

# Partners in Vaccine Development In General and During a Crisis

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I am a paid member of the Pfizer COVID-19  
vaccine Data Monitoring Committee

# Partners in Vaccine Development

- Academic Research Institutions
- National Institutes of Health and comparable organizations in other countries
- Biomedical Advanced Research and Development Authority (BARDA)
- Small (Biotech) & large (Pharma) vaccine companies
- Philanthropies
- Non-governmental organizations (NGOs)
- Food and Drug Administration (FDA) and Centers for Diseases Control and Prevention (CDC)

# Academic Research Institutions

- Scientists working at universities, research hospitals or institutes get funding to study a wide variety of topics that may be relevant in developing a vaccine:
  - Pathogen biology, disease pathogenesis, host immune responses, basic immunology, novel vectors, novel means of administering vaccines, others.
- Academic scientists may provide patents (intellectual property), animal models, expertise in disease pathogenesis and the design and conduct of vaccine clinical trials.
  - Example: Phase 1 Trial of the TA-HSV DISC Vaccine in HSV-2 Seronegative Subjects. Cantab Ltd., UK. Role - Co-Principal Investigator with DI Bernstein.

# Academic Research Institutions and IP

~ Year	Invention/Discovery	Scientist(s)	Institution
1937	Yellow Fever Vaccine	Max Theiler	Rockefeller Foundation
1941	Cell culture of polio virus	Enders, Weller & Robbins	Harvard U.
1955	Inactivated polio vaccine	Jonas Salk	U. Pittsburg
1961	Live-attenuated polio vaccine	Albert Sabin	Cincinnati Children's
2004	Live-attenuated rotavirus vaccine	Bernstein & Ward	Cincinnati Children's
2006	VLPs and HPV vaccines	Fraser & Zhou	U. Queensland

# National Institutes of Health (NIH)

- Sets research priorities and funds intramural and extramural basic, translational and clinical research.
  - R01 & P01 investigator-initiated research, grants
  - U01 & U19 cooperative research agreements
  - N01 contract agreement
  - Example: 2003-2010: In Vitro & Animal Models for Emerging Diseases and Biodefense. National Institute of Allergy and Infectious Diseases Grant No. **N01-AI-30065**. Role – Principal Investigator. Award: \$14,430,801

# National Institutes of Health (NIH)

- NIAID intramural programs that conduct vaccine research
  - Bethesda, Maryland labs and Vaccine Research Center  
<https://www.niaid.nih.gov/research/vaccine-research-center-labs>
  - Rocky Mountain Labs, Hamilton, Montana  
<https://www.niaid.nih.gov/about/rocky-mountain-laboratories>



# NIH Rocky Mountain Laboratory





# Biomedical Advanced Research and Development Authority (BARDA)

- Part of the Department of Health and Human Services, BARDA, established in 2006, responsible for the procurement and development of medical countermeasures, principally against bioterrorism and pandemics.
- An official interface between the U.S. federal government and the biomedical industry.

# BARDA

- Product-driven approach supporting transition of experimental vaccines from research through advanced development towards FDA approval and inclusion into the Strategic National Stockpile.
- Support ranges from a clinical research organization network to Centers for Innovation in Advanced Development and Manufacturing, and a fill-finish manufacturing network.

# BARDA – COVID-19 Vaccine Projects

- Pfizer – mRNA-Spike protein. \$1.95B
- AstraZenca - replication-deficient simian adenovirus vector ChAdOx1 with Spike protein. \$1.2B
- Moderna – mRNA-spike protein - based vaccine encoding a pre-fusion stabilized Spike protein. \$1.67B
- Merck + IAVI - Recombinant vesicular stomatitis virus (VSV $\Delta$ G)-vectored vaccine expressing the Spike protein. \$38M

<https://www.citizen.org/article/barda-funding-tracker/>

<https://www.medicalcountermeasures.gov/app/barda/coronavirus/COVID19.aspx>

# BARDA – COVID-19 Vaccine Projects

- Sanofi-Pasteur + GSK - Recombinant Spike protein with deleted transmembrane region. \$2.06B
- Jansen (J&J) - non-replicating Adenovirus 26 – Spike protein vaccine. viral-vector vaccine. \$1.46B
- Novavax – Spike protein with Matrix-M™ adjuvant. \$1.60B

<https://www.citizen.org/article/barda-funding-tracker/>

<https://www.medicalcountermeasures.gov/app/barda/coronavirus/COVID19.aspx>

# Biotech & Big Pharma Vaccine Companies

- Both require intellectual property (IP)
- Small companies may take product through early phase development and then partner with large vaccine company.
- Chiron, using UCSF IP expressed the Hepatitis B surface antigen in yeast – this led to the development and approval of the Merck HB vaccine in 1986.
- Moderna, BioNTech, Novavax - all Biotechs.
- Merck, GSK, Sanofi, Pfizer, J&J – all big pharma

# Philanthropies/Foundation

**The Bill and Melinda Gates Foundation:** Accelerate development and commercialization of novel vaccines and sustainable manufacture of existing vaccines

- Support for NGOs and Programs:
  - Coalition for Epidemic Preparedness Innovations (CEPI)
  - GAVI Alliance (formerly the Global Alliance for Vaccines and Immunisation)
- Grant support: e.g. 2006-2009 Innovative Influenza Vaccine Linking Innate and Adaptive Immunity. Bill and Melinda Gates Foundation Grant No. 42462. Award: \$9,456,945

<https://www.gatesfoundation.org/what-we-do/global-health/vaccine-development-and-surveillance>  
<https://www.gatesfoundation.org/Media-Center/Press-Releases/2020/12/Bill-and-Melinda-Gates-call-for-collaboration-innovation-to-deliver-COVID-19-breakthroughs>

# Philanthropies/Foundations

**The Wellcome Trust:** Support the development of new and improved vaccines and enable better and broader use of the vaccines that already exist.

