Global Collaborative Innovation in Vaccines

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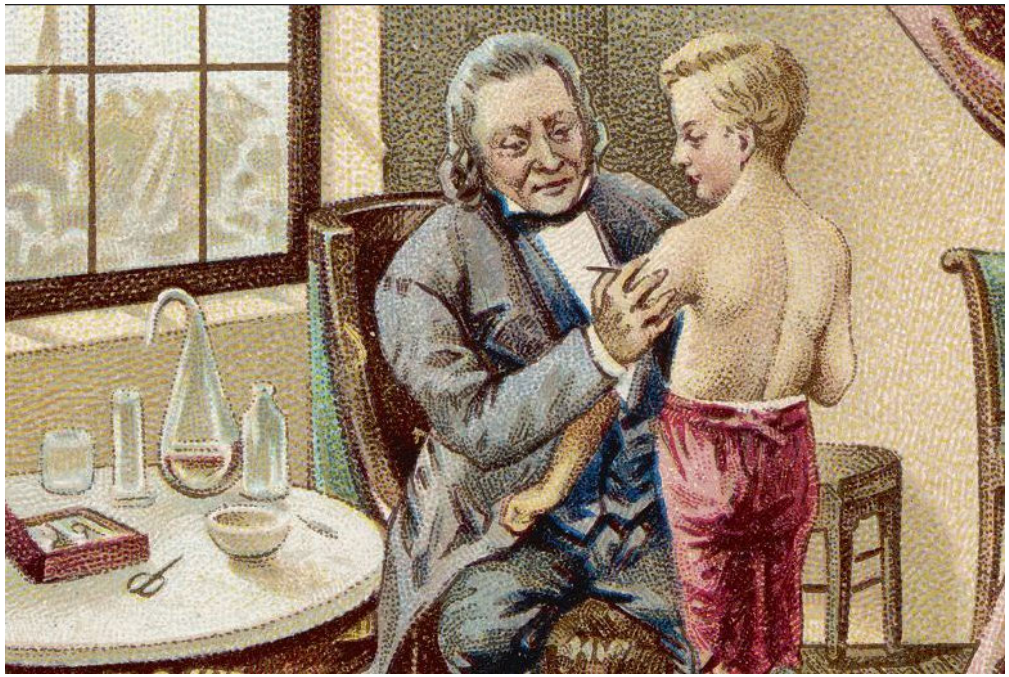
At the beginning developing vaccines was a one man's job…



Edward Jenner

1749-1823

Louis Pasteur

1822-1895

Then, small teams became necessary to get the science right...

Jonas Salk and his staff in the Virus Research Lab, 1957; Courtesy of March of Dimes

- Jonas Salk and his staff 1957

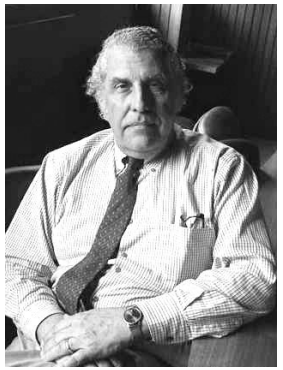
but testing the Salk vaccine was “the most elaborate program of its kind in history, involving 20,000 physicians and 220,000 volunteers “

- O’Neill, W. 1989. American High.

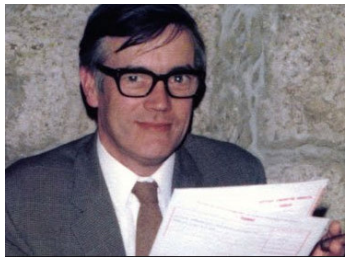
By 1980s international collaboration (?) / competition was required

Baruch Blumberg Identified Hep B virus in 1963

Maurice Hilleman and team at Merck purified and inactivated Hep B surface protein. Vaccine licensed in 1981



Pablo Valenzuela at Chiron produced recombinant antigen in yeast in1981



Ken Murray at Biogen patented recombinant HepB antigens in 1978

Merck and GSK licensed the patents and produced vaccine in 1986

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Followed by 20 years of intense competition for high-value markets

