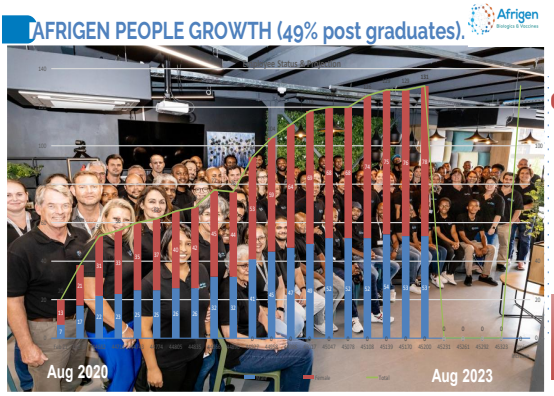
From Construction to End-to-End Drug Substance and Drug Product GMP Manufacturing of mRNA Vaccines in Africa: A Cross-Country Race to Epidemic/Pandemic Preparedness and Public Health Impact

Petro Terblanche
CEO, Afrigen Biologics

OVERVIEW

- ❑Meet Afrigen Biologics, a proudly SA Biotechnology Co
- ❑An ecosystem context
- ❑The Covid catalyst
- ❑Purpose and status of the mRNA TT Programme
- ❑CMC the critical bridge
- ❑mRNA the promise of impact
- ❑Enabling local manufacturing
- ❑Future Africa

Afrigen: Proudly South African Biotech Company



2014/15

Established by the Industrial Development Corporation and IDRI (now AAHI) to **localize production capacity** and capabilities for a TB vaccine.

2017

Created **first adjuvant formulation centre in Africa.**

2018

Develop adjuvant platform into products through vaccine **innovation partnerships**. **Explored** immunotherapy landscape.

2019

Innovate around our adjuvant formulation platform and developed **a formulation platform for wellness and health products**.

2020

Started first construction of R&D laboratories and adjuvant manufacturing suites to fully operationalize the start-up business.

2021/2022

Research, development platform and GMP facility construction or mRNA started Nov 2021.

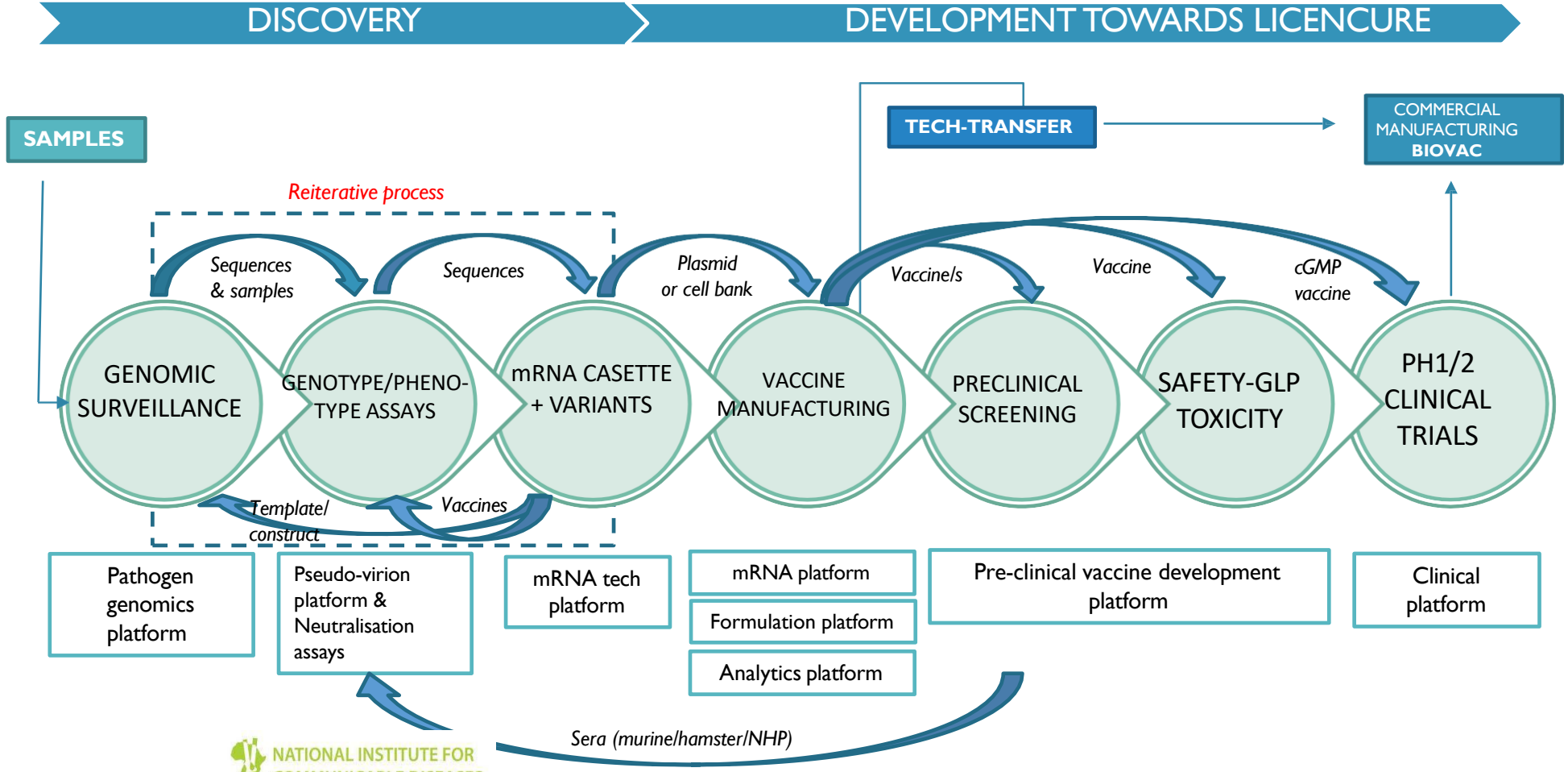
mRNA Technology Transfer Programme

2023-2025

Facility construction, qualification, equipment validation, process development and scaleup with complete analytics, CTA for IND AfriVac2121 mRNA vaccine completed and **GMP** inspection for licensure of **end- to-end (DS & DP) mRNA vaccine manufacturing completed** 25 Sept 2025.

Afrigen Biologics & Vaccines

Vaccine development value chain in South Africa: Public Private Partnerships



Commercial supply

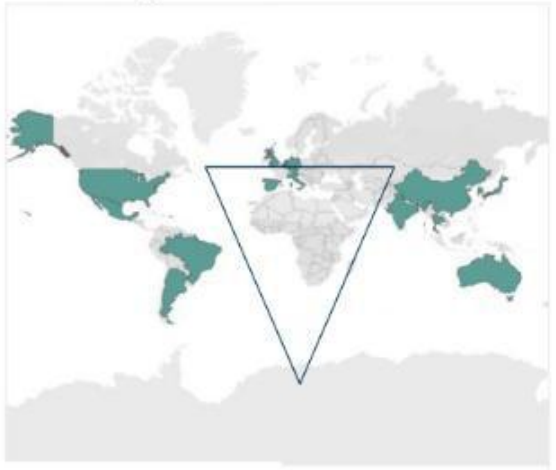
LESSONS RE-LEARNED: WHERE VACCINES ARE PRODUCED MATTERS!

Global vaccine manufacturing is centralized in a few regions:

73% of global vaccine production by **value** is from 4 companies in high income countries.

