# Polio Eradication: A Challenge for Vaccine Delivery

Marta Murreddu, PhD

19 October 2026

Cerba Research



# Our history

## Rooted in specialty and diagnostic laboratory services

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**Foundation of** Cerba Laboratory

1967

**Foundation of** BARC Central Laboratory Belgium

BARC Global Central Laboratory

1983

BARC South Africa 1996

2007

**BARC acquired by Cerba Laboratory**

2012

2016

New Platform: **Cerba Xpert** (IVD & Medical Devices)

Cerba Xpert

2018

**Joint Venture Cerba Lancet** Europe & Africa

Pathologists Lancet Laboratories Key to Diagnostic Excellence

2020

**Rebrand** BARC to **Cerba Research**

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2021

**Joint Venture** ACT Genomics Asia, Taiwan

2022

**Acquisition of Viroclinics-DDL**: Virology & Vaccines

Viroclinics DDL Diagnostic Laboratory

2023

**Acquisition Cirion Biopharma Research**: Bioanalytical, Biosimilars & Biologics MOU: Teddy Lab

CIRION

Specialty Laboratory

Diversification into Clinical Research Laboratory and geographical expansion

Diversification into IVD

Diversification into Precision Medicine and geographical expansion

Diversification into multi-specialist platforms

# Infectious Diseases and Virology Highlights

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**~600**
ID trials since 2018

**250**
Focused on COVID-19

**90%+**
Trials include specialty testing

**Cerba NL**
Virology center of excellence

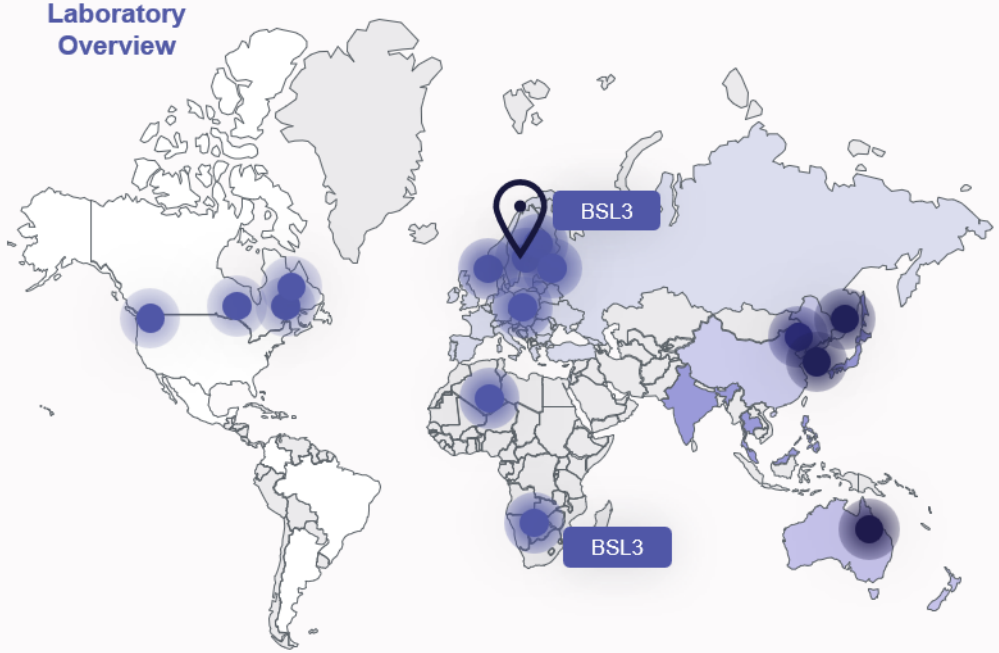
**Targets**

Influenza (seasonal and HP), Sars-Cov-1 and 2, MERS, RSV, HMPV, PIV, HPV, HBV, HCV, HDV, CMV, Dengue, EBV, HIV, TB and Polio.

CEPI · Gates Foundation · SII Serum Institute of India · Operation Warp Speed · PATH · NIH National Institutes of Health

**Partnership**

**Laboratory Overview**




**NL center of excellence for virology – global capacity for method transfer at CR laboratories & partner labs**

Cerba Research Data In-house (updated 12Jan2025-excluding Cirion); ID=infectious disease

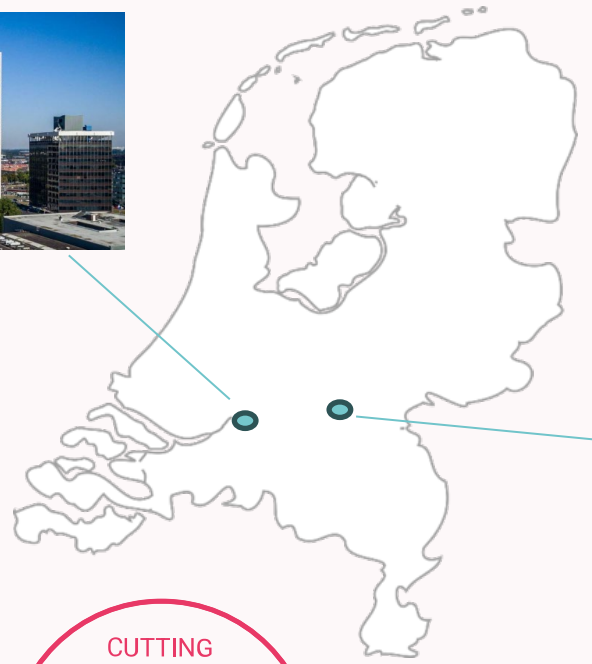
# Our Virology and Vaccine Center of Excellence

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## Rotterdam

- Sequencing Center of Excellence
- Next Generation Sequencing, Long Read Sequencing
- Bio-informatics
- FDA compatible data analysis pipelines
- Multiple isolation and PCR platforms
- Real Time qPCR
- ddPCR
- Clinical Trial Support for Infectious Diseases
- Virology Laboratory Services
- Immunology & Biomarker Analysis
- Custom Assay Development & Validation
- Biobanking & Logistics
- Dedicated team of Scientists and Consultants