Men-AC

PCV

Men-ACWY

HiB

Hepatitis A

Zoster

Rotavirus

TBE

HPV

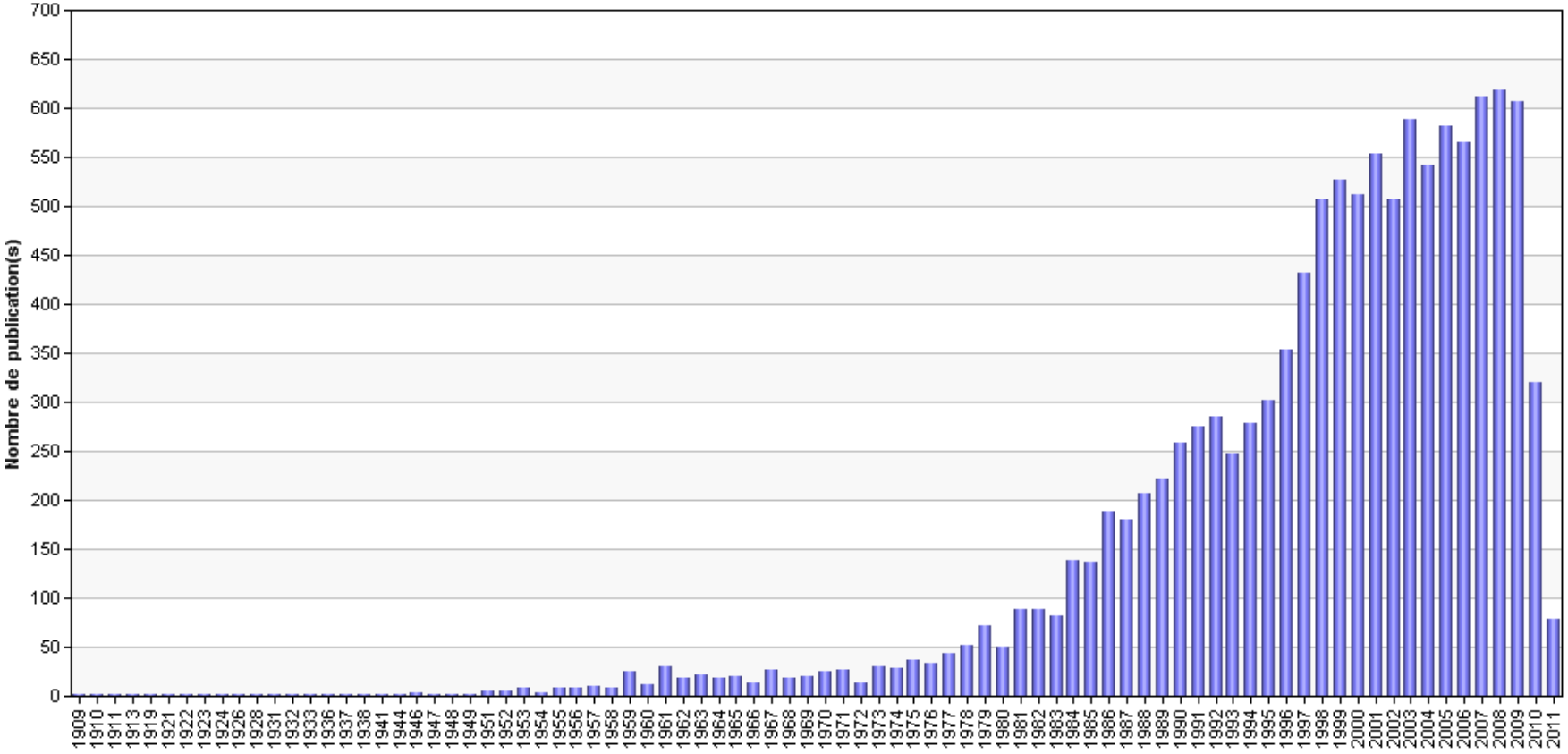
Chicken Pox

LAIV

Men-B

Lyme

More researchers, more patents..