76% of global production by **volume** is from developing country manufacturers (India leading)

Manufacturing Countries



Africa faces 470 million COVID-19 vaccine shortfall in 2021

- So far, **around 2% of the nearly 6 billion doses** administered globally have been administered in Africa.
- Africa has been able to fully vaccinate some **50 million people = 3.6% of the continent's population.**

- The 470 million doses, which are now expected to arrive by the end of December, are just enough to vaccinate just **17% of Africans** on the

es administered per 100 people, Mar 7, 2022

Africa makes only <1% of the vaccines it uses

The Problem - Insufficient Global Vaccine Manufacturing Capacity to Respond to an Influenza Pandemic

Flu vaccine shortage a worldwide crisis

Immediate and sustained action required to sharply increase pandemic influenza vaccine supply

The global swine flu vaccine shortage

Category: Big Pharma • Swine flu • Vaccines • WHO

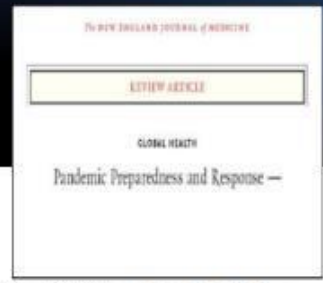
Posted on: November 23, 2009 6:45 AM, by revere

Thursday, April 29, 2010

Vaccine Shortage Threatens 2009 H1N1 Control in Nigeria

BUT We've been here before..... (courtesy: Rick Bright)

Pandemic Response



The most serious operational shortcoming was the **failure to distribute enough vaccine in a timely way**. Ultimately, 78 million doses of vaccine were sent to 77 countries, but mainly long after they would have done the most good.

At its root, this reflected a **shortfall in global vaccine-production capacity** and technical delays due to production, as well as **distributional problems**.

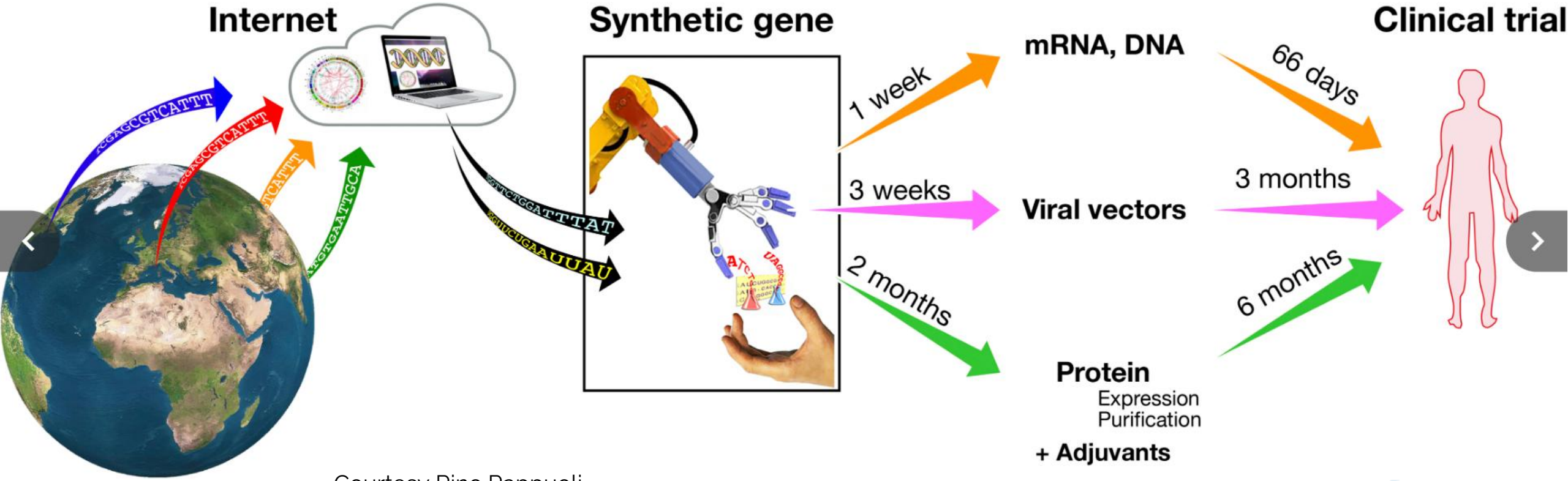
Among the latter were variation among wealthier countries and manufacturers in their **willingness to donate vaccine**, **concerns about liability**, **complex negotiations over legal agreements** with both manufactures and recipient countries and limited national and local capacities to transport, store, and administer vaccines.

COVID 19 LESSONS LEARNED:

The equipped universe can move fast!

10 January 2020 SARS-COV-2 sequence posted on the internet.

350 labs worldwide use the sequence to make synthetic genes



Courtesy Rino Rappuoli

Vaccinology in the post–COVID-19 era

Rino Rappuoli, Ennio De Gregorio, Giuseppe Del Giudice, +3, and Emmanuel Hanon Authors Info & Affiliations

Edited by Diane E. Griffin, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, and approved November 30, 2020 (received for review October 15, 2020)

January 11, 2021 | 118 (3) e2020368118 | https://doi.org/10.1073/pnas.2020368118

Afrigen Biologics & Vaccines

A Pandemic to Accelerate mRNA Into the Clinic. BUT…… Speed does not fall from the sky (60 years & 15B USD later)

2013-2019 | 2020

SARS-CoV-2 Outbreak

2013-2019

Extensive work on MERS, other CoV, and other Fusion proteins

Dec 31, 2019

1st report of respiratory virus outbreak in Wuhan, China

Jan 6, 2020

Wuhan outbreak may be CoV

Jan 10, 2020

2019-nCoV sequences published

Jan 31, 2020

VRC makes nCoV spike protein

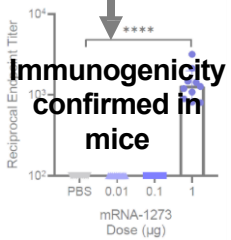
Feb 1, 2020

First nCoV spike ELISA for cross-reactivity

Feb 3, 2020

UT-Austin solves spike structure

Feb 18, 2020

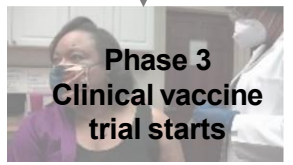


Immunogenicity confirmed in mice

Mar 16, 2020

Phase 1 Clinical vaccine trial starts

Jul 27, 2020



Phase 3 Clinical vaccine trial starts

6.5 months to phase 3

10 months to phase 3 results

11 months to EUA

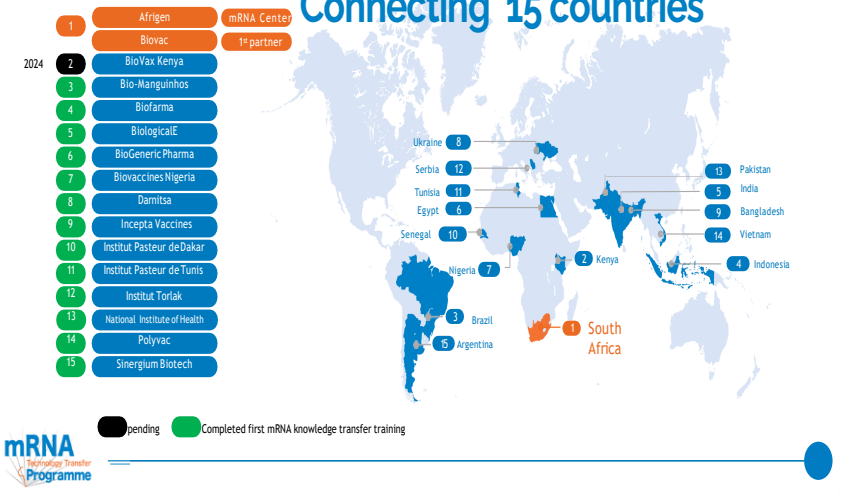
Slide courtesy Dr Barney Graham

mRNA TT Programme: Access, Preparedness and Innovation for Sustainability

Future pandemic readiness through ACESS

Create mRNA-based vaccine manufacturing **platform** and transfer to Programme Partners to build capacity in LMICs for future pandemic response

