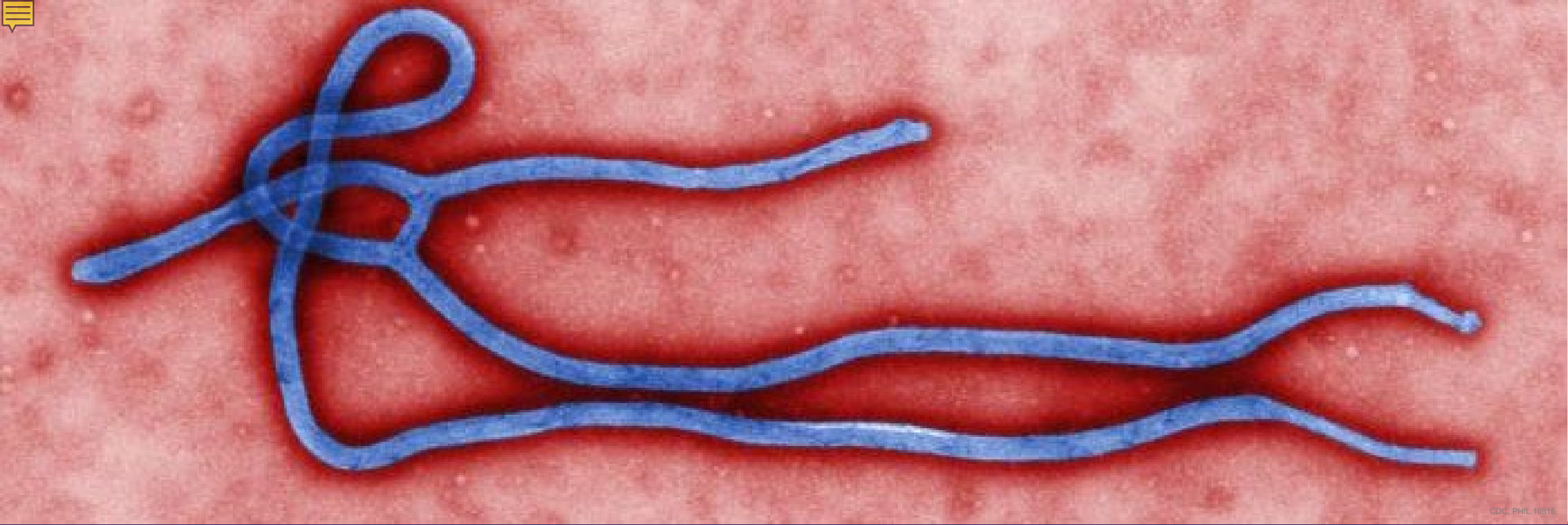
MERS-CoV (2015, 2018)



Zika (2015-2016)



SARS-CoV-2 (2019-Present)