- Patents on vaccines per year 1900-2015

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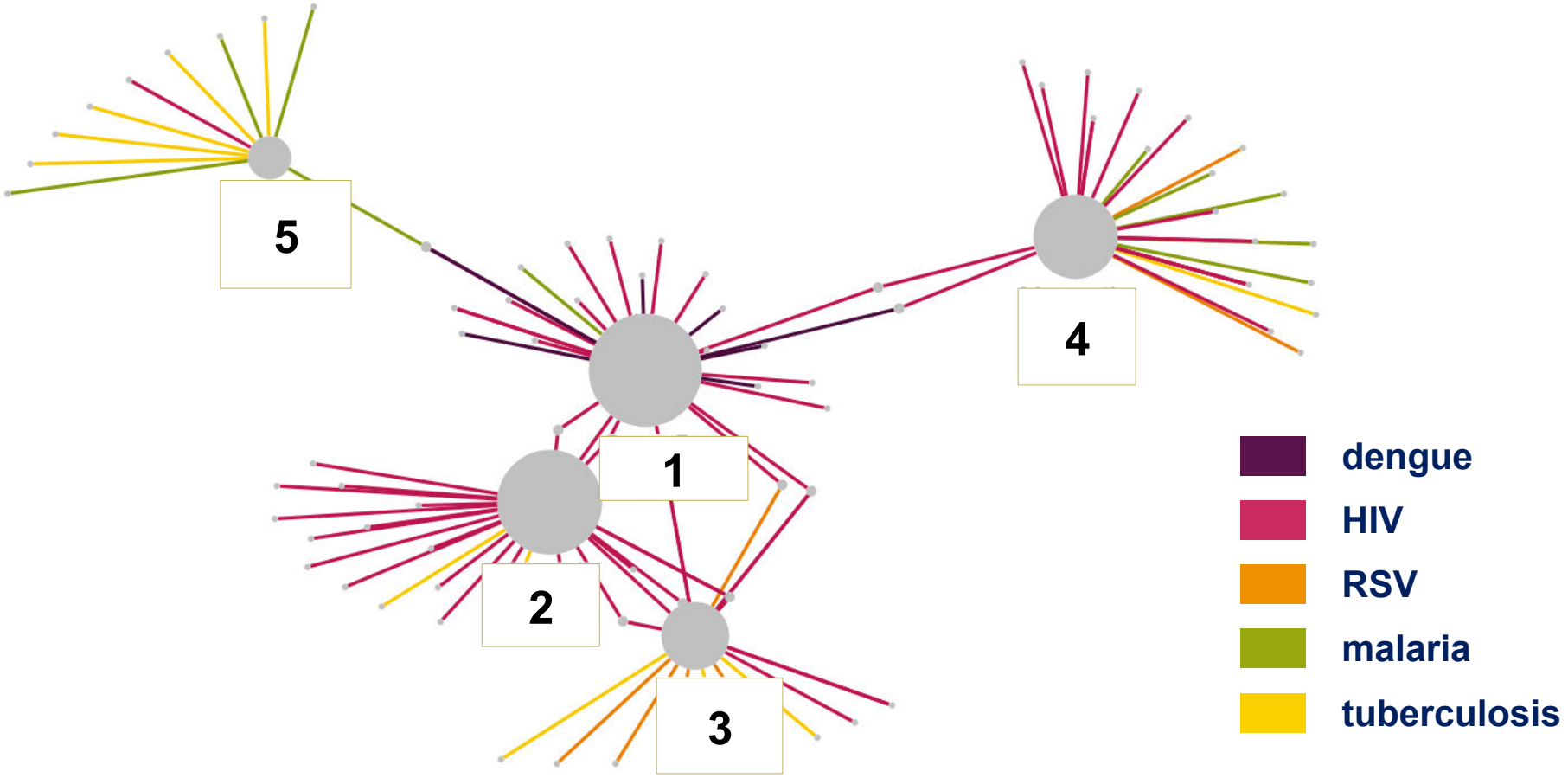
And increasingly complex collaborations…



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A new paradigm: Global Collaborative Innovation

- Priority disease targets are no longer only those important for high-income countries: collaboration with developing countries has become critical.
- More complex science: ideal candidate vaccine are no longer immediately identifiable: collaboration with multiple vaccine development groups is important.
- Public sector investment is essential: public private partnerships, and centralised project management.
  - The birth of PPPs
  - Mening A, RTS,S, Dengue, Ebola

The Meningitis Vaccine Project (MVP)

Early development

- **Early 2000**: WHO expert group concludes that development of a meningococcal conjugate vaccine offers an attractive strategy for epidemic control in sub-Saharan Africa

- **April 2000**: group of international experts and delegates from African ministries of health endorse the initiative

- **June 2001:** Bill & Melinda Gates Foundation funds MVP
  - *10-year partnership between WHO and PATH*
  - *Goal of eliminating epidemic meningitis as a public health problem in sub-Saharan Africa through the development, testing, licensure, and widespread use of **conjugate** meningococcal vaccines*