A partnership network Straddling 4 continents Connecting 15 countries



Interpandemic sustainability requires R&D&INNOVATION

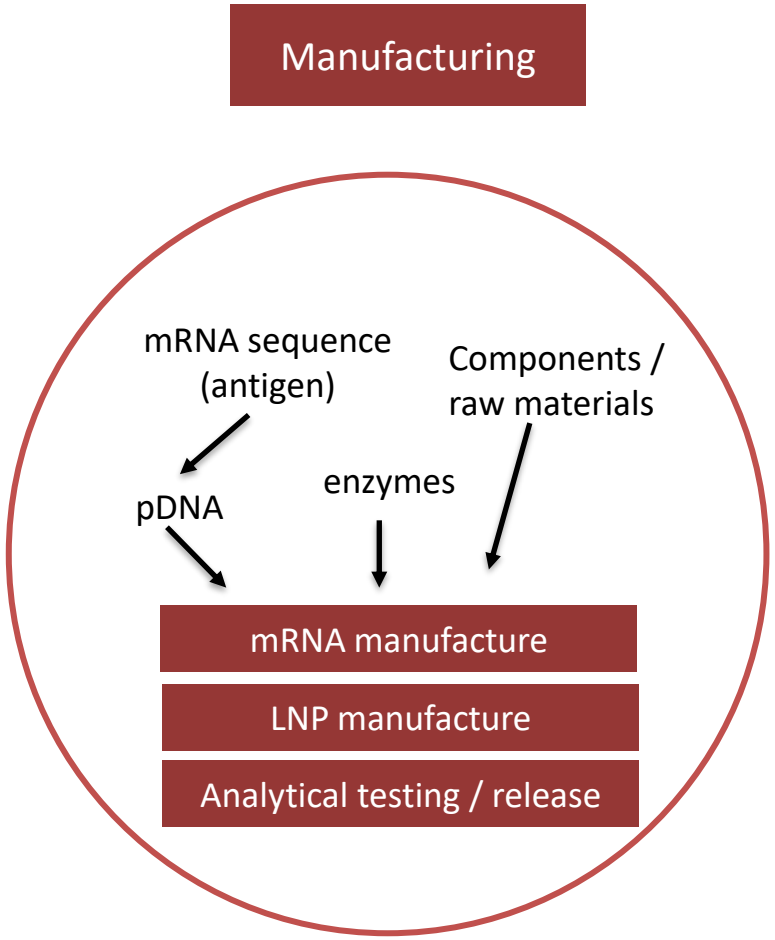
manufacturing of a **pipeline** of vaccines addressing local market needs & **next generation** mRNA technologies

mRNA Technology Transfer Hub Programme

Afrigen Biologics & Vaccines

mRNA Reduces Barriers to Entry for Vaccines

- Less capital-intensive infrastructure vs. other vaccine platforms
  - Smaller footprint/scale vs cell-culture or fermentation
  - Multi-product facilities for drug substance/product manufacture
- Cell-free manufacturing processes
  - Greater worker safety (e.g. no live viruses used)
  - Shorter manufacturing cycle times
- Platform manufacturing process
  - Standardized manufacturing process (less changes for different antigens)
  - Shorter lead times to clinical development
  - Rapid iteration in exploratory medicine trials
  - Standardized release testing methods
  - Easier switching of products
  - Easier to produce multi-valent products
  - Multi-product, multi-purpose facilities for optimal ROI



(Slide provided by Dr Amin Khan)

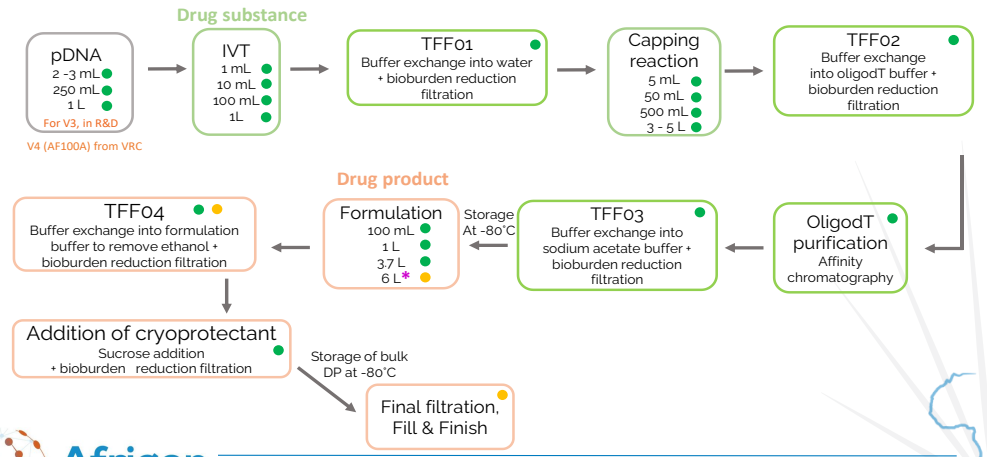
Building a **NEW** mRNA Technology Platform **FAST** (people, facilities, systems and processes from R&D to GMP)

AFRIGEN'S FACILITY DEVELOPMENT 2021 to 2023 FROM BASIC CONSTRUCTION TO MANUFACTURING SUITES FOR mRNA TECHNICAL BATCHES ON ROUTE TO GMP LICENSE FOR DS AND DP

AFRIGEN PEOPLE GROWTH (49% post graduates).

> 700 SOPs and > 200 validated analytical methods

Manufacturing Processes



Process Stage	Stage	Quality Attribute	Assay	Method	Compendial	IPC	IPT	Characterization	Release	Stability
pDNA	CoA release	Identity	PolyA tail length	AGE/CGE					X	
pDNA	CoA release	Identity	pDNA sequence	Sanger Sequencing					X	
IVT IPC	In-process	Purity	Confirmation of pDNA Linearization	AGE		X				
IVT IPT	In-process	Content	mRNA crude quantification	Qubit			X			
DS & DP	Bulk and FF	Other	Appearance	Ph. Eur. 2.2.1 and Ph. Eur. 2.2.2, USP <790>	X				X	X
DS & DP	Bulk and FF	Other	pH	Ph. Eur. 2.2.3, USP <791>	X				X	X
DS & DP	Bulk	Safety	Endotoxin	Ph. Eur. 2.6.14, USP <85>	X				X	
DS	Bulk	Safety	Bioburden	Ph. Eur. 2.6.12, USP <61>	X				X	
DS	Bulk	Content	mRNA concentration	UV (A260)			X		X	X
DS & DP	Bulk	Identity	mRNA sequence	RT-PCR followed by Sanger sequencing					X	
DS	Bulk	Purity	Capping efficiency	Capture probe + RNAse H treatment followed by CGE					X	X
DS	Bulk	Purity	PolyA tail length	RNase A treatment followed by CGE					X	X
DS & DP	Bulk and FF	Integrity	Size and integrity	CGE		X			X	X
DS	Bulk	Purity - Product related impurities	dsRNA content	Immunoblot (dot blot)					X	
DS	Bulk	Purity - Process related impurities	Residual pDNA template	qPCR				X		
DS	Bulk	Purity - Process related impurities	Residual enzymes and proteins	AccuOrange - Fluorescence				X	X	
DP	Bulk and FF	Integrity	Particle size & Polydispersity	Dynamic light scattering using the Zetasizer					X	X
DP	Bulk	Integrity	Zeta Potential	Laser Doppler Electrophoresis using the Zetasizer				X		
DP	Bulk and FF	Content	mRNA concentration & % Encapsulation	Ribogreen Assay - Fluorescence		X			X	X
DP	Bulk and FF	Potency	Functional Protein expression (size / purity)	Western Blot					X	X
DP	Bulk and FF	Content and Identity	Lipid quantitation	HPLC-CAD					X	X
DP	FF	Other	Container Closure integrity testing	USP <1207>	X				X	X
DP	FF	Other	Extractable volume	Ph. Eur. 2.9.17, USP <697>	X				X	
DP	FF	Safety	Sterility	Ph. Eur. 2.6.1, USP <71>	X				X	X
DP	Bulk and FF	Other	Osmolality	Ph. Eur. 2.2.35, USP <785>	X				X	
DP	Bulk and FF	Other	Residual solvent	Ph. Eur. 2.4.24, USP <467>	X			X		
DP	FF	Other	Particulate matter	Ph. Eur. 2.9.19, USP <788>	X				X	

CMC a Essential Bridge
Technology Transfer & mock CTA

Afrigen
Biologics & Vaccines

Internal TT
(R&D/ R&D Analytics/ CMC/Production/QC)

Documents

External TT/ Partner Training
(R&D/ R&D Analytics/ CMC/ Production)

Documents

Documents

Clinical Trial Application (CTA)
(R&D/ R&D Analytics/ CMC/ Production)/ QC/ QA/ Regulatory

- Clinical Trial Protocol:
- Investigational medicinal product dossier (IMPD):
- Certificate of Analysis of AfriVAc2121
- Facility GMP Certificate
- Dossier – Module 3 and 4

Process Flow Chart

Pre-Clinical studies

Process Description

Process Development

Manufacturing Records

BOM/BOC/BOE

Process Schedule

Material Specifications

Sampling Plan

Batch results

Analytical Profile (DS &DP)

Assay Development

Analytical Assays

And many more . . .