CUTTING EDGE LAB

BSL 2 BSL 3

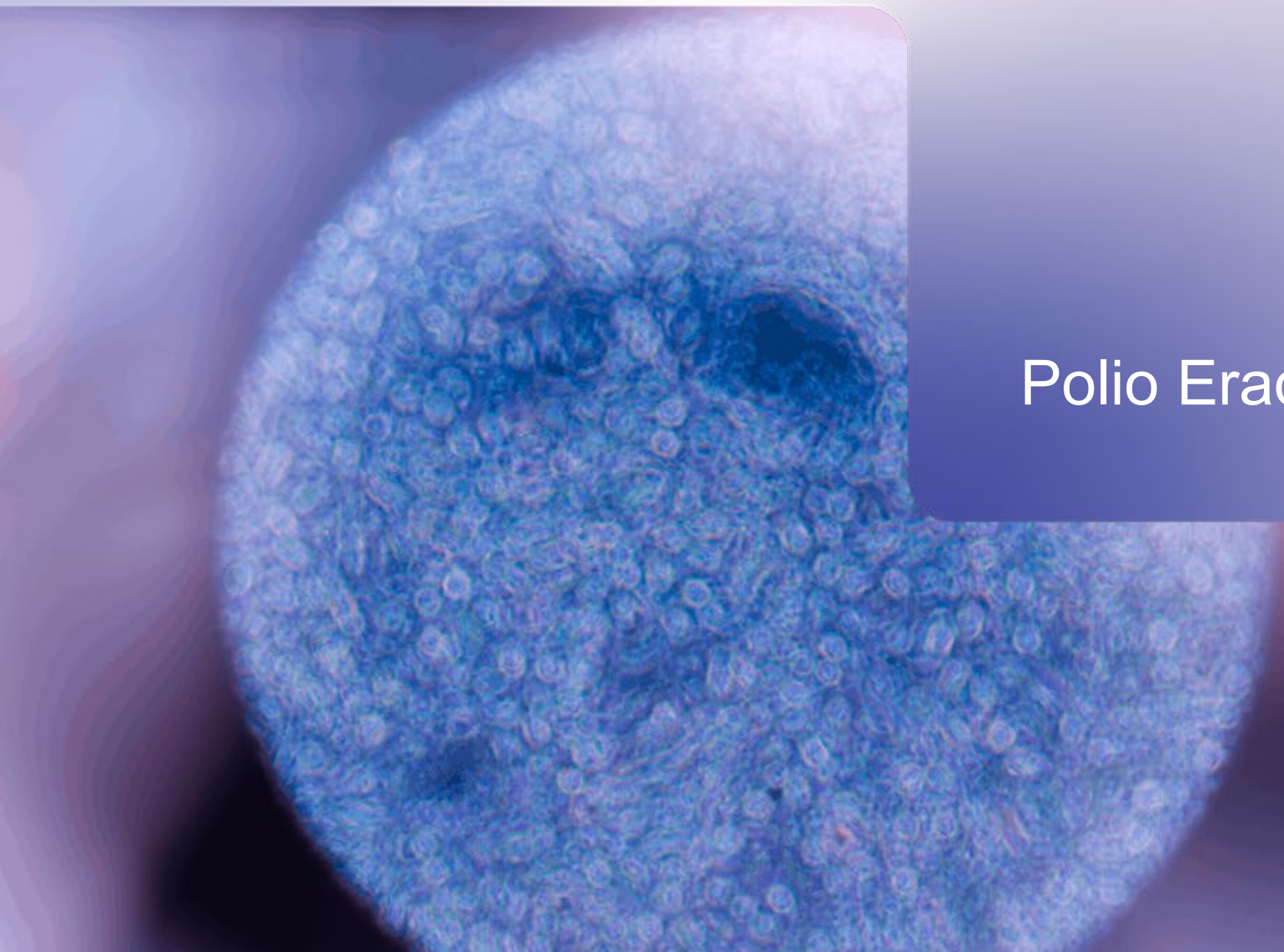
State-of-the-Art Facilities

## Schaijk

- Preclinical facility for SPF, Conventional, BSL2 and BSL3(+)
- Wide Range of different preclinical animal models (wild-type and GMO)
- Solutions for any kind of experimental set up and early development
- Dedicated Team of Scientists and Study Directors
- **Polio High Containment Facility (working towards GAPIV certification) for clinical sample testing**



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# Polio Eradication: Main Challenges

# World Polio Day: October 24

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- **Raises awareness** of polio and the vital role of vaccination in preventing this devastating disease.
- **Polio can cause irreversible paralysis:** approximately **1 in 200 infections** results in paralysis, with **5–10% of paralysed patients dying** when respiratory muscles are affected.
- **Major progress since 1988:** following the global eradication initiative, wild poliovirus cases have declined by **99%**.



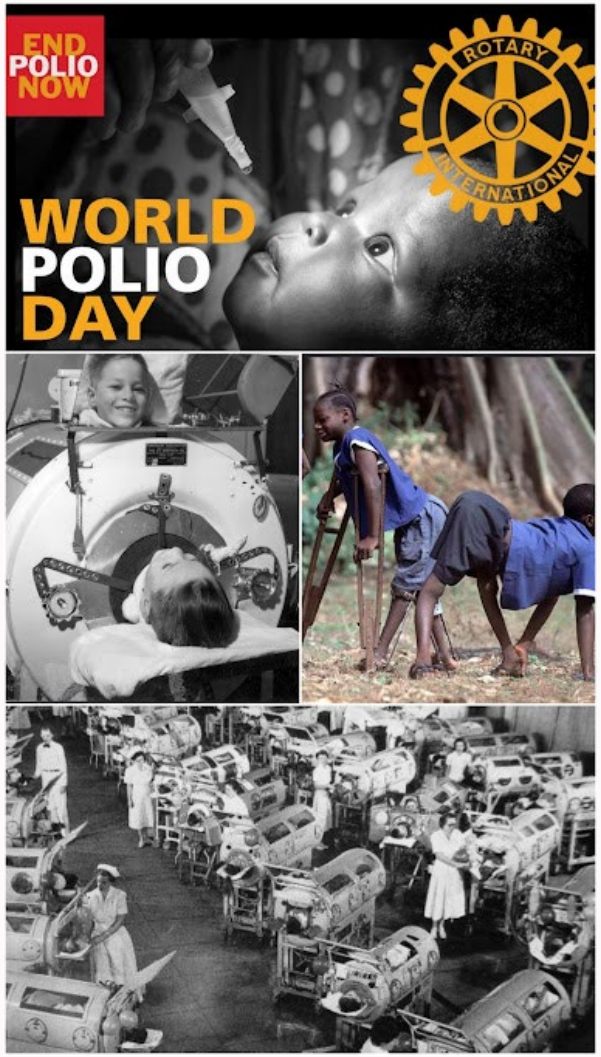

Polio (Poliovirus)

Family *Picornaviridae* > Genus *Enterovirus* > Species *Enterovirus Coxsackiepol*

30nM particle & Single-stranded +RNA genome &7.5 kb genome

3 serotypes/genotypes:

- Poliovirus 1 (PV1)
- Poliovirus 2 (PV2)
- Poliovirus 3 (PV3)




World Polio Day, October 24 | Rotary Club of Rockland

# Global Polio Eradication: Current Status

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**Significant Progress**

- **>99% reduction** in wild polio cases since 1988
- Wild poliovirus **Types 2 and 3 eradicated**
- Wild poliovirus **Type 1 (WPV1)** remains endemic only in: Afghanistan and Pakistan
- Global efforts also contend with outbreaks of circulating vaccine-derived polioviruses (cVDPV)