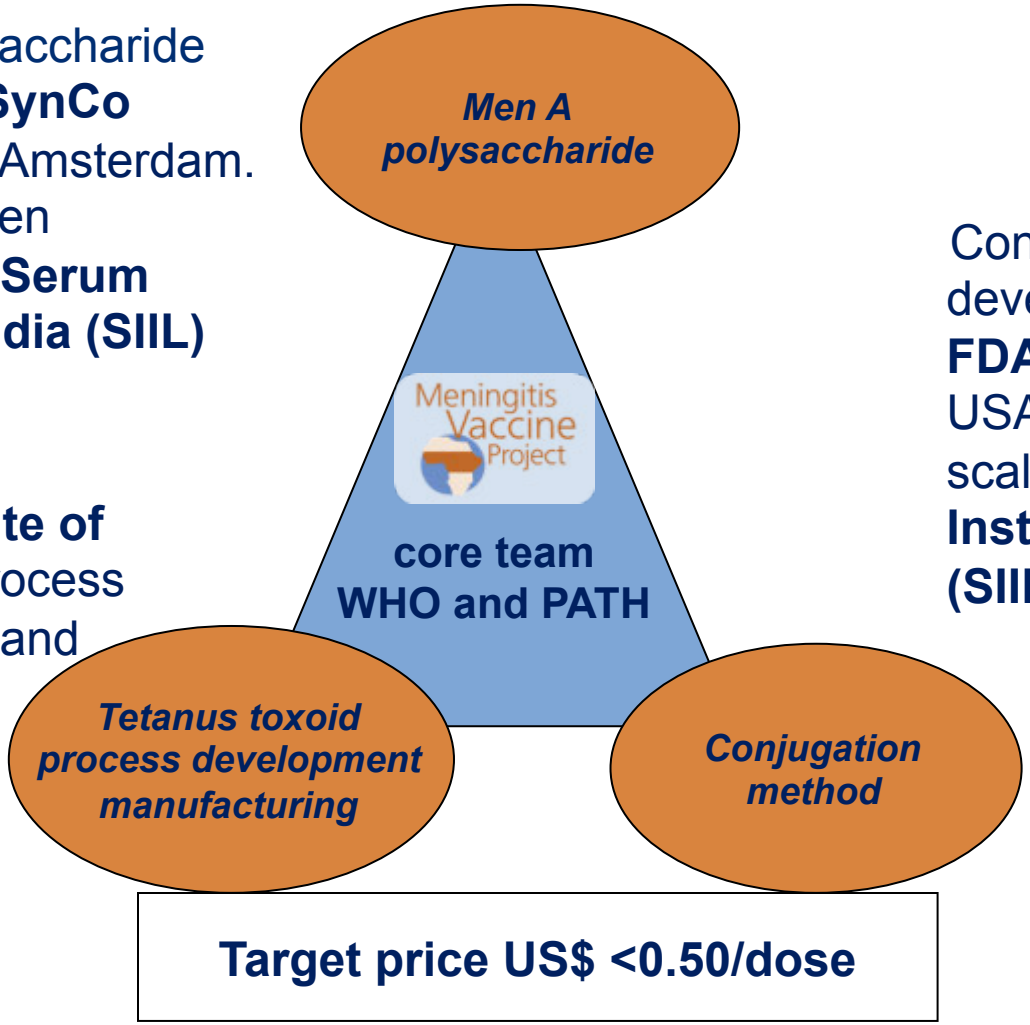
- **2001–2002:** African public health officials emphasize the key importance of a low vaccine price for a sustainable supply **(< $0.5 USD per dose)**

Meningitis Vaccine Project

MenA vaccine development

Group A polysaccharide produced by **SynCo BioPartners**, Amsterdam. Technology then transferred to **Serum Institute of India (SIIL)**

Serum Institute of India (SIIL) process development and manufacturing



Conjugation method developed at **CBER/ FDA**, Bethesda, USA; transferred and scaled-up at **Serum Institute of India (SIIL)**

Target price US$ <0.50/dose

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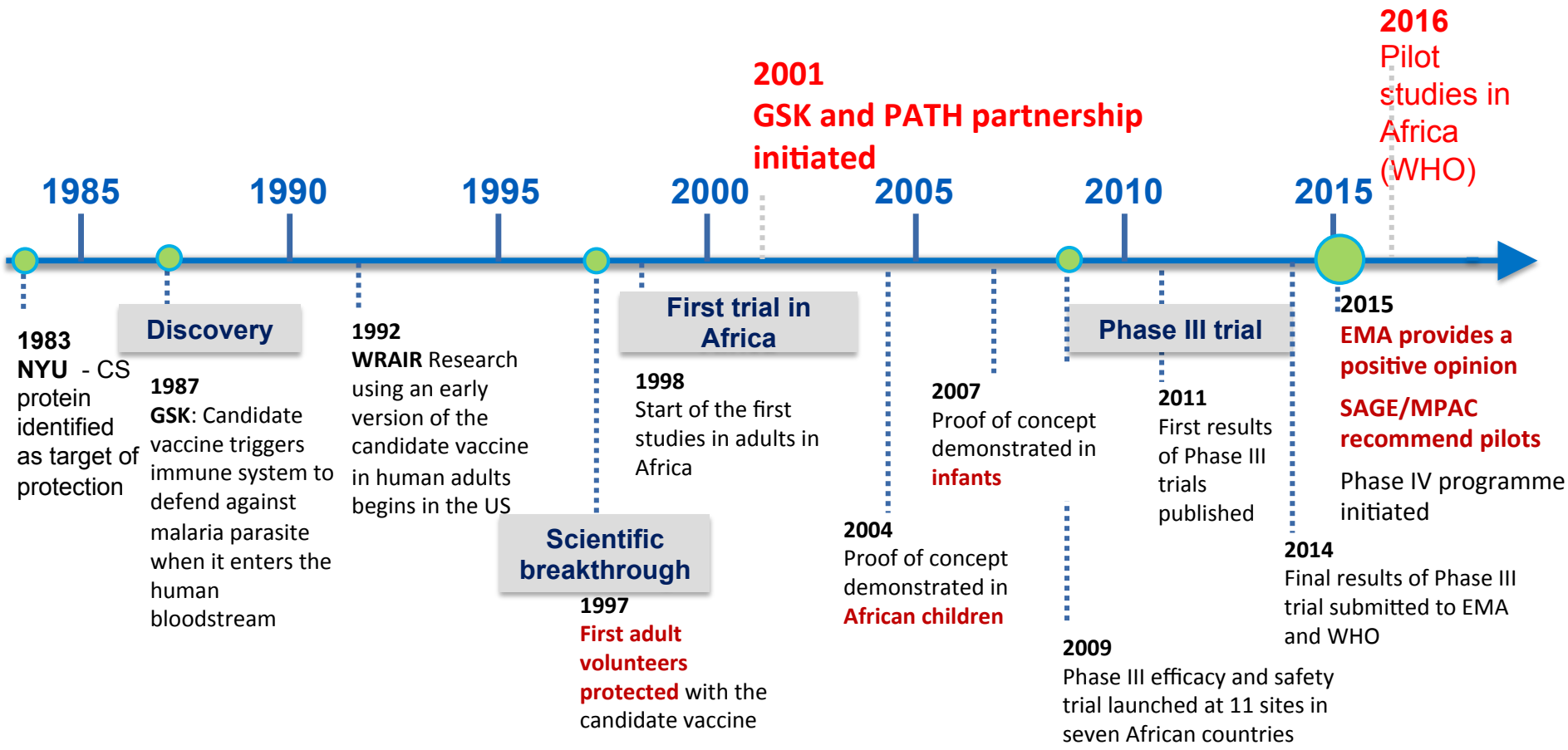
In collaboration with health authorities of 26 countries in sub-Saharan Africa and of India