. . . . . .

. . . . . .

mRNA Technology Transfer Hub Programme

Ensuring Technical and Regulatory Capabilities, Effective Translation and Empowering Partnerships For a Better Prepared Global South

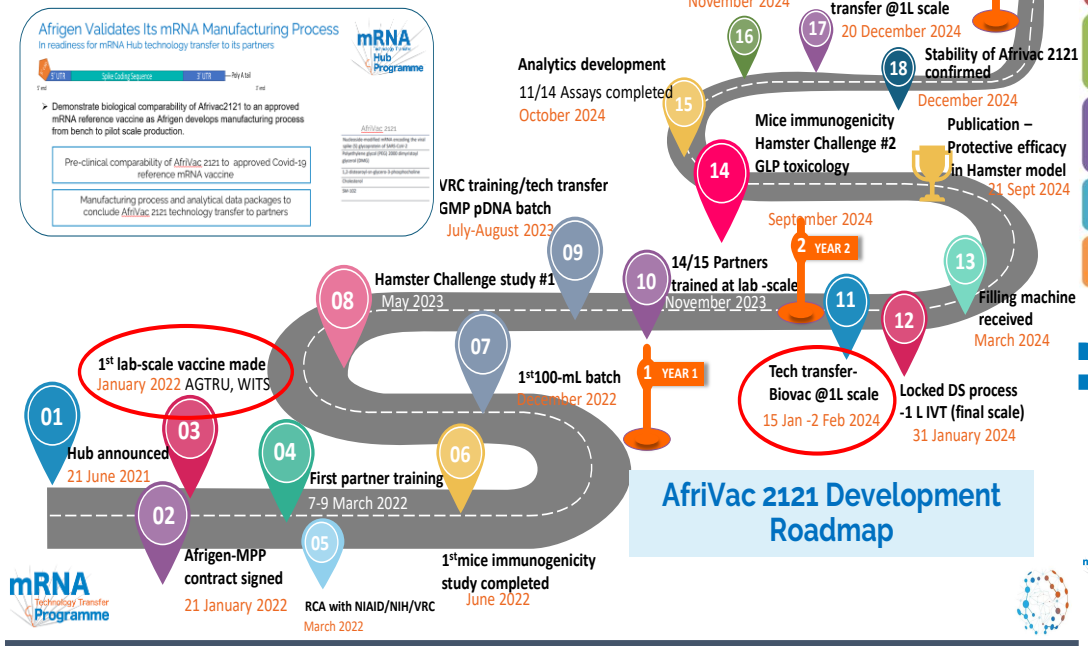
Afrigen Biologics & Vaccines

R&D translation by design

cGMP DS, DP, FF and Release Testing

Through the mRNA TT Programme, 10 manufacturers could produce mRNA vaccines for human use by 2030.

Development of mRNA Technology Platform: Academic Public Private partnership



GMP REQUIREMENTS

End-to-end mRNA development and manufacturing

mRNA DS and DP TT to 15 Partners have commenced.....

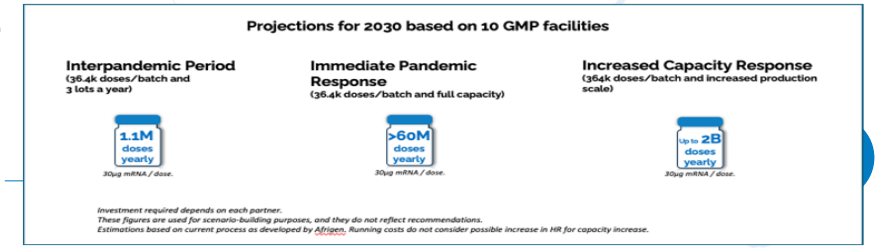
Tech Transfer demonstration batch at Afrigen, with hands-on training

Serbia: Torlak Institute (14 Oct-01 Nov 2024)

Tech Transfer demonstration batch at Afrigen, with hands-on training

Argentina: Sinergium Biotech (4 -22 Nov 2024)

India Biological E TT training at Afrigen 2 to 20 December 2024



mRNA Technology Transfer Programme

Team effort Knowledge & Technology Transfer from Afrigen to Partners

(Customized to partner readiness and sustainable strategies assessed by MPP and WHO).

THE BRIDGES WE BUILD – TRAVELS ON 2 LEGS.

mRNA Technology Transfer Programme

A sweet reward! Traditional SA Koeksister

Proudly celebrating the final drug product manufactured by the partner at Afrigen!

WHO Africa and Eastern Mediterranean Regions

South Africa: Biovac	15 Jan-2 Feb 2024	
Senegal: Institut Pasteur de Dakar	3 Mar -20 Mar 2025	
Tunisa: Institut Pasteur de Tunis	31 Mar-17 Apr 2025	
Pakistan National Institutes Of Health	7 Jul -25 Jul 2025	
Egypt BioGenerics Pharma	4 Aug -22 Aug 2025	
Nigeria BioVaccines/NIMR	1 Sept -19 Sept 2025	
Kenya BioVax/KEMRI	17 Nov-5 Dec 2025	

Welcoming all our partners with their Country Flag in the Cape Town wind.

WHO Americas, Europe, South East Asia, Western Pacific Regions

Argentina: Sinergium Biotech	4 Nov-22 Nov 2024	
Serbia: Torlak Institute	14 Oct-1 Nov 2024	
Ukraine: Darnitsa	TBC	
India: Biological E. Ltd	2 Dec-20 Dec 2024	
Indonesia: BioPharma	3 Feb-21 Feb 2025	
Bangladesh Incepta	12 May-30 May 2025	
Polyvac Vietnam	6 – 31 Oct 2025	**TEAMS AT AFRIGEN AS WE SPEAK!**

mRNA Technology Transfer Programme

Innovation Driven Collaborations are critical to the continued building the mRNA platform for a Sustainable Future

Afrigen Biologics & Vaccines

Archetype	Disease	Pathogen	GAVI	WHO	CEPI	PAVM	mRNA app	difficulty
Legacy	Measles							
	Tuberculosis	**						
	Whooping Cough							
	Tetanus							
	Diphtheria							
	Hepatitis B							
	Yellow Fever	*						
	Typhoid							
	Cholera							
Expanding	Rotavirus							
	Pnemococcal	**						
	Papilloma Virus	#						
	HIV/AIDS							
	Malaria	*						
	SARS-Cov-2							
Outbreak	Chikungunya	*						
	Lassa Fever							
	Rift Valley Fever	*						
	Ebola							
Next Horizon	Varicella							
	Hepatitis A							
	Influenza							
	Syphilis	#						
	Genital herpes	#						
	Otitis	**						
	Gonorrhea	**/#						
	Chlamydia	#						
Other	RSV							
	Strep A	**						
	Group B Strep	**						
	Rabies							

DNA & RNA Development

Manufacturing Technology

Alternative Delivery Method

Additional Disease Targets

Formulation Research

✓ Active collaborations

mRNA Disease Targets

mRNA Technology Transfer Programme

medicines patent pool

World Health Organization

Expanding preventative measures for unmet medical needs and improving patient outcomes.