[Polio This Week | GPEI | Most Recent News | Countries]

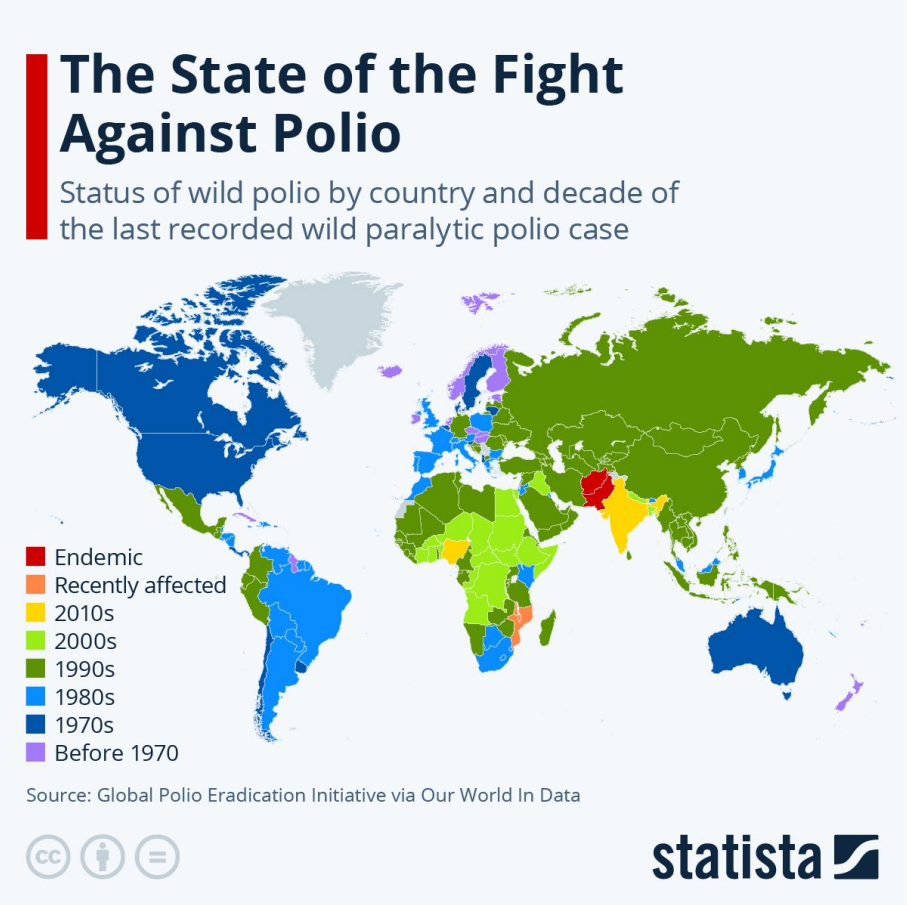



Chart: The State of the Fight Against Polio | Statista

# Key Challenges

## Ongoing transmission persists in hard-to-reach and conflict-affected communities

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- Continued transmission in hard-to-reach and conflict-affected areas
- Outbreaks of **circulating vaccine-derived poliovirus** in under-immunized populations
- Vaccine hesitancy and misinformation
- Maintaining high routine immunization coverage
- Surveillance and rapid outbreak response

Review

**Public health responses following identification of poliovirus in wastewater**

Marie Lesenfants, Elisabetta Suffredini, Pamela Mancini, Agata Franco, Daniele Congiu, Jan Richter, Christina Christodoulou, Anke Meyers, Shahin Huseynov, Paola Stefanelli, Giuseppina La Rosa

Poliovirus continues to pose a global public health threat, with both wild and vaccine-derived viruses detected in clinical and environmental samples, including in countries declared to be polio free. Although wastewater and environmental surveillance increasingly reveal silent poliovirus circulation, how these findings are translated into public health action remains unclear. We reviewed the literature to identify documented events in which poliovirus detection in wastewater triggered public health responses across WHO regions. 26 unique events across 21 countries and all six WHO regions were included. Public health actions were analysed across five response domains defined for this Review: environmental surveillance; clinical surveillance; vaccination; risk communication; and coordination. Across diverse epidemiological contexts, poliovirus detection in wastewater consistently prompted public health action, often in the absence of paralytic cases. Enhanced environmental surveillance was the most common response, frequently accompanied by intensified clinical surveillance and targeted vaccination activities. Overall, our Review highlights environmental surveillance as an operational early warning system within the Global Polio Eradication Initiative and provide insights applicable to preparedness and response frameworks beyond poliovirus.

Lancet Public Health 2026; 11: e329–42
Published Online April 10, 2026
https://doi.org/10.1016/S2468-2667(26)00051-4

Epidemiology of Infectious Diseases Service, Epidemiology and Public Health Department, Sciensano, Brussels, Belgium (M Lesenfants MSc, A Meyers MSc); Department of Food Safety, Nutrition and Veterinary Public Health,

Outbreak News Today

INDIAN SUBCONTINENT

**Pakistan reports 6th polio case of 2026**

ROBERT HERRIMAN
OCT 06, 2026

Share

Pakistan health officials report the sixth polio case of 2026 in a seven-year-old male from Union Council Ghundi-A, in Tehsil Jamrud, Khyber District in Khyber Pakhtunkhwa (KP) province.

Five of this year's six cases have been reported from Khyber Pakhtunkhwa province, four of them from Southern Khyber Pakhtunkhwa alone.

ELSEVIER
eClinicalMedicine
Volume 81, March 2025, 103136

Health Policy

**Public health, war and cross-border challenges: the recent cVDPV2 polio outbreak in Gaza**

Itamar Grotto [a], Hazem Agha [b], Ahmad Abu Al-Halaweh [c], Nadav Davidovitch [a b], Martin McKee [d], Dorit Nitzan [a]

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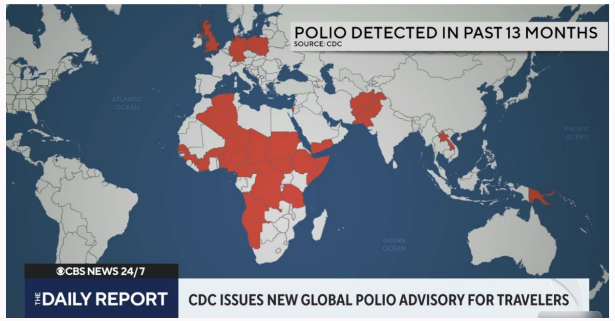
**Letter to the editor:**