- Support for CEPI
- Direct project support, e.g., universal influenza vaccine
- Request for proposals: analysis of the vaccines regulatory system – “Our primary focus is on low- and middle-income countries, and on vaccines for epidemics and for pathogens without a dual market.”

[https://wellcome.org/what-we-do/our-work/vaccines?gclid=EAlaIQobChMI4732z97E7gIVWMDICh3JcgZNEAAYASAAEgIRRfD\\_BwE](https://wellcome.org/what-we-do/our-work/vaccines?gclid=EAlaIQobChMI4732z97E7gIVWMDICh3JcgZNEAAYASAAEgIRRfD_BwE)

# The Coalition for Epidemic Preparedness Innovations (CEPI)

- Global partnership between public, private, philanthropic, and civil society organizations to accelerate development of vaccines against emerging infectious diseases and enable equitable access to these vaccines during outbreaks.
- Launched in 2017, headquartered in Oslo, Norway.



# Development of CEPI

- Concept outlined in 2015 NEJM paper "Establishing a Global Vaccine-Development Fund", by Jeremy Farrar, Stanley Plotkin and Adel Mahmoud.
- Concept expanded at the 2016 World Economic Forum as a solution to the problems encountered in developing and distributing a vaccine for the Western African Ebola virus epidemic.

# Development of CEPI

- At the 2016 World Economic Forum:
  - Bill Gates said: "The market is not going to solve this problem because epidemics do not come along very often — and when they do you are not allowed to charge some huge premium price for the tools involved".
  - Sir Andrew Witty, CEO of GlaxoSmithKline commented, "It is super-disruptive when the red phone rings in our vaccine division because of a health emergency. People do not realise that there's no spare capacity in the world's vaccine production system today".

# CEPI Missions

1. Advance vaccines against known threats through proof-of-concept and safety testing in humans and will establish investigational vaccine stockpiles before epidemics begin—“just in case”.
2. Fund new and innovative platform technologies with the potential to accelerate the development and manufacture of vaccines against previously unknown pathogens (eg: within 16 weeks from identification of antigen to product release for clinical trials)—“just in time”.
3. Support and coordinate activities to improve our collective response to epidemics, strengthen capacity in countries at risk, and advance the regulatory science that governs product development.

# CEPI Investors and Partners

Founded by Norway and India, the Bill and Melinda Gates Foundation, the Wellcome Trust, and the World Economic Forum.

Additional support from the European Commission, Australia, Belgium, Canada, Denmark, Ethiopia, Germany, Japan, Mexico and the United Kingdom.

The COVID-19 vaccine programs have garnered \$1.4 B from Austria, Australia, Belgium, Canada, European Commission, Finland, France, Greece, Germany, Italy, Japan, Luxembourg, Kingdom of Saudi Arabia, Norway, the Netherlands, New Zealand, Serbia, Spain, Switzerland, the United Kingdom private sector companies.

<https://cepi.net/covid-19/> accessed June 21, 2020

# CEPI Funded COVID-19 Vaccine Projects

[Curevac, Inc.](#)

[Inovio Pharmaceuticals Inc.](#)

[Moderna, Inc.](#)

[Novavax, Inc.](#)

[The University of Queensland](#)

[The University of Hong Kong,](#)

[The University of Oxford,](#)

Consortium led by [Institut Pasteur,](#)

[Clover Biopharmaceuticals](#)

# Food and Drug Administration (FDA) and Centers for Diseases Control and Prevention (CDC)

- Similar organizations as regards vaccine approval and safety assessment:
  - The World Health Organization Pre-qualification
  - European Medicines Agency
  - Medicines & Healthcare products Regulatory Agency (UK)
  - Pharmaceuticals and Medical Devices Agency (Japan)
  - National Regulatory Authority (India)

# COVAX

- Co-led by Gavi, CEPI and WHO
- Aim: accelerate the development and manufacture of COVID-19 vaccines, and to guarantee fair and equitable access for every country in the world.
- Two key components:
  - The COVAX Facility - continually monitors the COVID-19 vaccine landscape to identify the most suitable vaccine candidates and commits to purchasing the vaccines. All countries can participate in the program.
  - Within the COVAX Facility there is a separate funding mechanism, the COVAX Advance Market Commitment (AMC), which supports access to COVID-19 vaccines for lower-income economies.

<https://www.gavi.org/vaccineswork/covax-explained>

# COVAX

- Focus of the Gavi COVAX AMC is to ensure that the 92 middle- and lower-income countries that cannot fully afford to pay for COVID-19 vaccines themselves get equal access to COVID-19 vaccines as higher-income self-financing countries and at the same time.
- What COVAX offers:
  - Doses for at least 20% of countries' populations
  - Diverse and actively managed portfolio of vaccines
  - Vaccines delivered as soon as they are available

<https://www.gavi.org/vaccineswork/covax-explained>





**Questions?**