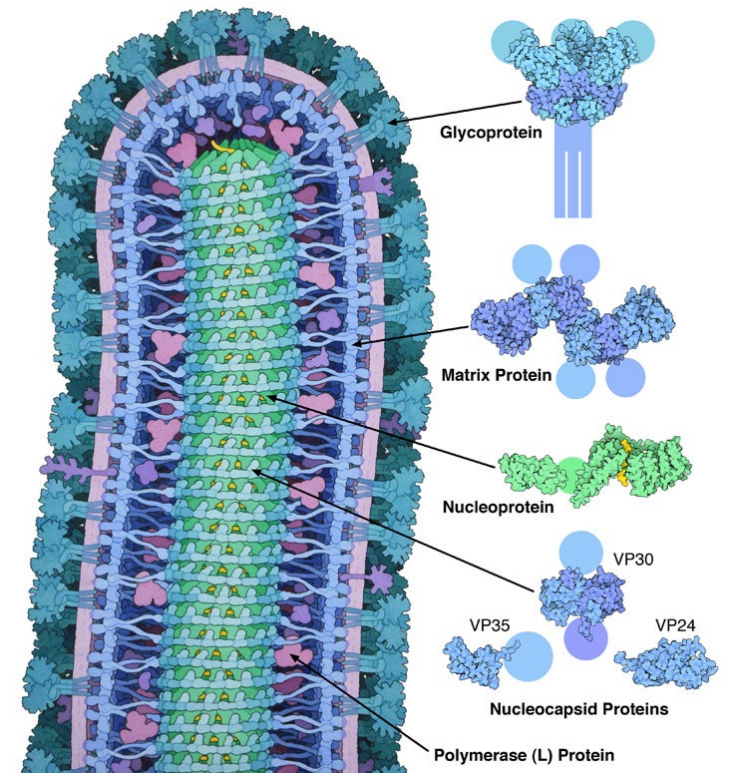
CDC, PHIL 10815

# Ebolavirus (2013-2016)



# Ebolavirus

- Family *Filoviridae*
  - ssRNA(–) viruses
  - Genomes  $\approx$ 19 kb
- Ebolavirus is transmitted primarily by contact with infected bodily fluids
- Suspected index case in Dec. 2013 in Guinea
- Reached 10 countries, including the United States
- >28,000 cases, >11,000 deaths

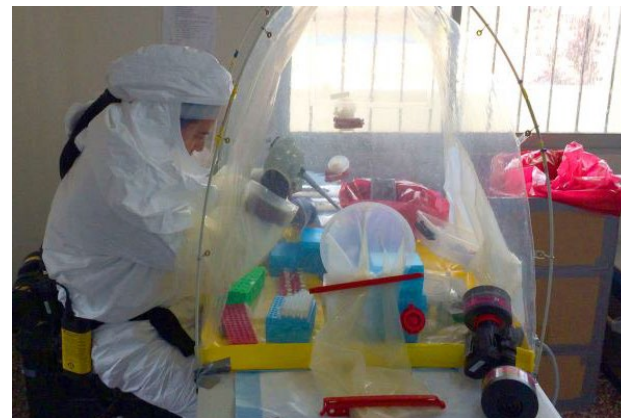
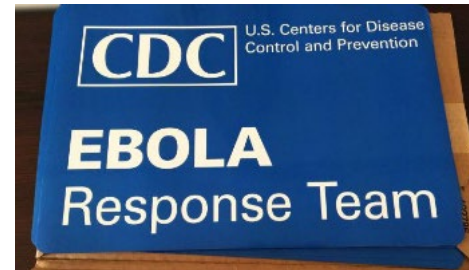


Goodsell, RCSB PDB Molecule of the Month, October 2014, <https://pdb101.rcsb.org/motm/178>.

# Ebola Virus Disease (EVD)

## Outbreak (2013-2016)

- During the Ebola outbreak, BEI Resources responded by distributing:
  - 1,275 reagents from 82 unique catalog items to more than 130 laboratories in 14 countries from 2014-2016.
- Highpoint was the successful rapid manufacture and distribution of essential reagents produced from the 2014 outbreak strain acquired early in the outbreak.
- Over 96 Ebolavirus strains and reagents in the catalog to include a panel of inactivated Ebolavirus strains used by diagnostic developers.