Archetype	Disease	Pathogen	GAVI	WHO	CEPI	PAVM	mRNA app	difficulty
Legacy	Measles							
	Tuberculosis	**						
	Whooping Cough							
	Tetanus							
	Diphtheria							
	Hepatitis B							
	Yellow Fever	*						
	Typhoid							
	Cholera							
Expanding	Rotavirus							
	Pneumococcal	**						
	Papilloma Virus	#						
	HIV/AIDS							
	Malaria	*						
	SARS-Cov-2							
Outbreak	Chikungunya	*						
	Lassa Fever							
	Rift Valley Fever	*						
	Ebola							
Next Horizon	Varicella							
	Hepatitis A							
	Influenza							
	Syphilis	#						
	Genital herpes	#						
	Otitis	**						
	Gonorrhea	**/#						
	Chlamydia	#						
Other	RSV							
	Strep A	**						
	Group B Strep	**						
	Rabies							

Afrigen

Biovac

BioVax Kenya

Bio-Manguinhos

Biofarma

BiologicalE

BioGeneric Pharma

Biovaccines Nigeria

Darnitsa

Incepta Vaccine

Institut Pasteur de Dakar

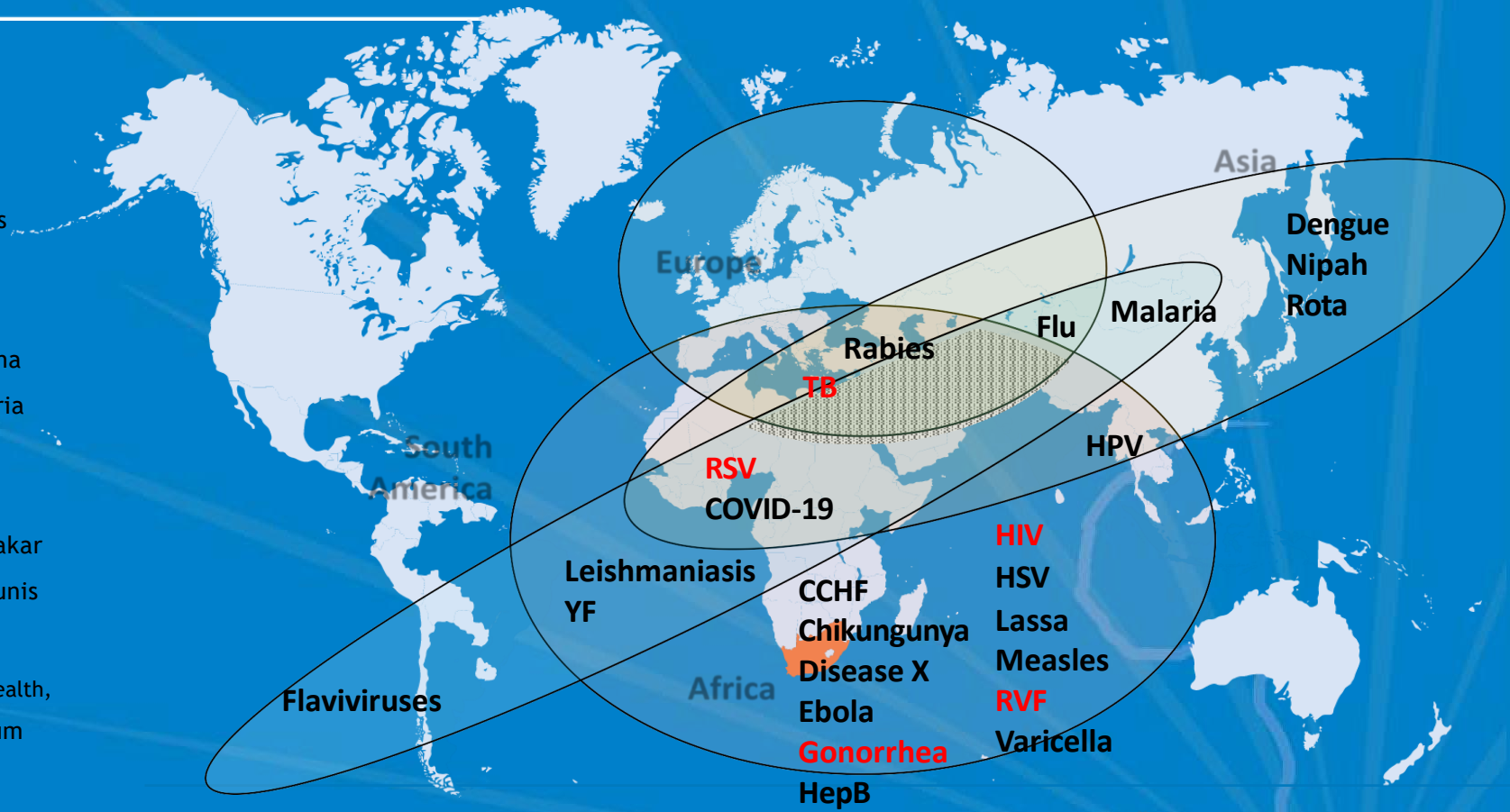
Institut Pasteur de Tunis

Institut Torlak

National Institute of Health,

Polyvac Sinergium

Biotech

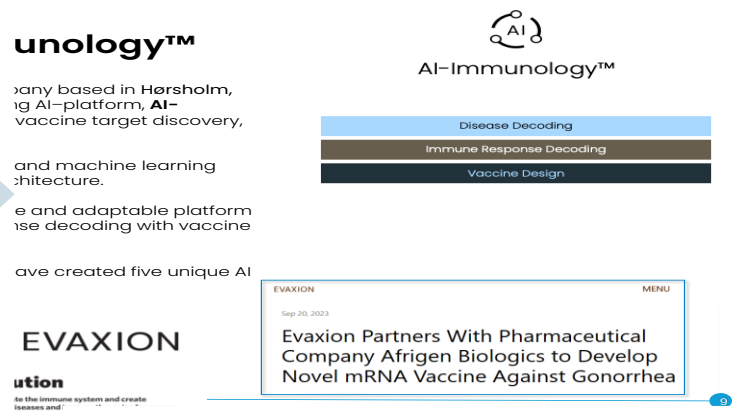


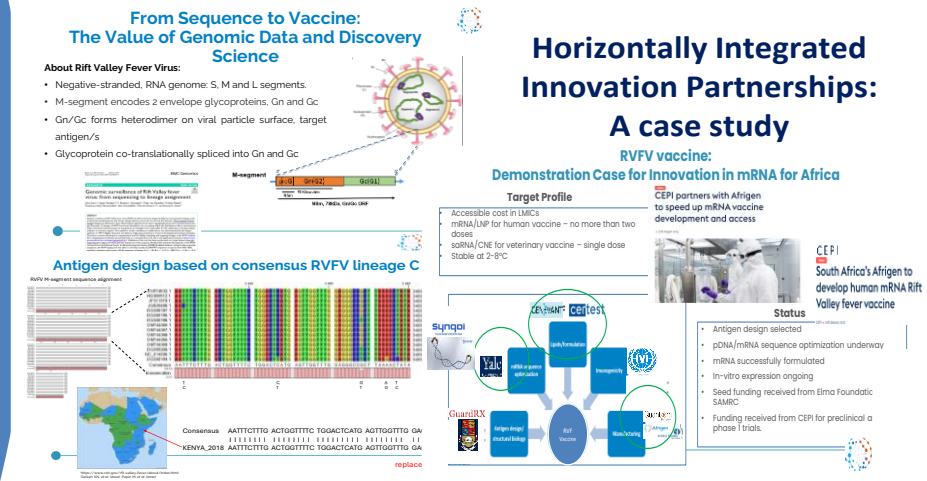
SAMRC, Afrigen and partners products in early development