Malaria: The RTS,S malaria vaccine
A 30-year collaborative effort



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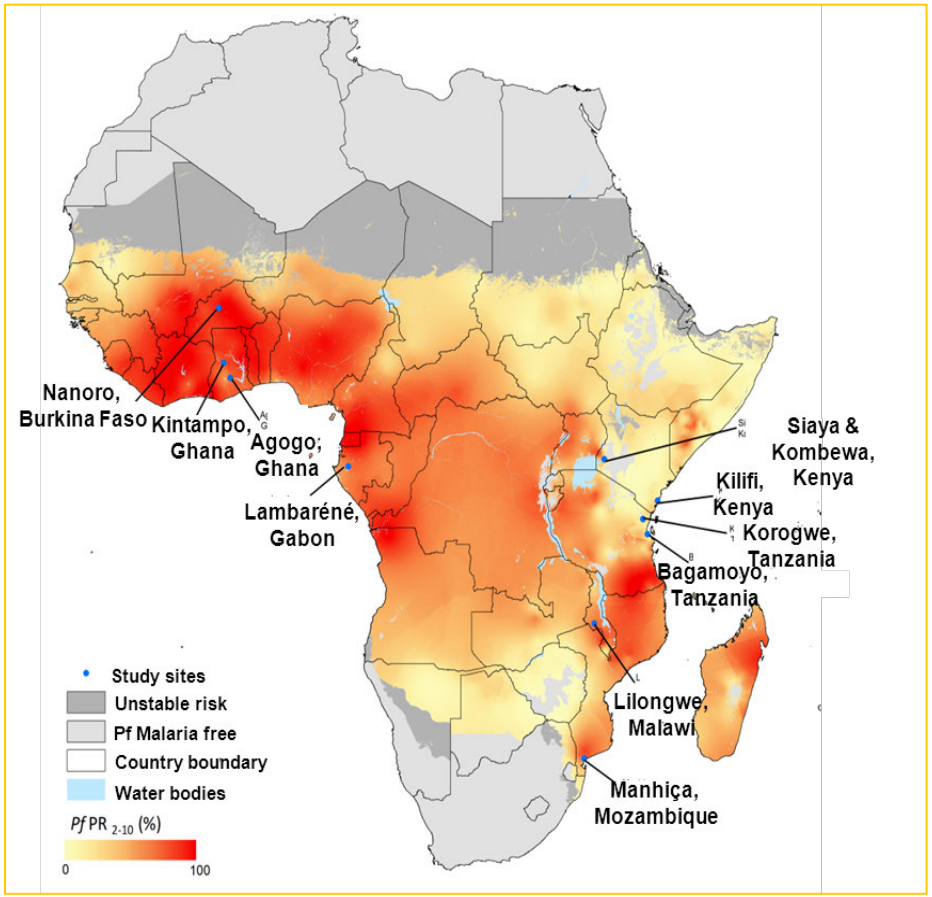
Pivotal Phase III RTS,S/AS01 trial

- Double-blind, individually randomised, controlled trial to assess vaccine efficacy, immunogenicity, safety and impact of RTS,S/AS01
- From mid-2009 to early 2014
- 11 sites in 7 countries: Burkina Faso, Gabon, Ghana (Kumasi, Kintampo), Kenya (Kilifi, Kombewa, Siaya), Malawi (Lilongwe), Mozambique and Tanzania
- 15,459 children enrolled in two age categories
- 2017: pilot roll-out studies



Leach A., et al. Malaria J 2011; 10:224 ; PLoS Medicine 2014; 11(7): e1001685; Hay SI, Guerra CA, Gething PW et al. A World Malaria Map: Plasmodium falciparum Endemicity in 2007. PLOS Med 2009;6:e1000048

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Collaborative efforts to develop a dengue vaccine

Comprehensive non-clinical and early clinical development programme at US NIAID and Johns Hopkins University (JHU) leads to two major live, tetravalent dengue vaccine formulations TV003 and TV005.