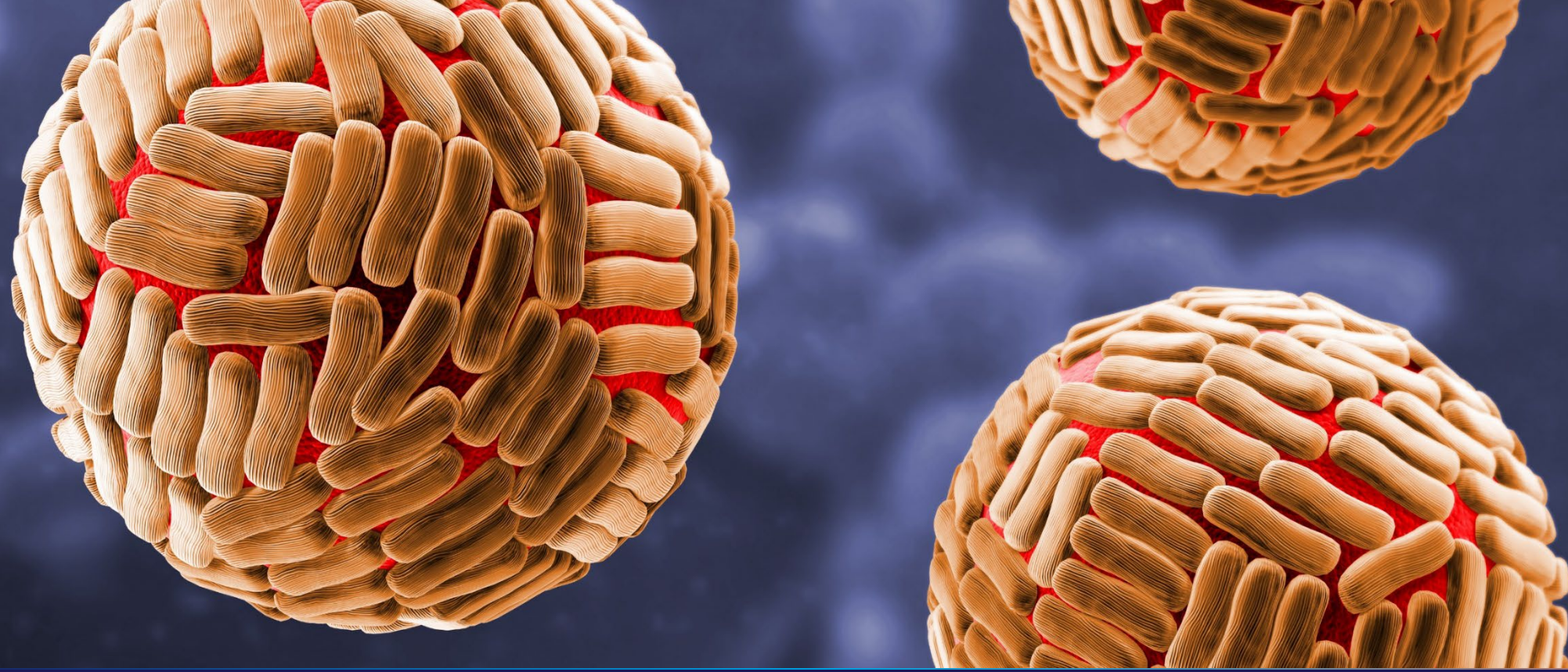


CDC-PHIL 1400

CDC-PHIL 18121

CDC-PHIL 18122





# Zika (2015-2016)

# Zika Virus

## Discovery and Deposit

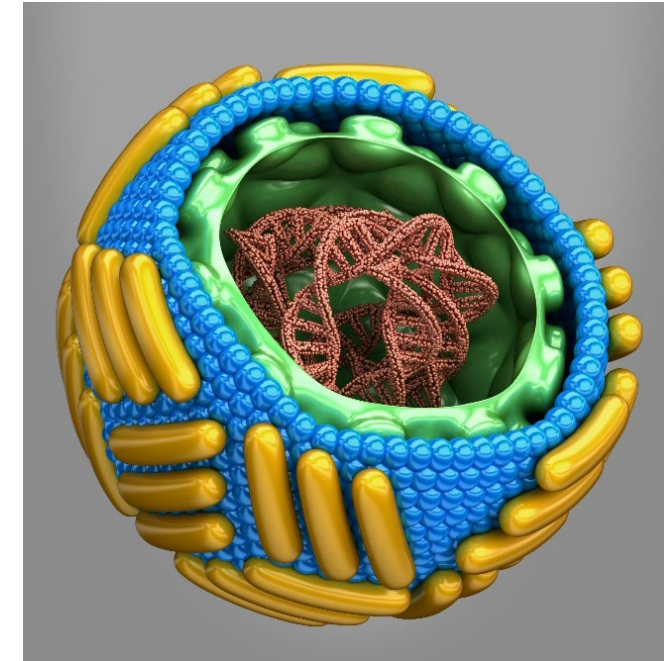
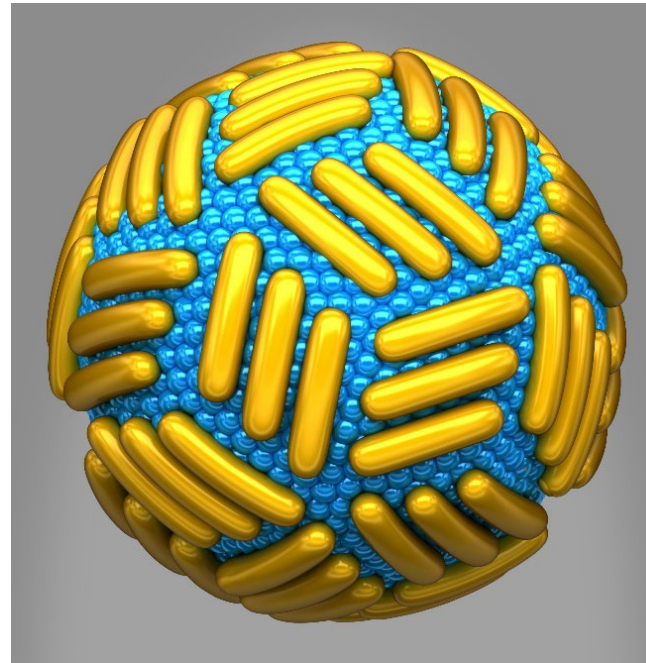
- First isolated from a Rhesus monkey (*Macaca mulatta*) in the Ziika Forest in Uganda in 1947
- Deposited as ATCC<sup>®</sup> VR-84<sup>™</sup> in 1953
  - No indication that it would emerge as an important medical pathogen a few decades later