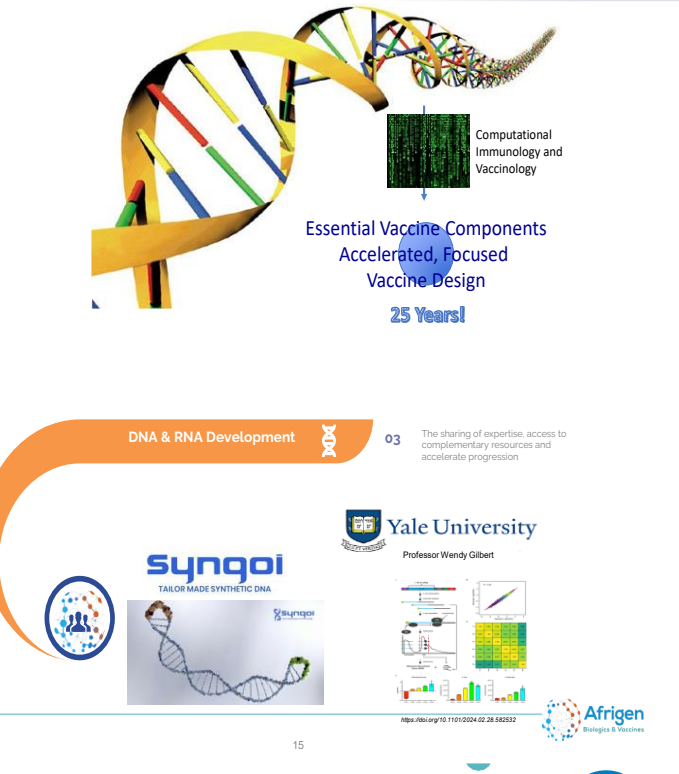
Courtesy Pierre Gsell. WHO/MPP mRNA Technology Transfer Programme Meeting. Cape Town. April 2023

THE QUEST FOR A SUSTAINABLE FUTURE REQUIRES AN ECOSYSTEM LENS AND EMBRACING NEW TECHOLOGIES (while we boldly built).

mRNA Technology Transfer Programme







mRNA Programme Evolution and Future Focus

2021 → 2022 → 2023 → 2024 → 2025 → 2026....

Pandemic response & interpandemic sustainability

mRNA-based COVID-19 Wuhan vaccine

mRNA-based COVID-19 vaccine with epidemiologically relevant variant

mRNA-based vaccine manufacturing technology platform

mRNA-based vaccine candidates for LMICs (R&D consortia)

mRNA-based therapeutics

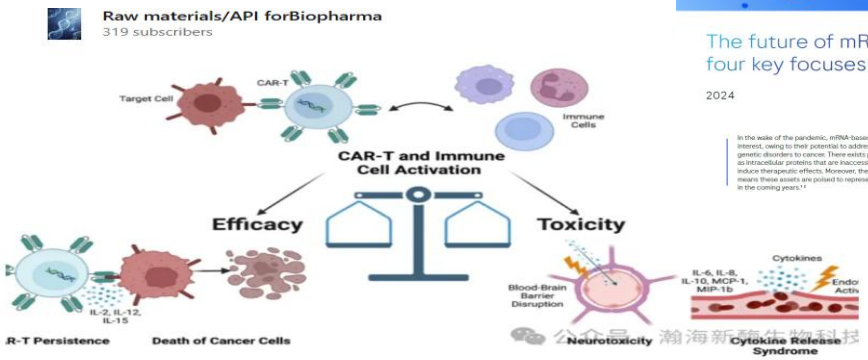
mRNA-based 2nd gen technologies

South African consortium + South African mRNA Vaccine Consortium (SAMVAC) + Programme Manufacturing partners + Research centers

mRNA Technology Transfer Programme

AND HOW RELEVANT IS FUTURE RELEVANT……?

IMAGINE……



The future of mRNA:
four key focuses for industry

2024

In the wake of the pandemic, mRNA-based therapeutics and vaccines have seen increasing research and development interest, owing to their potential to address a wide range of therapeutic indications, from infectious diseases to genetic disorders to cancer. There exists promising versatility within mRNA technology; for example, for targets such as intracellular proteins that are inaccessible to many protein-based therapeutics, mRNA drugs can be leveraged to induce therapeutic effects. Moreover, the speed with which mRNA drugs can be developed without sacrificing quality means these assets are poised to represent an increasingly large segment of the biotherapeutic development pipeline in the coming years.[1]

In vivo CAR-T: Breakthrough and Clinical Progress of mRNA-LNP Driven Technology, Reshaping the Landscape of Cell Therapy

Trasy Ding
Raw materials and API/ intermediates/FDF for Biopharma

November 5, 2025

Innovation in vaccine technologies:
1970s to 2020s: Nucleic acid platform expansion

1970s

Vaccine platforms:
- Live attenuated
- Whole killed,
- Inactivated
- Subunit,
- Toxoid,
- Alum adjuvants

Vx manufacturing
- Stainless steel bioreactors,
- cells or embryonated eggs

1980s

1st conjugate Vx (Hib)

1st recombinant Vx (HepB)

1990s

New adjuvant: MF59

1st mAb for infectious disease (Palivizumab, RSV)

2000s

Single use bioreactors (facilitates lower manufacturing cost and local production)

Pentavalent combination

New adjuvant: AS03

2010s

1st viral vector Vx (Ebola)

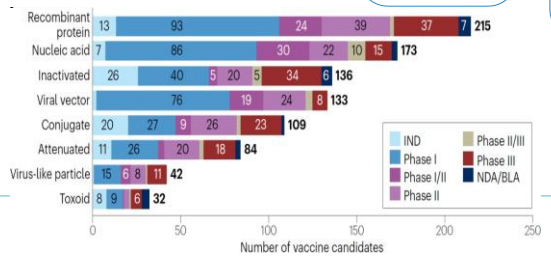
Hexavalent combination

Rabies mAbs (alternative to serum-derived immunoglobulin)

2020s

1st mRNA Vx (COVID-19)

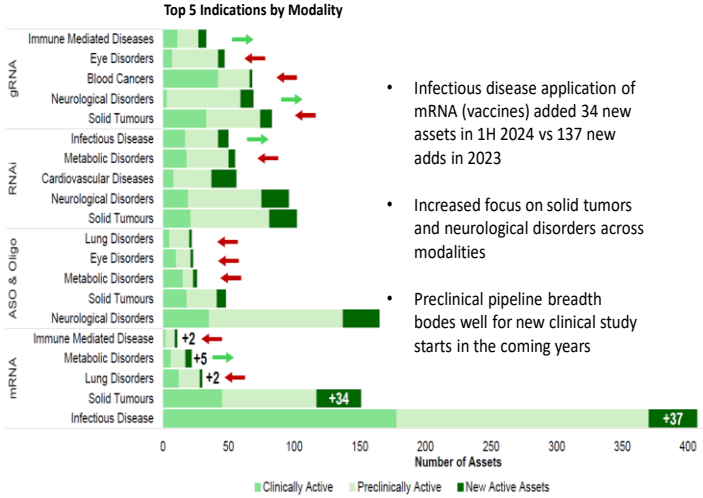
New adjuvants: AS01, Matrix-M



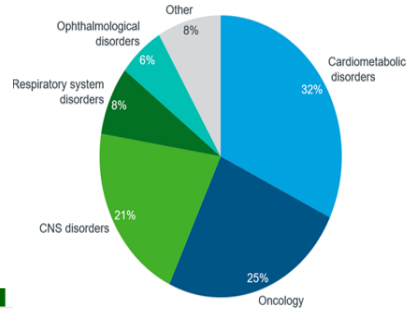
Slide courtesy Dr. Rogerio Gaspar
Director, Dept Regulation and Prequalification
Division of Access to Medicines and Health Products
Division, World Health Organization, Geneva, Switzerland

14

Breath of All Disease Targets Continues to Grow, Vaccine Targets more Refined



- Infectious disease application of mRNA (vaccines) added 34 new assets in 1H 2024 vs 137 new adds in 2023
- Increased focus on solid tumors and neurological disorders across modalities
- Preclinical pipeline breadth bodes well for new clinical study starts in the coming years



RNA Therapeutics - IQVIA

Adapted from
Beacon | H1 2024 RNA Landscape Review | (beacon-intelligence.com)