**IS POLIO MAKING A COMEBACK? THE COST OF VACCINE HESITANCY AND THE DISPARITY IN VACCINE COVERAGE**

Thalles Guilarducci Costa[1], Rizia Rocha Silva[1], João Victor Rosa de Freitas[1], Rodrigo Luiz Vancini[2], Marilia Santos Andrade[3], Claudio Andre Barbosa de Lira[1]

1 Federal University of Goiás, Goiânia, Brazil
2 Federal University of Espírito Santo, Vitória, Brazil
3 Federal University of São Paulo, São Paulo, Brazil

* **Corresponding author:** Claudio Andre Barbosa de Lira, Federal University of Goiás, Goiânia, Brazil. Tel.: +55 64 98142-8455, E-mail: andre.claudio@gmail.com




**SUMMARY**

Poliomyelitis is caused by Poliovirus, a member of a large group of enteroviruses. Vaccine-derived polioviruses (VDPVs) stem from mutated live poliovirus, which is contained in the Oral Polio Virus vaccine (OPV). In addition, the emergence of VDPV is one of the global challenges for the eradication of poliomyelitis. VDPVs continue to affect different parts of the world; 1081 cases occurred in 2020 and 682 cases in 2021. There are several reasons that may have caused the increase in circulating vaccine-derived poliovirus (cVDPV) after the "switch" from the trivalent to the bivalent oral polio vaccine. One reason is the low vaccination rate among the targeted population, which has been further aggravated by the COVID-19 pandemic. Several strategies could control the spread of VDPV including the use of the monovalent OPV (mOPV-2). The risk of VDPV can be minimized through increased immunization rates and the use of safer vaccine alternatives. The global effort to eradicate polio has made significant progress over the years, but continued vigilance and investment in immunization programs are needed to achieve the ultimate goal of a polio-free world.

*Keywords:* Poliovirus, vaccine derivative poliovirus.

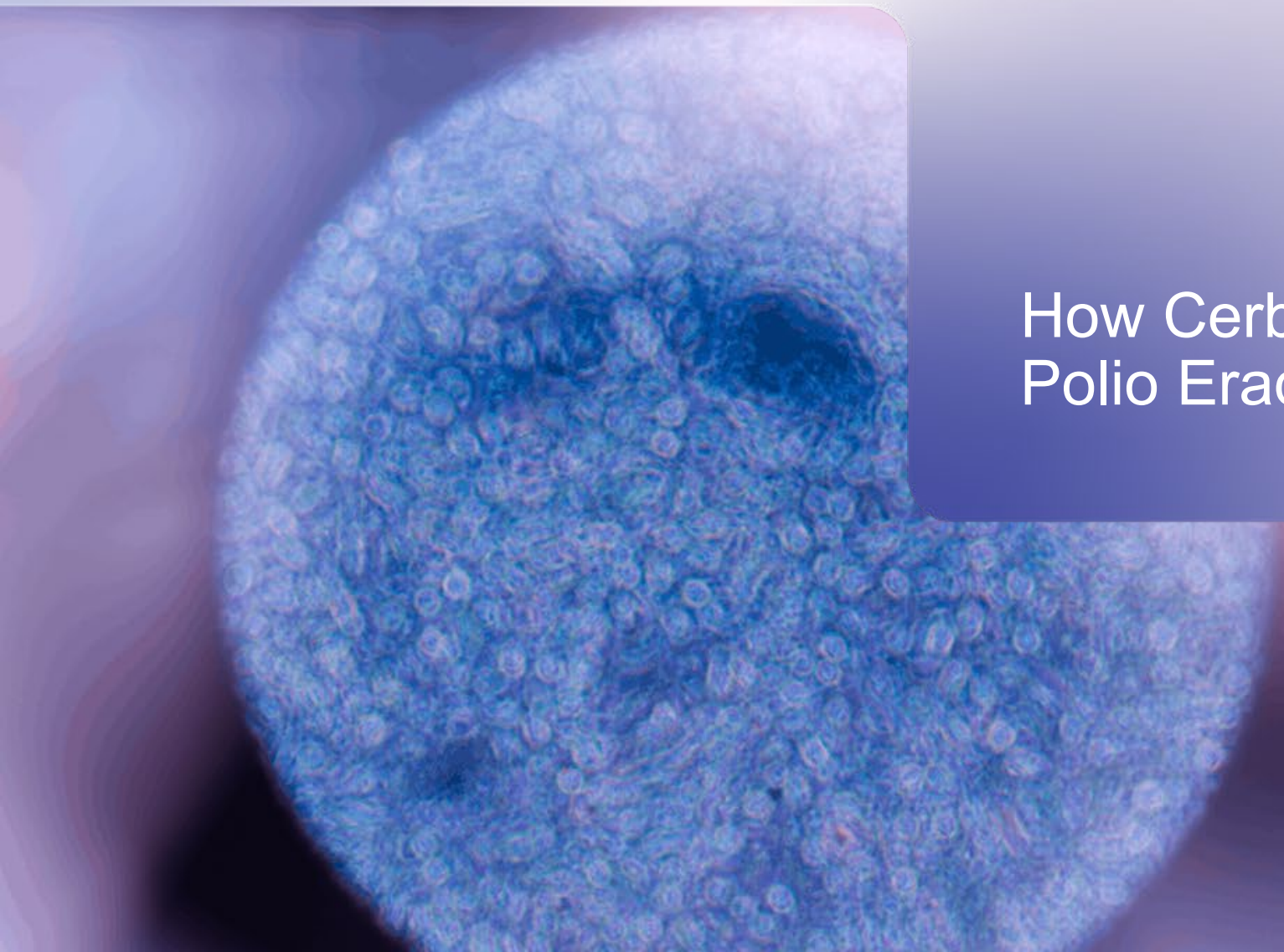
Correspondence

**Why is polio still a concern, also in Europe?**

Thea K. Fischer[a,b,*] Caroline Klint Johannesen[a] Natasa Berginc[c] Jean-Luc Bailly[d] Kim Benschop[e,f] and Heli Harvala[g,h]

[a]Department of Clinical Research, Nordsjællands Hospital, Hillerød, Denmark
[b]Department of Public Health, University of Copenhagen, Copenhagen, Denmark
[c]National Laboratory of Health, Environment and Food, National WHO Reference Laboratory for Polio, Ljubljana, Slovenia
[d]Université Clermont Auvergne, CNRS, Laboratoire Microorganismes Génome Environnement, France
[e]National Institute for Public Health and the Environment (RIVM), Bilthoven, the Netherlands
[f]Centre for Infectious Disease Control (CIb), the Netherlands
[g]Microbiology Services, National Health Service (NHS) Blood and Transplant, London, UK
[h]Division of Infection and Immunity, University College London, London, UK

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# How Cerba Research is supporting Polio Eradication

# Specialized Laboratory Services: Schaijk

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*We are participating in the WHO Global Action Plan for Poliovirus Containment, Fourth Edition (**GAPIV**)**



The main objectives are to:

- **Prevent accidental release** of poliovirus from laboratories or manufacturing facilities.
- **Reduce the risk of reintroducing poliovirus** into communities where polio has been eliminated.
- **Ensure appropriate containment measures**, including facility requirements, biosafety procedures, risk assessments, and staff training.
- **Support global polio eradication efforts** by managing poliovirus materials safely.