Non-exclusive and territorially exclusive licenses granted to various private and public sector vaccine developers: Butantan, GSK, Merck, Panacea, Serum Institute India, Vabiotech.

Most advanced programme with Butantan (phase 3 RCT ongoing).

Normative and technical support by partners:

- Continuous support by NIAID and JHU to technology recipients.
- Technical consultancies by DVI*
- Normative and regulatory guidance by WHO
- *Partnerships for volume production needed*

NIH National Institute of Allergy and Infectious Diseases — TetraVax-DV TV003

butantan — Butantan-DV

*(*DVI: Dengue Vaccine Initiative at International Vaccine Institute IVI)*

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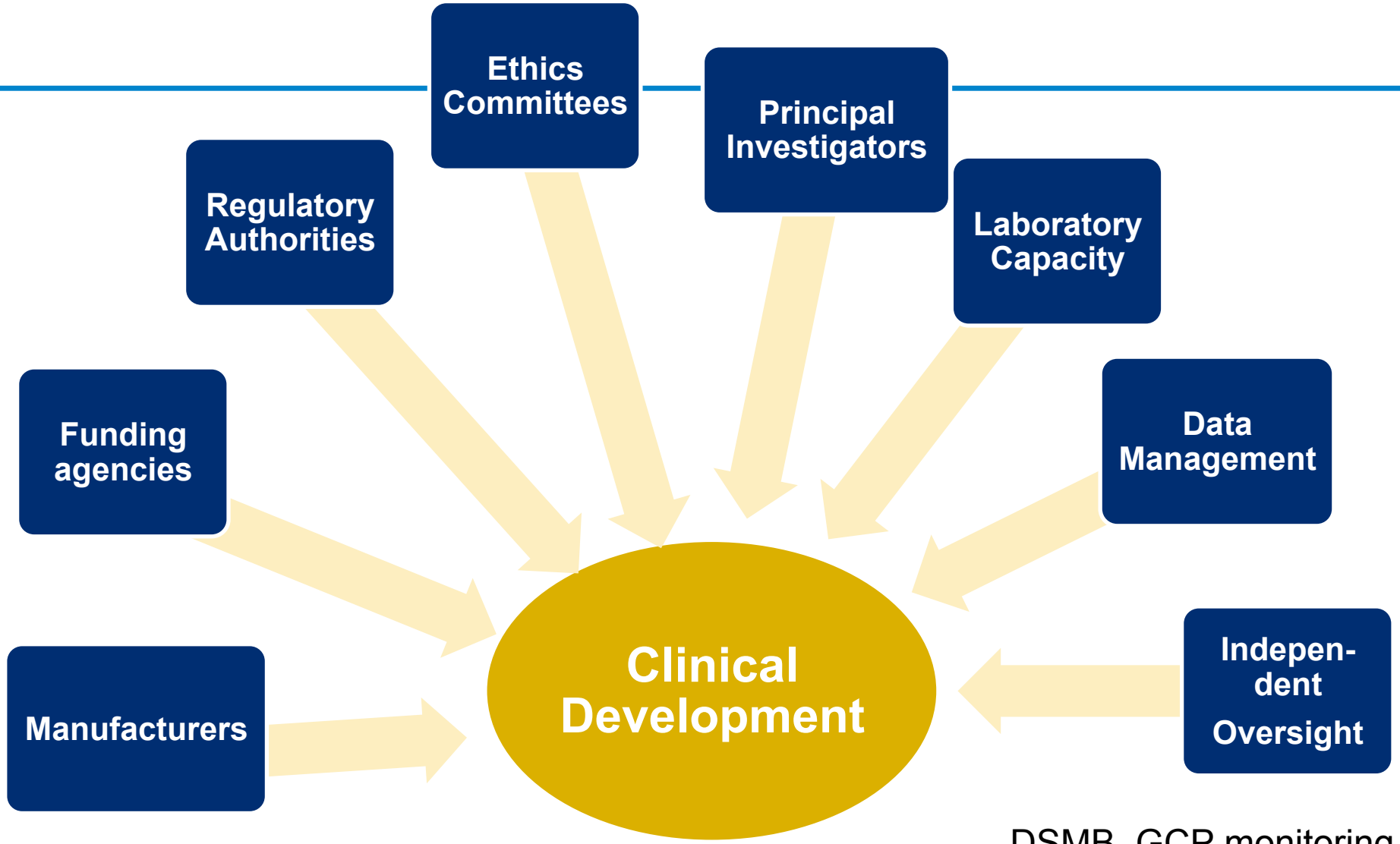
Accelerated Ebola vaccine development