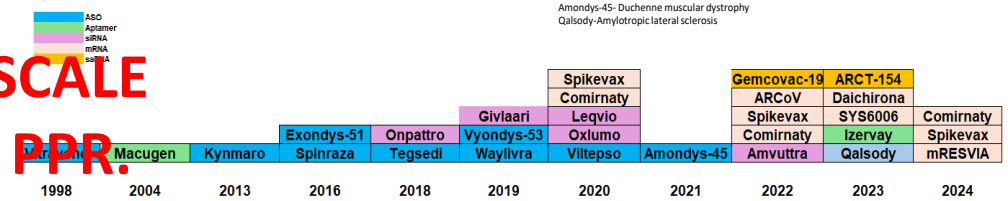
Afrigen Biologics & Vaccines

Growing RNA Product Approvals

- 50% for genetic disorders
- 24% for vaccines

Genetic Disorders
Kynmaro- hypercholesteremia
Waylivra- chylomicronemia syndrome
Leqvio- hyperlipidemia
Tegsedi- transthyretin amyloidosis
Onpattro- transthyretin amyloidosis
Amvuttra- transthyretin amyloidosis
Spinraza- spinal muscular atrophy
Exondys-51- Duchenne muscular dystrophy
Viltepso- Duchenne muscular dystrophy
Vyondys-53- Duchenne muscular dystrophy
Amondys-45- Duchenne muscular dystrophy
Qalsody-Amylotropic lateral sclerosis

SARS-Cov2 vaccines
ARCT-154[7]
Comirnaty[6]
Spikevax[5]
SYS6006[4]
Daichirona[3]
ARCoV[2]
Gemcovac-19[1]



1: EUA India. Gennova Biopharma. 2: Walvax (China). 3: Daiichi Sankyo. (Japan). 4: DSPC Pharma (China). 5: Moderna. 6: Pfizer/BioNtech. 7: Arcturis (Japan)

Afrigen Biologics & Vaccines

GLOBAL EFFORT AND SCALE FOR IMPACT AND E & PPR. ….. JUST IN CASE.

KEY ENABLERS FOR LOCAL MANUFACTURING IN SA/AFRICA

CROSS DEPARTMENTAL ALIGNMENT AND POLICY COHERENCE ARE MOST CRITICAL ENABLERS

1 

Ministry of Health

Technical leads and manage the process of selecting & procuring vaccines for country immunisation programmes.

2 

Ministry of Finance

Willingness to create the fiscal space necessary to materialise demand for African-made vaccines is key.

3 

Ministry of Trade and Industry

Support and understanding how trade policies can facilitate vaccine imports and exports.

4 

Ministry of Science, Technology and Innovation

Robust national industrial policy can support local vaccine manufacturing.

SA Local Manufacturing:

Landmark policies to enable regulatory efficiency.

SAHPRA
South African Health Products Regulatory Authority

POLICY POSITION OF THE SOUTH AFRICAN HEALTH PRODUCTS REGULATORY AUTHORITY ON ENABLING LOCAL MANUFACTURING

DOCUMENT REVIEW AND APPROVAL

Policy Number : CEO04
Revision : 1.0

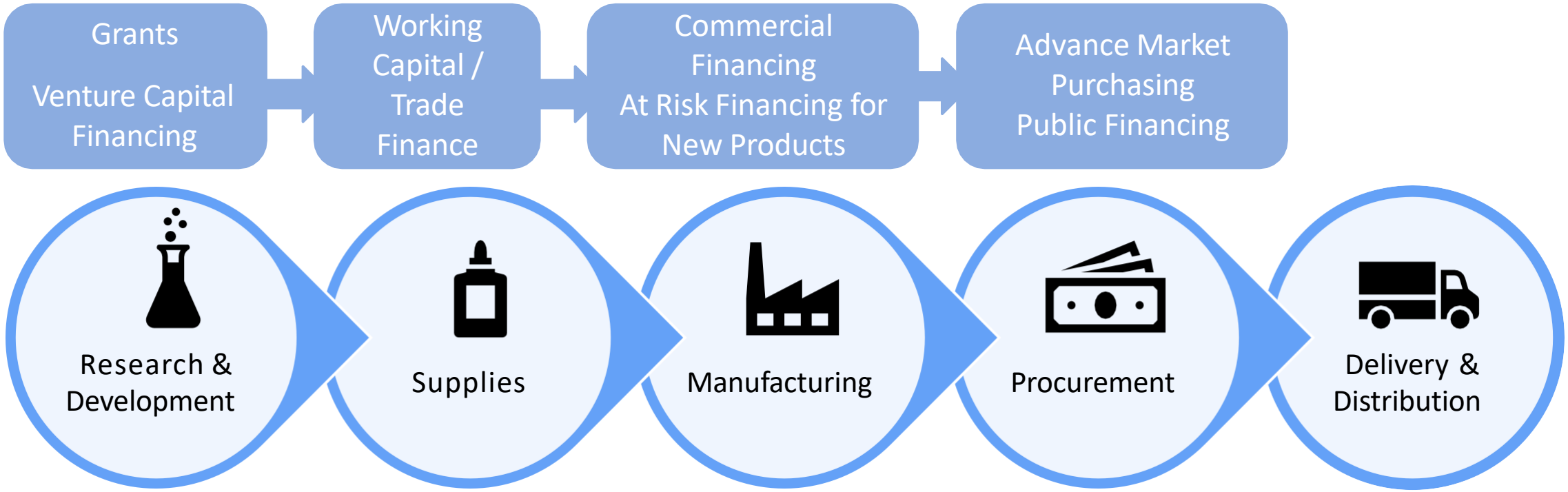
Revision History

Version	Reason for Amendment	Date of Revision
1	New document	September 2024
2	Inclusion of input from comments received	April 2025

6.1.2 This policy position is aimed at facilitating the long-term security of supply of health products in South Africa by supporting local manufacturers through shorter evaluation times and reduced fees for the assessment.

6.1.3 SAHPRA will ensure that any prioritisation of applications will be transparent, fair, objective, timeous, efficient, effective and without favour or prejudice, while focusing primarily on safety, quality, and therapeutic efficacy. This policy position will be incorporated into SAHPRA's Priority Review guideline, which as per SAHPRA practice will incorporate the industry's input.

Financing for Vaccines
"Business as Usual" vs. "Holistic and innovative" models



Blended and Coordinated Facilities, Liquidity Facilities Backed by Procurement contracts

System Strengthening Investments (Trade, Regulatory, Skills)

AFRICA 2021

WHERE ARE AFRICA'S VACCINE MANUFACTURERS?

The continent has around ten established or planned vaccine manufacturers*. Some make the substance that goes into vaccines. Others 'fill and finish' imported vaccine substance. Nigeria and South Africa also have facilities for vaccine research and development.

- Vaccine-substance manufacturer and fill and finish
- Only fill and finish
- Planned vaccine-substance manufacturer

*Algeria has an organization that does some substance manufacturing and distributes vaccine imports. Ethiopia, Morocco and South Africa also import vaccines for distribution.

©nature

Source: 'Vaccine manufacturing in Africa', a report from UK Aid.

AFRICA 2024

AfricaCDC

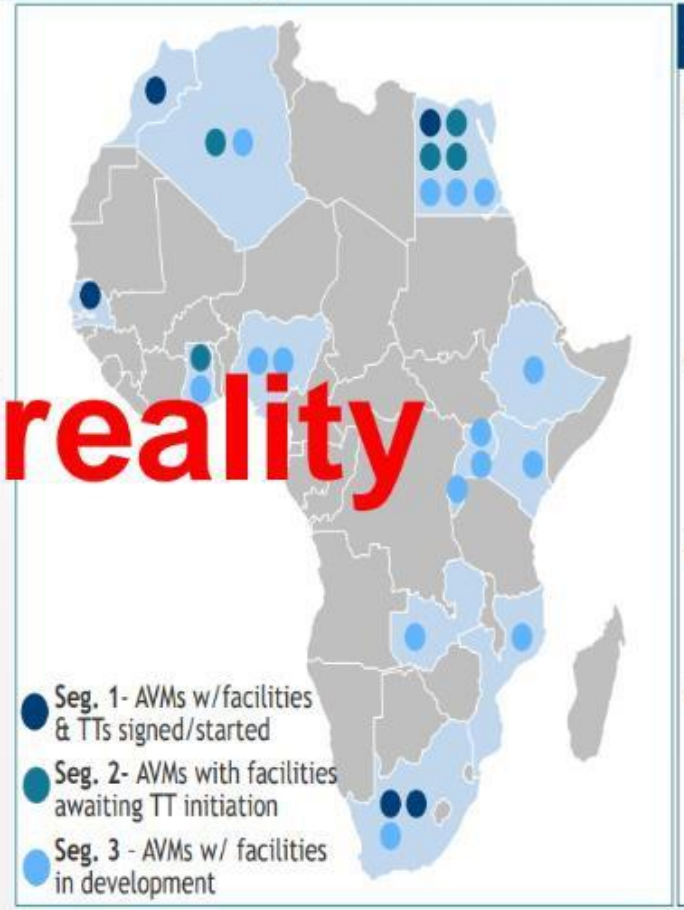
PATH

In 2024, there are 25 active AVM projects which can be divided into three segments based on overall supplier maturities and capabilities