# Zika Virus

- Genus *Flavivirus*
  - ssRNA(+) viruses
  - Genomes  $\approx$ 10-11 kb
- Zika virus is transmitted primarily by the *Aedes aegypti* mosquito
- Beginning in mid-2015, a spike in cases of both Guillain-Barré syndrome (GBS) and birth defects, primarily congenital microcephaly
  - Quickly correlated to infection with Zika virus

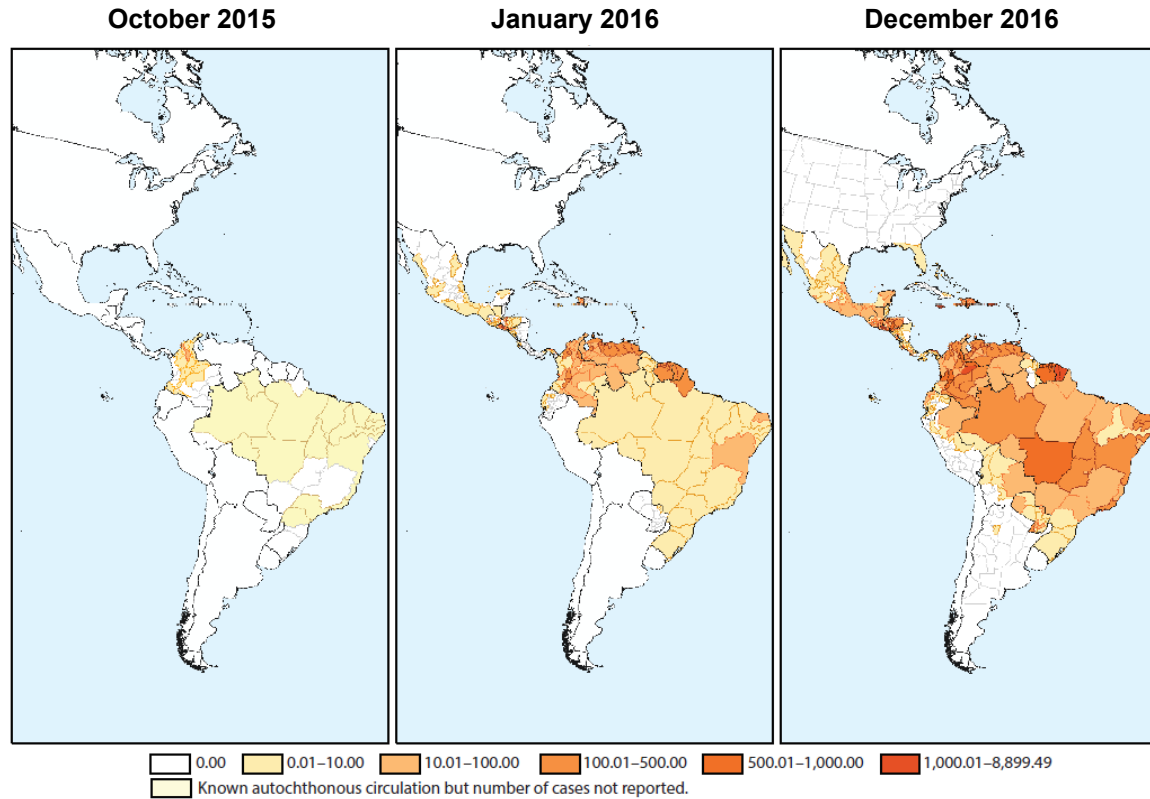




# Zika Virus Disease

## Outbreak (2015-2016)

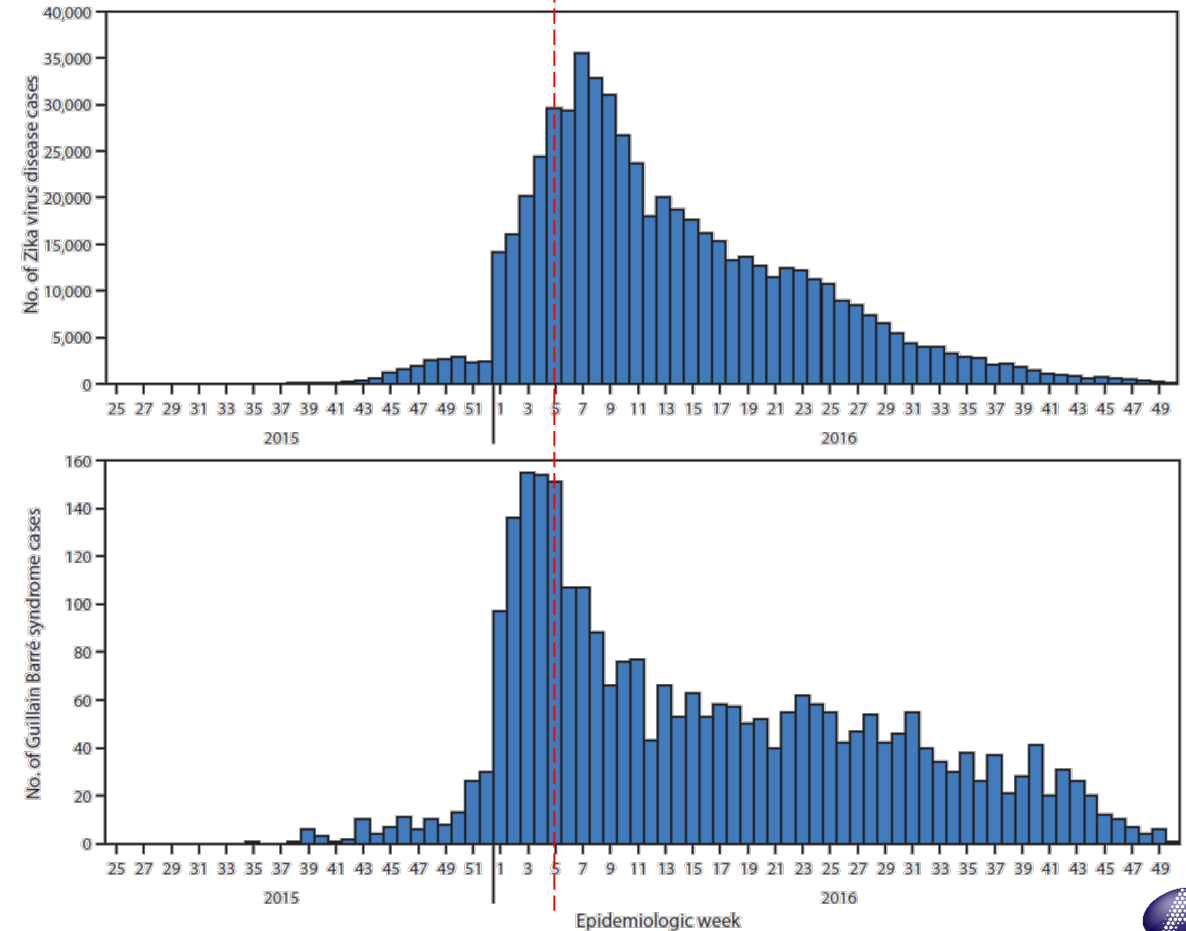
FIGURE 1. Cumulative suspected and confirmed cases of Zika virus disease per 100,000 population — Region of the Americas,\* October 2015, January 2016, and December 2016



\* Maps show first-level administrative divisions (states, departments, and provinces) with circulation of Zika virus, as officially reported by national health authorities. Where data on the incidence of Zika virus disease at the subnational level were not available, the national incidence rate was used for the entire country/territory; Zika virus was not necessarily present throughout the entire shaded area.