Once Public Health Emergency of International Concern was declared, WHO called for an international partnership to bring forward availability of high quality safety and immunogenicity data



DSMB, GCP monitoring

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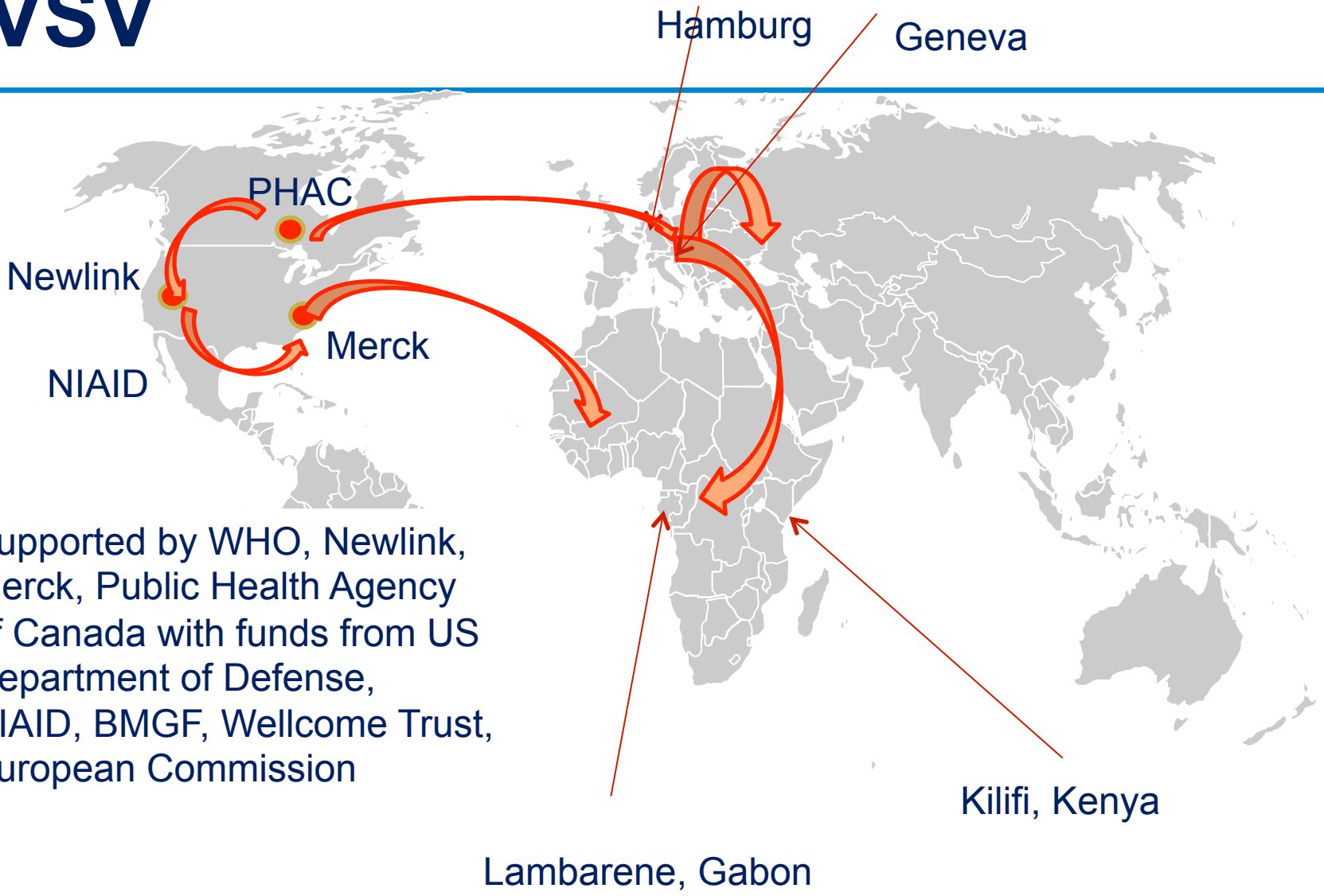
The international partnership for rVSV-ZEBOV phase 1 clinical evaluation

VSV



Supported by WHO, Newlink, Merck, Public Health Agency of Canada with funds from US Department of Defense, NIAID, BMGF, Wellcome Trust, European Commission