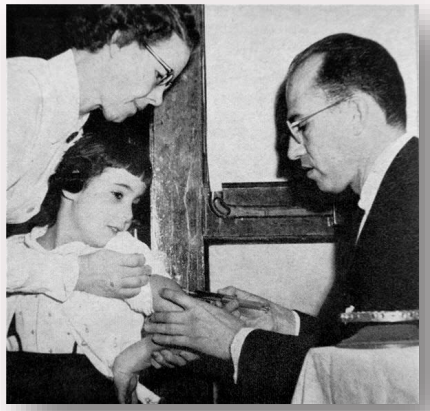
Containment Guidance & Tools | Polio Biosafety | GPEI

**It replaced GAPIII and came into force on 1 July 2022*

# Polio Vaccines

## IPV (Inactivated Polio Vaccine) vs OPV (Oral Polio Vaccine)

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*Jonas Salk administering inactivated vaccine (1954)*
*Source:Jonas Salk - Wikipedia*

| IPV: Inactivated Polio Vaccine | OPV: Oral Polio Vaccine |
|---|---|
| Inactivated (non-live) poliovirus | Live, weakened (attenuated) poliovirus |
| Injection | Oral drops |
| Excellent protection against paralytic polio | Strong intestinal immunity, helping interrupt transmission |
| Less effective at preventing intestinal infection/transmission | Highly effective at reducing person-to-person transmission |
| Cannot cause vaccine-associated polio | Rarely, vaccine-derived poliovirus can emerge in under-immunised populations |
| Expensive production | Excellent Protection against Paralytic Polio and Cheaper production. |



*Albert Sabin administering live-attenuated vaccine*
*Source:Jonas Salk and Albert Bruce Sabin | Science History Institute*

# IPV (Inactivated Polio Vaccine): Mechanism of Action

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💉 **IPV contains inactivated poliovirus**: it cannot replicate or cause infection.
🧬 The immune system recognizes the viral **antigens** as foreign.
🛡️ **B cells produce neutralizing antibodies**, particularly **IgG antibodies** in the blood.
🧠 **Immune memory cells** are generated, allowing a faster response if the person encounters poliovirus later.
🚫 These antibodies prevent poliovirus from reaching and damaging the **central nervous system**, thereby providing strong protection against **paralysis**.
⚠️ IPV provides less **intestinal/mucosal immunity** than OPV, so vaccinated individuals can still potentially become infected in the intestine and transmit the virus.

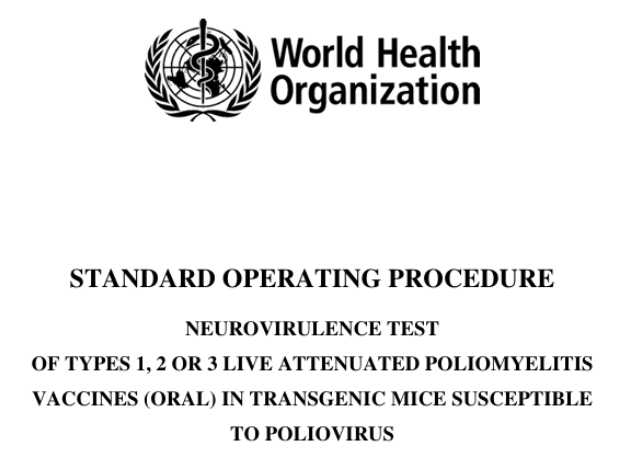



Polio_Lab_Manual04.pdf

# OPV (Oral Polio Vaccine): Mechanism of Action

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💧 **OPV contains live, attenuated poliovirus** that can replicate to a limited extent in the intestine without normally causing disease.
🧬 The attenuated virus is recognized by the **mucosal immune system** in the gut.
🛡️ This stimulates **mucosal immunity**, particularly the production of **secretory IgA antibodies**.
🚫 When the person encounters poliovirus later, intestinal antibodies can **limit viral replication and shedding**.
🌍 Reduced viral shedding helps **interrupt person-to-person transmission**, which is particularly important for polio eradication campaigns.
🧠 OPV also induces systemic antibodies and provides protection against **paralytic disease**.