Feb. 1, 2016: WHO declares a Public Health Emergency of International Concern (PHEIC)

FIGURE 3. Suspected and confirmed cases of Zika virus\* and Guillain-Barré syndrome,† by epidemiologic week — Region of the Americas, May 2015–December 2016

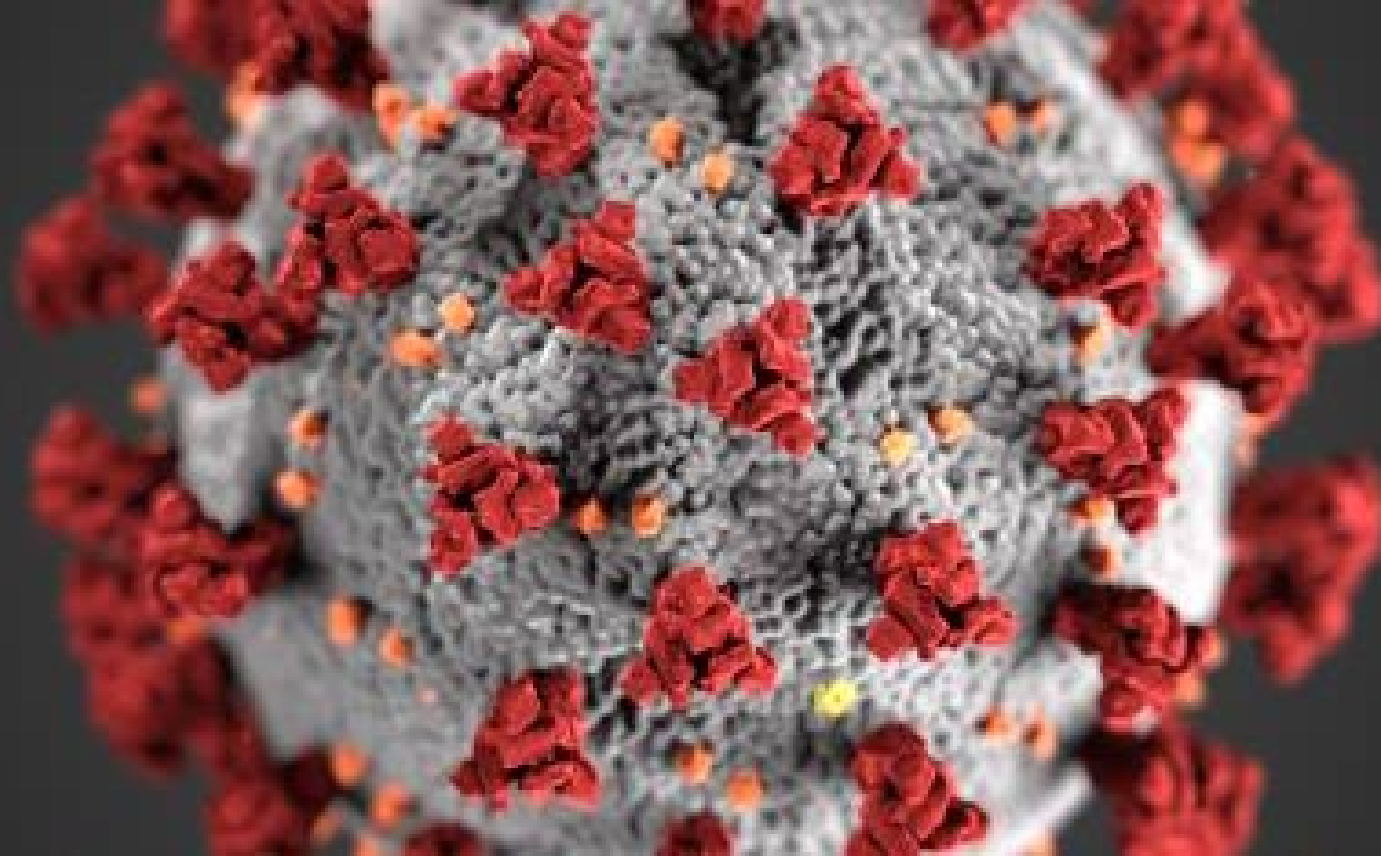




# Response to Zika

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- The scientific community's interest in ATCC's Zika strains grew overnight.
- Zika quickly jumped from relative obscurity to one of ATCC's most requested viruses.
- BEI Resources shipped more than 5,492 Zika-related items in 734 shipments to 362 investigators in 30 countries from 2016-2018.
- BEI Resources acquired and made available more than 400 catalog items to support the Zika response.