Seg. 1: Facilities w/ TTs underway
- Marbio
- Vacsera
- IP de Dakar
- Aspen Pharmacare
- Biovac

Seg. 2: Facilities awaiting TT
- Eva Pharma
- Minapharm
- Biogeneric
- Saidal[1]
- Atlantic Biotech

Seg. 3: Facilities in dev.
- IP de Algerie
- DEK
- Innovative Biotech
- BVNL[2]
- DEI Biopharma[3]
- VAI Uganda
- Biovax
- Shieldvax
- BioNtech
- Yash Life Pharma
- Mozambique Holdings[4]
- Afrigen[5]



Key Findings

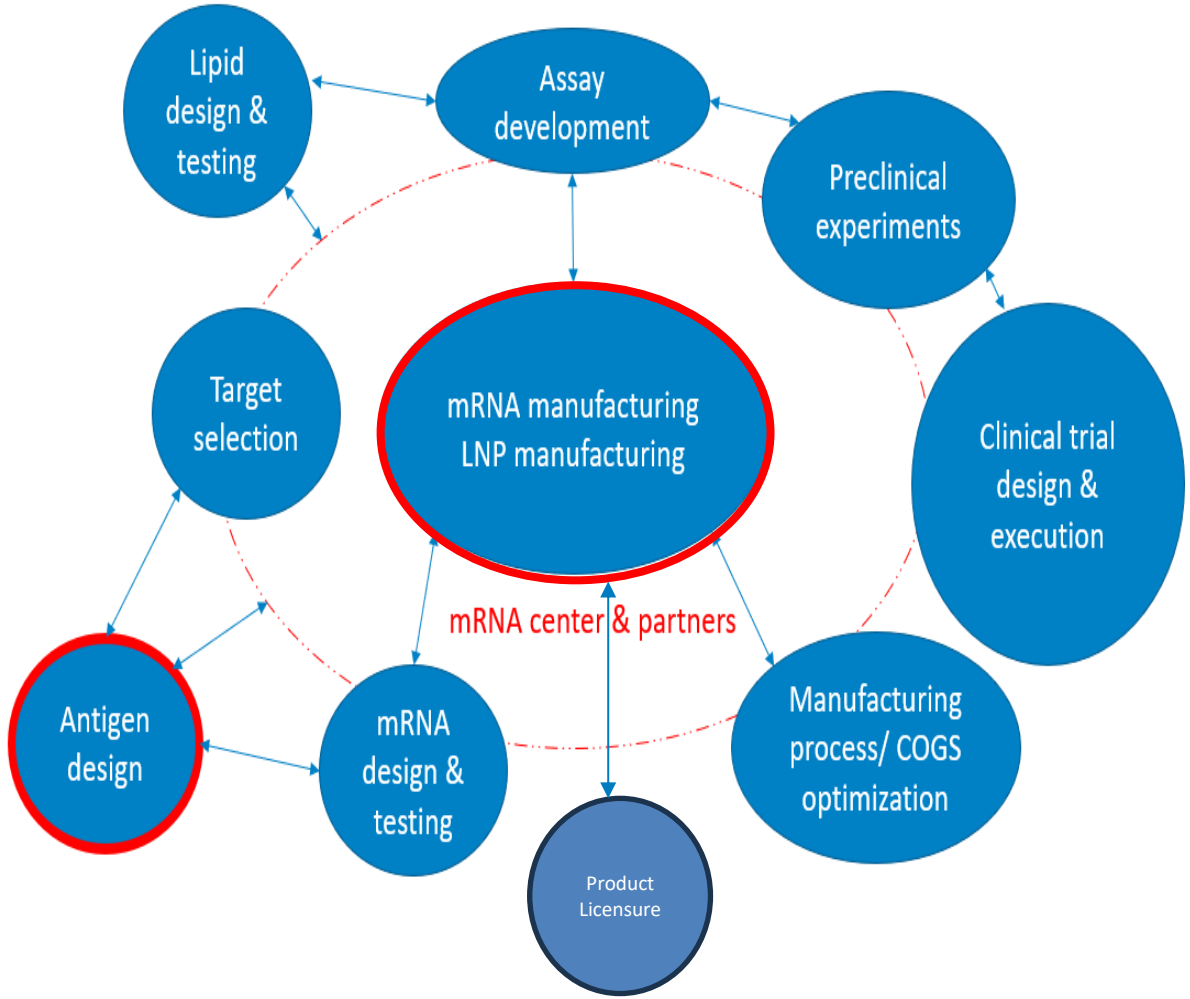
- 5 Suppliers in Segment 1 already have commercial scale facilities and tech transfers (TTs) underway or complete and are relatively close to commercialization
- 5 Additional suppliers in Segment 2 have commercial scale facilities qualified and are ready to receive TTs
- The remaining 15 suppliers in Segment 3 are still in development stages
- Rationalizing AVM projects remains an ongoing need as the long tail of pipeline projects may face challenges to gain a viable market share

1. Interview not yet held, but initial perspective is Saidal may also have a commercial scale facility ready to receive an influenza vaccine TT 2. As per an informal meeting with BVNL they do not have a facility yet 3. Construction of a modular Vxn facility has started in the US for shipment to Uganda in 2025 4. Unofficial reports indicates they have broken ground on a F/F facility 5. R&D facility complete, larger commercial facility built, expecting GMP inspection in 2025; Source: CHAI/PATH/PAVM Current State Vaccine Supply Mapping

Irreversible reality

Summary: Leverage the Power of mRNA

- mRNA technology has reduced barriers to entry for LMIC vaccine R&D and manufacturing.
- Many vaccine targets critically important for LMICs can be addressed through an mRNA platform.
- Critical R&D capabilities must be developed locally to fully benefit from mRNA technology.
- Sustainability will be enabled by:
  - ❑ Efficient, cost-effective manufacturing processes and infrastructure;
  - ❑ Development of products for local/regional use;
  - ❑ An enabling ecosystem with policy coherence and government support;
  - ❑ Supply chain security and access;
  - ❑ Adequate funding across the value chain.



THANKFUL FOR DIVERSE, UNIQUE, LOCAL, REGIONAL AND GLOBAL PARTNERSHIPS

AND DEDICATED COMPETENT PEOPLE… much more than a village, we're a universe!!

WHO and Medicines Patent Pool .
Funders: France, Belgium, Germany, Norway, Canada, Switzerland, South Africa, EC/EU. ELMA Foundation, SA Government DSI. AU and Africa CDC (PAVM).
SAMRC and SAMVAC consortium
Biovac
Civil Society Groups
mRNA Hub Steering Committee.
mRNA Hub Scientific Advisory Committee
PATH
NIH/VRC
Curapath
Equipment and technology suppliers
University of the Witwatersrand, NICD, CeBER-UCT, PCDDP NWU, and other SA Universities.
Our Biotech partners across the globe
CEPI
GIZ
CHAI
YALE
KUL Leuven: Access to Medicines
Quantoom
Afrigen Team and Supporting Stakeholders and Shareholders

mRNA Technology Transfer Hub Programme

Kristie Bloom, Abdullah Ely & Patrick Arbuthnot
Xavier Lamballerie & Antoine Nougairede, Ornellie Bernadin
Penny Moore, Thandeka Moyo-Gwete & team
Wendy Burgers, Roanne Keeton & team
Thanos Kotsiopolous & CeBER team
Jason Gall & VRC teams