World Health Organization

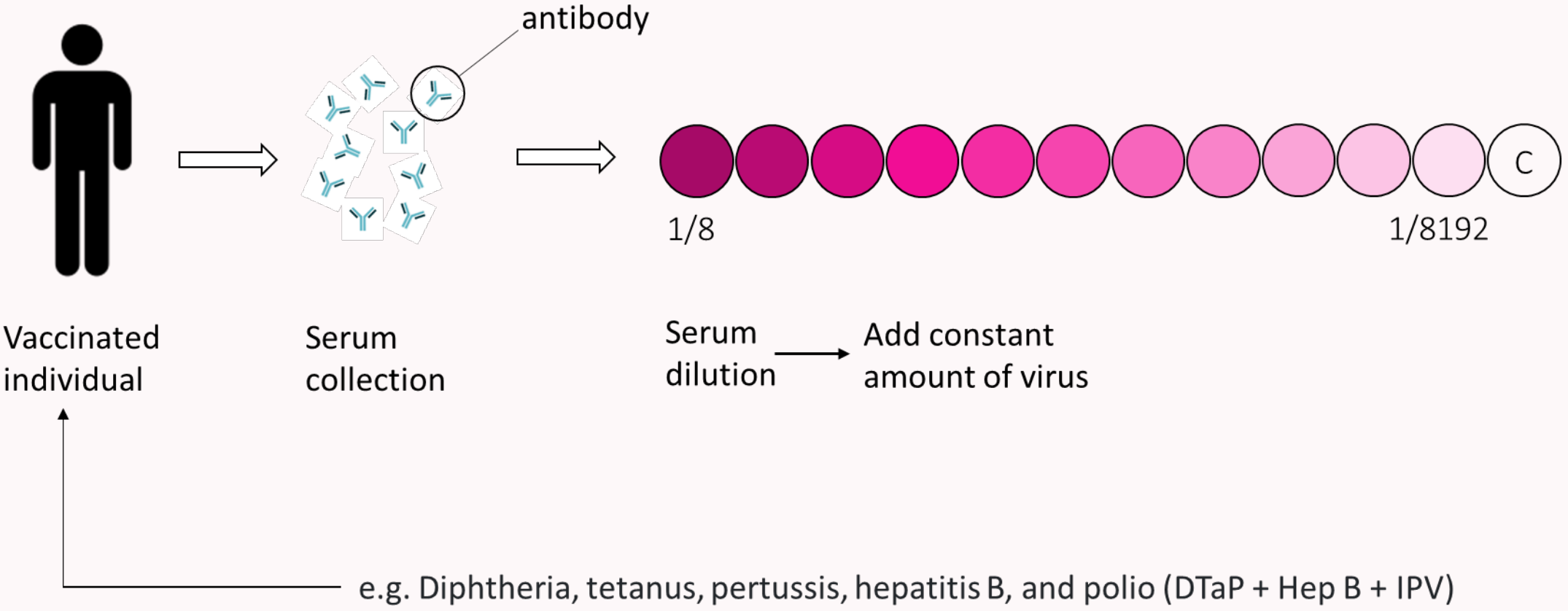
STANDARD OPERATING PROCEDURE

NEUROVIRULENCE TEST
OF TYPES 1, 2 OR 3 LIVE ATTENUATED POLIOMYELITIS
VACCINES (ORAL) IN TRANSGENIC MICE SUSCEPTIBLE
TO POLIOVIRUS

Neurovirulence Test of Types 1, 2 or 3 Live attenuated Poliomyelitis vaccines (Oral) in Transgenic Mice susceptible to Poliovirus

# Serological testing after IPV vaccination

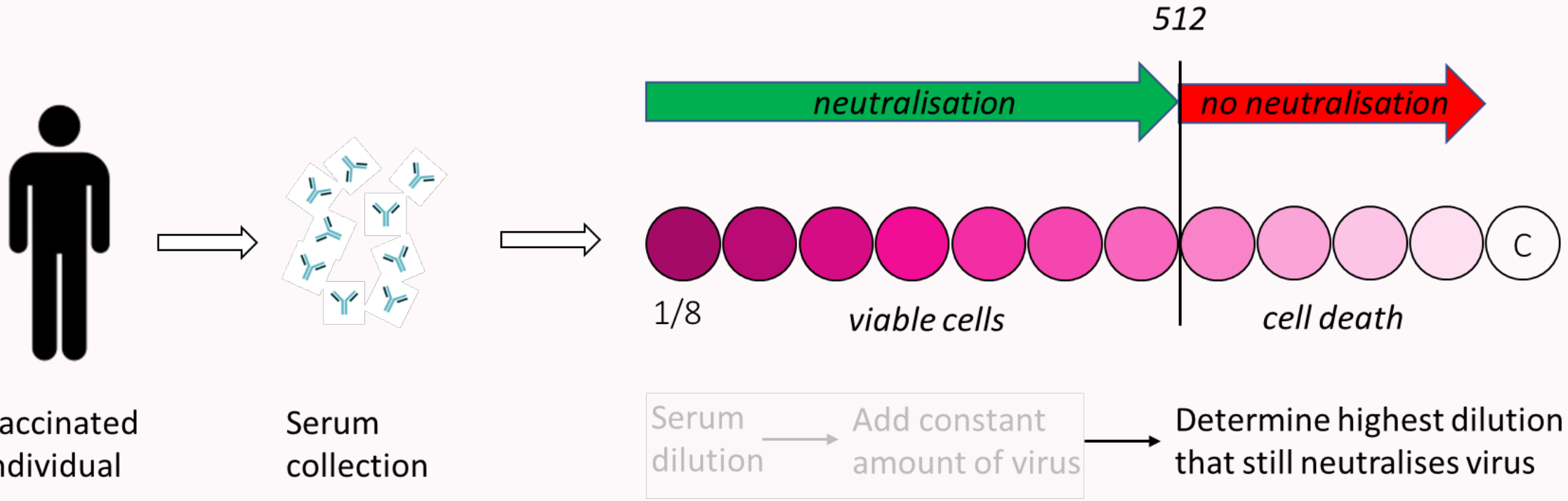
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# Serological testing after IPV vaccination

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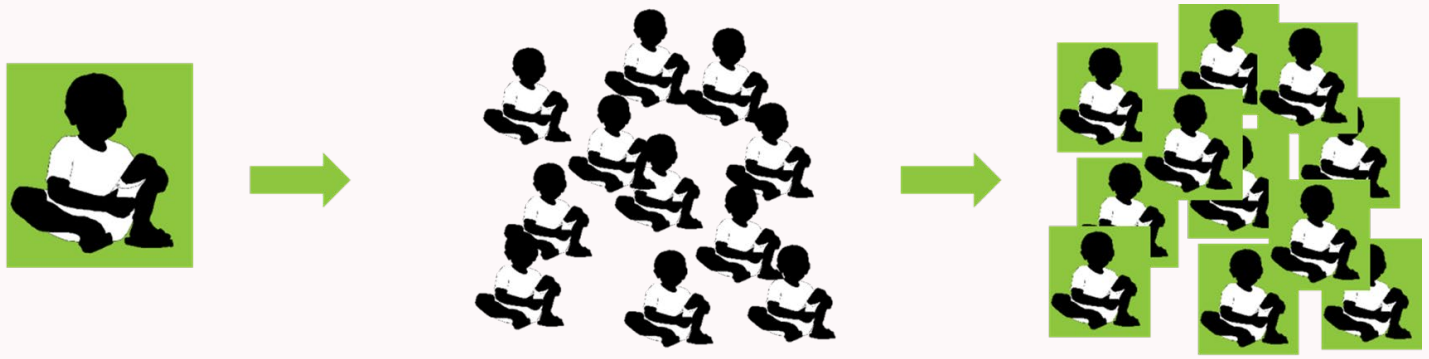



*Both Sabin and Salk poliovirus strains can be tested*



# Safety testing after (n)OPV vaccination

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Vaccinated individual (OPV)

Excretion and spread to others in close contact

Passive immunization



community with insufficient vaccine coverage

Prolonged circulation and spread, reacquired neurovirulence

Vaccine-derived poliovirus outbreak

World Health Organization

STANDARD OPERATING PROCEDURE

NEUROVIRULENCE TEST
OF TYPES 1, 2 OR 3 LIVE ATTENUATED POLIOMYELITIS VACCINES (ORAL) IN TRANSGENIC MICE SUSCEPTIBLE TO POLIOVIRUS