CDC, PHIL 23311

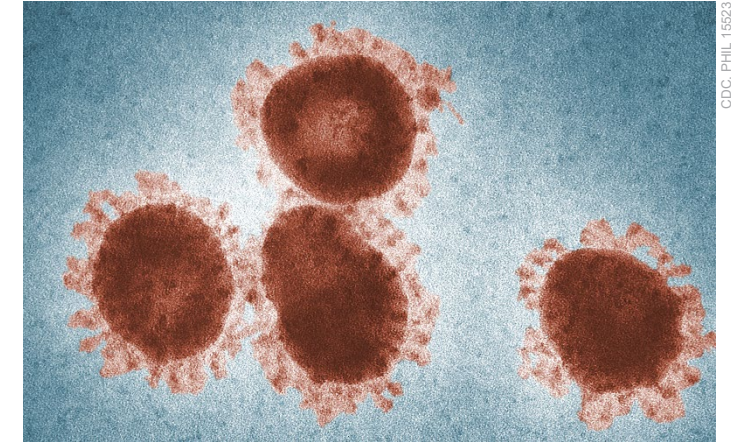
# SARS-CoV-2 (2019-Present)



# SARS-CoV-2

## Severe Acute Respiratory Syndrome Coronavirus 2

- Family *Coronaviridae*, Genus *Betacoronavirus*
  - ssRNA(+) virus
  - Genome  $\approx$ 29.9 kb
- SARS-CoV-2 is transmitted primarily by aerosol droplets
- Beginning in late 2019, pneumonia cases of an unknown origin began to emerge, centered in Wuhan, China



