RESPIRATORY VIRUS Summit

PANDEMIC PREPAREDNESS: WHERE SCIENCE AND POLICY MEET

organised by ESWI
Options for global and accessible vaccines

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Options for Global and Accessible Vaccines

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ESWI Respiratory Virus Summit
Pandemic Preparedness: where Science and Policy meet

Brussels June 21st 2022
- 2009
- 4 months to develop H1N1 vaccines
- 8 months to deliver them in large volumes
- Vaccines were delivered after the pandemic peak
Transforming vaccine development

Vaccine Vision in 2011

1980

Discovery

Development

1
2
3 Phase

Reverse vaccinology,
large-scale screening,
-systematic approaches,
new adjuvants

2010

Discovery

Development

Innovative trial design
Systems biology

2020

Discovery

Development

1/2
3 Phase

0 5 10 15

Time (years)
Transforming vaccine development is possible

Palio meeting, Rockville, July 1st 2019
Vaccine development has been transformed by

- New Technologies
- Public sector investment
4 technologies allowed fast development of Covid-19 vaccines

- **1930**: Empirical Approach
  - Diphtheria, Tetanus, Pertussis, Rabies, Influenza, Smallpox, Polio, BCG

- **1980**: Recombinant DNA
  - Hepatitis B, Acellular Pertussis, Lymo, Human papillomavirus

- **1990**: Glycoconjugation
  - MenACWY Pneumococcal, Hib, GBS, S. aureus

- **2010**: Reverse Vaccinology
  - Merth, GBS, GAS, E. coli, S. aureus, C. difficile

- **2021**: Structural Vaccinology

**Next Generation Technologies**

**Internet based vaccines**
2013: Internet-based synthetic vaccines in one week

In 2013, an RNA vaccine and a virus seed in one week using information teleported by internet.

Synthetic Generation of Influenza Vaccine Viruses for Rapid Response to Pandemics
Philip R. Dormitzer et al.
Sci Transl Med 5, 185ra68 (2013); DOI: 10.1126/scitranslmed.3006368

Emerging Microbes and Infections (2013) 2, e52; doi:10.1038/emi.2013.54
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www.nature.com/emi
Shipping information instead of viruses

Sequence data are posted on the web with open access and continuously monitored by algorithms to detect new antigenic variants.

Synthesized HA and NA genes are rescued directly on high growth backbones and tested as potential vaccine seed viruses.

National Influenza Centers sequence flu genes directly from respiratory secretions.

Seed viruses are shipped to additional manufacturing sites. When the technology matures, this shipment can also be replaced with electronic transfer and local synthesis.
from analog to digital vaccines
Accessible Vaccines Globally and even in Mars

Digital vaccines

Internet

vaccine

Mars
Vaccine development has been transformed by

• New Technologies

• Public sector investment
Need to transform classical vaccine development

1 billion

Antigen discovery
Adjuvant discovery
Optimization
Formulation
Animal studies

Systematic discovery
Optimization
Scalable preclinical
Phase I
Phase II

Final manufacturing process
Final facilities
Phase III
Licensor
Monitoring
Recommendation

Procurement
Deployment
Vaccination

Academia
Biotechs
Industry
Human vaccine project

Industry
Biotechs
GVGH
IVI
CEPI
Iliemann
MRT

Proof of concept in the laboratory
Proof of concept in the clinic
Registration Monitoring Recommendation
Unprecedented acceleration of Vaccine development

**Investment > 15 billion** investment from the public sector (>10 billion USA alone) in vaccine Development and Manufacturing allowed at risk development (parallel investment in discovery, early and late development)
The trillion dollar vaccine gap

Investment in vaccine development

- Rapid development of parallel SARS-CoV-2 vaccines using public funding to derisk clinical-stage development and manufacturing
- Parallel development of vaccines against pandemic and nonpandemic infections
- Fragmented vaccine discovery and development based on private funding
- Increased public investment for pandemic preparedness and emergency vaccine development
- 0.1-1 Billion USD
- 13 Billion USD
- 50-65 Billion USD
- Future

Pre-COVID-19  COVID-19  Post-COVID-19  Future

The trillion dollar vaccine gap
Simone Pecetta1, Daniel Tontorico1, Francesco Berlanda Scarza1, Mariagrazia Pizzio1, Gordon Dougan5, Richard Hatchett1, Steve Black1, David E. Bloom1, Rino Ramacciotti1
January 10th 2020 SARS-CoV-2 sequence posted in internet

350 labs worldwide used the sequence to make synthetic genes
Three main vaccine types for Covid-19 efficacy

95% efficacy !!!
First press release November 9th

- Novavax, Sanofi/GSK, Clover/GSK, Medicago/GSK
- Moderna, BionTech/Pfizer, Curevac
- Oxford/Astra Zeneca, J&J, Reithera
- Russian Vaccine, Chinese vaccines

62 - 90%

Neutralizing titers
Convalescent patients

Neutralizing antibodies from Phase I clinical studies
SARS-CoV-2 vaccine protection and deaths among US veterans during 2021

Barbara A. Cohn, Piera M. Cirillo, Caitlin C. Murphy, Nickilou Y. Krigbaum, Arthur W. Wallace
From basic Immunology textbooks

- **Primary immunization**: doses 1, 2
- **Secondary immunization**: 3rd dose
From basic Immunology textbooks

- **Primary immunization** doses 1, 2
- **Secondary immunization**
- **3rd dose**

- **Initial exposure**
- **Secondary exposure**

**Concentration of antibody**

- **Beta**
- **Wuhan**
- **Omicron**
Thank you