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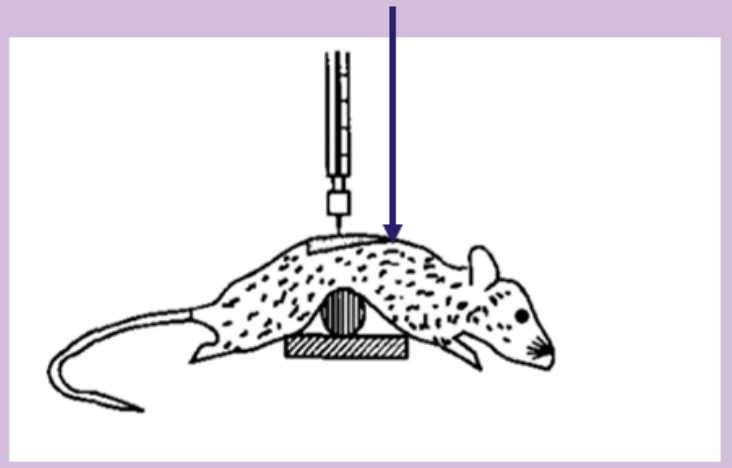
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# Safety testing after (n)OPV vaccination

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Needle inserted between the spinous process and the first lumbar vertebrae

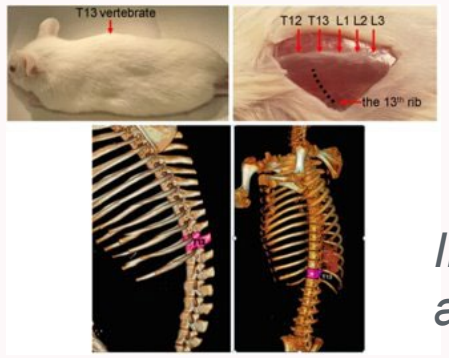


| Stages | Physical signes | | |
|---|---|---|---|
| Normal | Grips the edge of the cage | Walks normally on the grid and on a flat surface | Full ability to move limbs forward |
| Weak | Unable to grip the edge of the cage | Walks normally on the grid and on a flat surface | Full ability to move limbs forward |
| Paresis/ Partial paralysis | Unable to grip the edge of the cage | Limbs fall through the grid more than once while walking and toes curl repeatedly while walking on a flat surface | At least a partial to move limb forward |
| Paralysis | Unable to grip the edge of the cage | No use of limb on grid or flat surface | Inability to move the limb forward |

World Health Organization

STANDARD OPERATING PROCEDURE

NEUROVIRULENCE TEST
OF TYPES 1, 2 OR 3 LIVE ATTENUATED POLIOMYELITIS VACCINES (ORAL) IN TRANSGENIC MICE SUSCEPTIBLE TO POLIOVIRUS




*Inoculation via injection between the 13th Thoracic vertebrae and 1st Lumbar vertebrae*

# Molecular Assays available at Cerba Research

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1. Quantitative poliovirus detection: Validated qPCR protocols for quantitative virus detection.
2. Poliovirus whole-genome deep sequencing (NGS) Mutational analysis of the poliovirus genome using deep sequencing. Relevant for characterizing genetic variants and monitoring genetic stability.




NextSeq 1000 & NextSeq 2000 Systems | Flexible, versatile sequencing

**Genetic and phenotypic stability of poliovirus shed from infants who received novel type 2 or Sabin type 2 oral poliovirus vaccines in Panama: an analysis of two clinical trials**

*Rahnuma Wahid, Laina D Mercer, Tirza De Leon, Rodrigo DeAntonio, Xavier Sáez-Llorens, Andrew Macadam, Konstantin Chumakov, Jeroen Strating, Björn Koel, Jennifer L Konopka-Anstadt, M Steven Oberste, Cara C Burns, Raul Andino, Erman Tritama, Ananda S Bandyopadhyay, Gabriela Aguirre, Ricardo Rüttimann, Chris Gast, John O Konz*

Evaluating stability of attenuated Sabin and two novel type 2 oral poliovirus vaccines in children

Rahnuma Wahid[1], Laina Mercer[1], Chris Gast[1], Tirza De Leon[2,3], Xavier Sáez-Llorens[3,4], Alan Fix[1], Andrew Macadam[5], Laura Stephens[5], Konstantin Chumakov[6,7], Saskia L. Smits[8], Marta Murreddu[9], Jennifer L. Konopka-Anstadt[10], M. Steven Oberste[10], Cara C. Burns[10], Raul Andino[11], Novilia Sjafri Bachtiar[12], Erman Tritama[12], Ananda S. Bandyopadhyay[13], Gabriela Aguirre[14], Ricardo Rüttimann[14] and John O. Konz[1]

# NGS as an alternative to Poliovirus Neurovirulence Testing

## A promising molecular approach — with an important distinction between molecular consistency testing and biological neurovirulence testing

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### What NGS can contribute

- Quantifies minority genetic variants and attenuation-associated mutations
- Provides a high-resolution view of viral genome composition
- Collaborative WHO studies found strong agreement with MAPREC for OPV molecular consistency

### What it does not automatically replace

- NGS measures genotype; NVT assesses biological neurovirulence
- Evidence for replacing MAPREC is not the same as formal replacement of an animal NVT
- Applicability depends on vaccine type, intended use, validation and regulatory acceptance

### Regulatory signal: WHO ECBS, April 2026

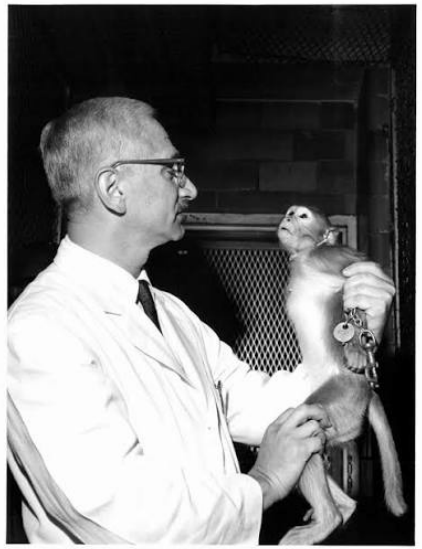
WHO reported establishing international reference reagents for high-throughput sequencing of Sabin IPV (sIPV), noting the potential of these technologies to improve quality control and reduce animal testing where scientifically justified.

**Take-home: NGS is a strong candidate for modernising poliovirus vaccine QC; a claim of NVT replacement must be product- and regulator-specific.**

Sources: WHO ECBS, Main outcomes, 20–24 Apr 2026 (WHO PDF); WHO/BS/2022.2438 (NGS vs MAPREC in OPV); WHO Poliomyelitis standards page.

*For discussion purposes; confirm current product-specific requirements with the relevant regulatory authority.*

# Animal Efficacy Studies in Poliomyelitis



Albert Sabin and a research monkey, c.1950s. Courtesy the Hauck Center for the Albert B. Sabin Archives, Henry R. Winkler Center for the History of the Health Professions, University of Cincinnati Libraries.