CDC, PHIL 15523

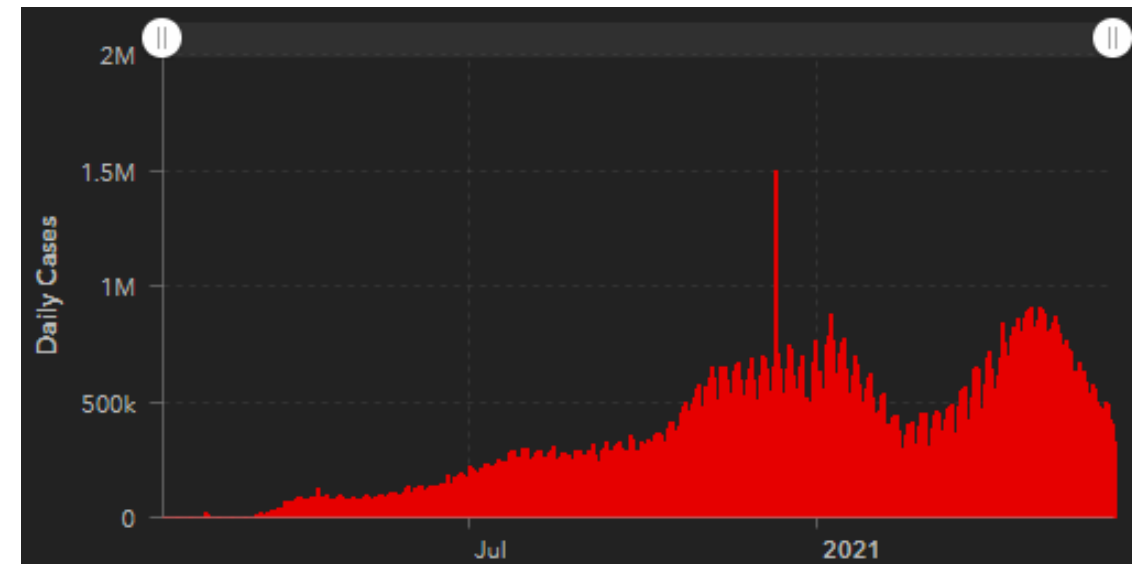


Daniel Wood, NPR

# COVID-19

## SARS-CoV-2 Outbreak (2019-Present)

- 30 DEC 2019, 11:59 PM: ProMED: Undiagnosed pneumonia - China (HU), RFI
- 10 JAN 2020: First genome available in GenBank: Wuhan-Hu-1 isolate
- 19 JAN 2020: Sample (USA/WA1) isolated from first US reported patient
- **04 FEB 2020: BEI Resources receives USA/WA1 isolate; immediately begins producing and characterizing**
- **06 FEB 2020: BEI Resources begins distribution of USA/WA1 isolate**
- 11 FEB 2020: The ICTV Coronavirus Study Group names the virus SARS-CoV-2
- 11 FEB 2020: WHO designates name of disease COVID-19 (coronavirus disease 2019)



COVID-19 Dashboard, Johns Hopkins University (JHU)

# Response to SARS-CoV-2 (2019-Present)

- ATCC
  - Heat-inactivated material
  - Ready-to-use external control kit
  - gRNA from clinical isolates, including recent VOIs
  - $\alpha$ -Spike polyclonal antibodies
  - Synthetically-derived RNA safe for BSL-1 facilities
  - Cell lines for virus growth, vaccine development, respiratory studies, and immune research
  - Genomes added to the ATCC Genome Portal ([genomes.atcc.org](https://genomes.atcc.org))



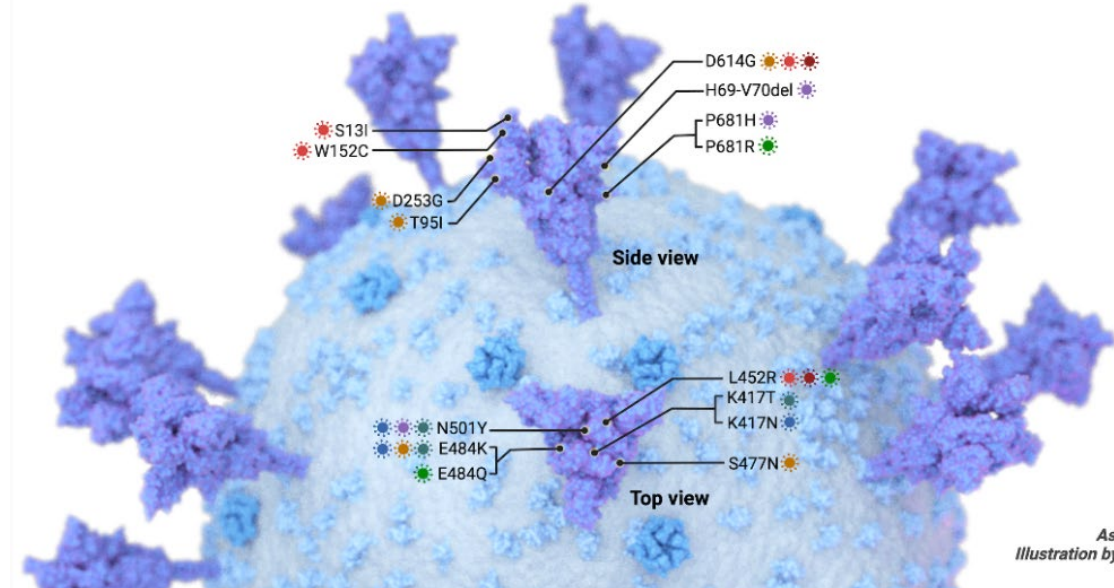


# Response to SARS-CoV-2 (2019-Present)

- BEI Resources
  - More than 180 SARS-CoV-2-related catalog items released
  - >2,500 new and upgraded registrants
  - Shipped to >70 countries
  - >6,500 Orders for SARS-CoV-2 material for 33,000 units
- BEI Resources continues to actively acquire and produce
  - Variants of Concern (VOCs)
  - Tools for assays and diagnostics



CDC, PHIL 24502



# Conclusion

## *Why Biological Collections Are Essential*

- Biological collections are essential to standardization, quality control, and accessibility of biological resources to the scientific community.
- General collections such as ATCC can house items that suddenly become tremendously relevant.
- Specialized government-supported programs like BEI Resources are an essential lynchpin in efforts to collect and characterize infectious disease reagents and rapidly distribute them to the scientific research community.