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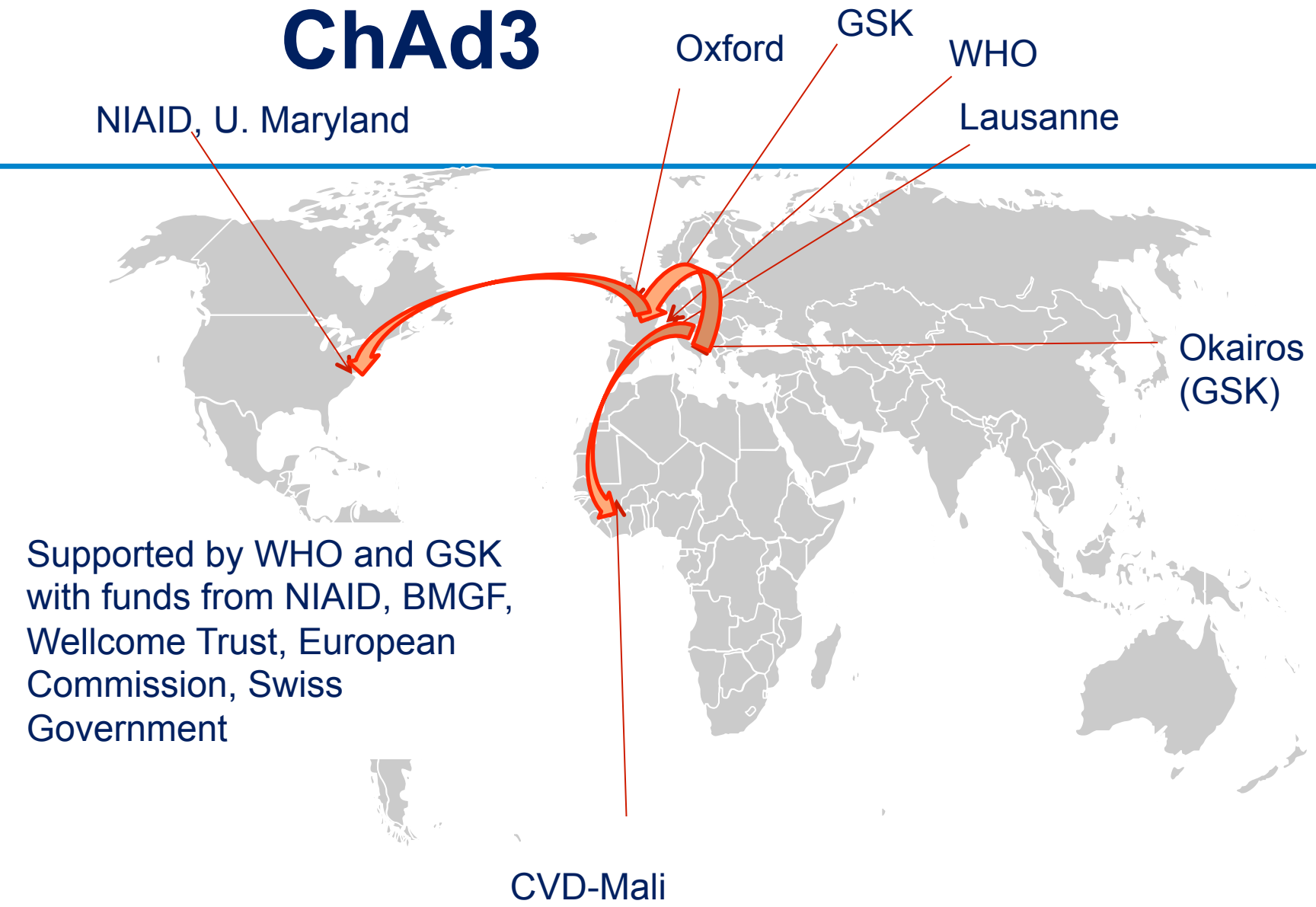
ChAd3



Supported by WHO and GSK with funds from NIAID, BMGF, Wellcome Trust, European Commission, Swiss Government

The global collaboration facilitating ChAd3-ZEBOV Phase 1 evaluation

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Phase III : Guinea Collaboration

The Funding partners

WT, Norway, Canada, MSF, WHO

Guinea Consortium

Study Steering Group

Scientific Advisory Group

Data Safety Monitoring Board

Clinical Monitors

AARSH
AGENCE AFRICAINE DE RECHERCHE EN SANTE HUMAINE

Center for Vaccine Development
"Developing and deploying vaccines: weapons of mass protection"

UNIVERSITY of MARYLAND SCHOOL OF MEDICINE

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CELLULE DE COORDINATION NATIONALE DE LUTTE CONTRE LA MALADIE À VIRUS ÉBOLA

MEDECINS SANS FRONTIERES DOCTORS WITHOUT BORDERS

UF UNIVERSITY of FLORIDA

LONDON SCHOOL of HYGIENE &TROPICAL MEDICINE

EMLab

UNIVERSITÄT BERN

Norwegian Institute of Public Health

A new player in Vaccine R&D

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What role for DCVMN in future collaborative innovations ?

- Essential : future vaccines need to be deployed globally.
- Development and Production in OECD countries not always commercially viable.
- R&D capacity increasing in emerging economies.

What is required at DCVMN members to ensure full participation ?

- R&D capacity : the ability to take on and develop novel production processes and assays.
- Business development: the ability to ensure that partnerships are among equals, and investment is justified.
- Regulatory capacity – Internal and NRA : to ensure that products can be approved.
- A commitment that public health is everyone's responsibility.

Health and Wellbeing for all at all ages as the Objective