*Macaques have historically been used to assess oral polio vaccine neurovirulence and vaccine safety.*
*Applications: neurovirulence assessment and studies of poliovirus pathogenesis.*



Transgenic Mouse Models as Alternatives | Charles River

**Transgenic mouse models:**
Mice expressing the human poliovirus receptor (CD155) develop susceptibility to poliovirus.
Applications: vaccine-induced protection, antibody responses and antiviral efficacy

Animal studies are essential for evaluating vaccine protection, live-vaccine neurovirulence and candidate antiviral activity. Vaccine efficacy evidence is more established; poliovirus antivirals remain investigational.

# Antiviral candidates under investigation

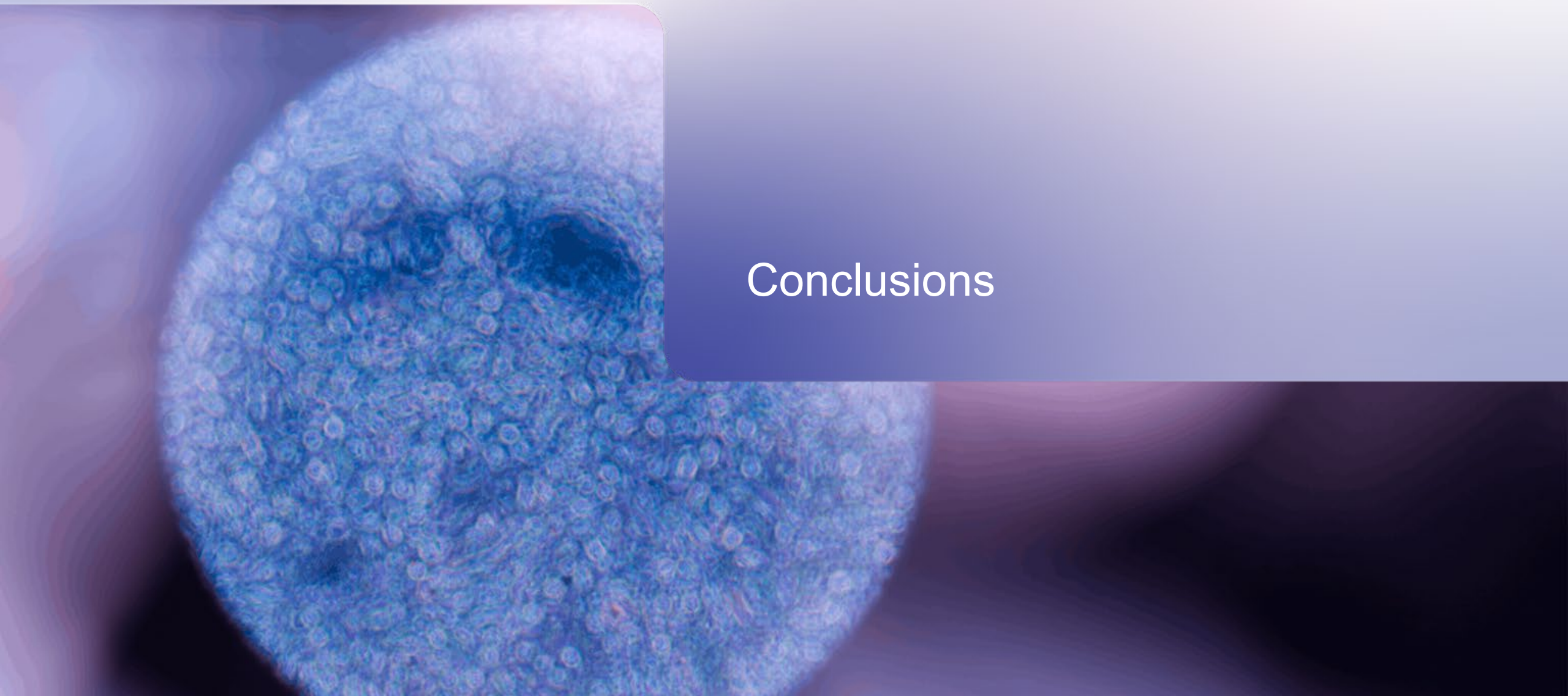
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- No licensed specific antiviral therapy for poliovirus infection.
- Treatment is supportive: respiratory support, pain management, rehabilitation and prevention of complications.

| Antiviral | Mechanism | Current status |
|---|---|---|
| Pocapavir (V-073) | Capsid inhibitor; interferes with viral uncoating | Investigational; available through compassionate-use pathways for selected patients |
| V-7404 (imocitrelvir) | Viral protease inhibitor | Investigational; studied in combination with pocapavir |
| Poliovirus-neutralising monoclonal antibodies | Bind the virus and block infection | Under development |

*Pocapavir is a leading investigational poliovirus antiviral; Pocapavir plus V-7404 is a combination strategy under development. Supportive care and vaccination remain central to clinical management and prevention.*

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# Conclusions

# Global Polio Eradication: Current Status & Key Challenges

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**Innovation & Response**

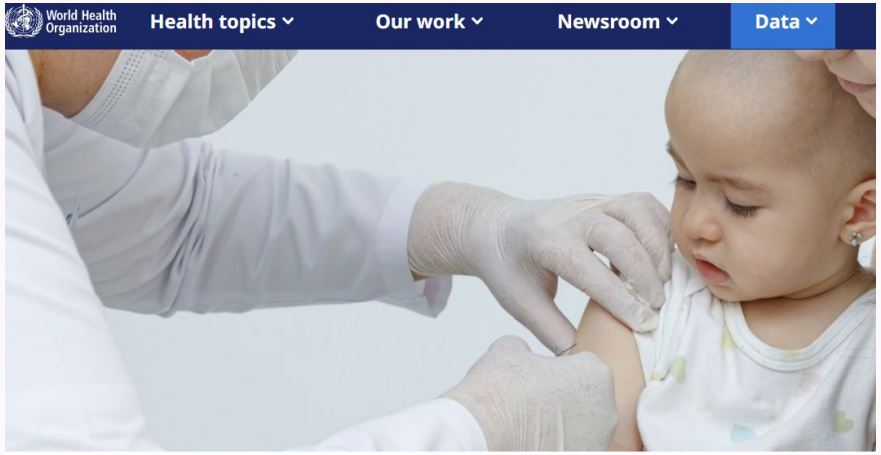
- Deployment of **Novel Oral Polio Vaccine** to improve outbreak control
- Enhanced environmental surveillance
- Integrated vaccination campaigns reaching vulnerable communities
- Continued global collaboration through the **Global Polio Eradication Initiative (GPEI)**

**Looking Ahead**

**Final eradication requires:**

- Sustained political commitment
- Strong surveillance systems
- High vaccination coverage
- Reliable vaccine supply and delivery
- Long-term investment until transmission is interrupted worldwide

*The world is closer than ever to eradicating Polio but reaching the last remaining reservoirs and controlling cVDPV outbreaks require sustained vaccination, surveillance, and global collaboration.*



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For more information contact:
Marta Murreddu marta.murreddu@cerbaresearch.com



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