



mRNA Innovations for Sustainability: Establishing an Enabling Environment

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WHO/MPP mRNA Technology Transfer Programme

Regional meeting in South-East Asia

Shangri-la hotel, Bangkok, Thailand

31 Oct-1 Nov 2023

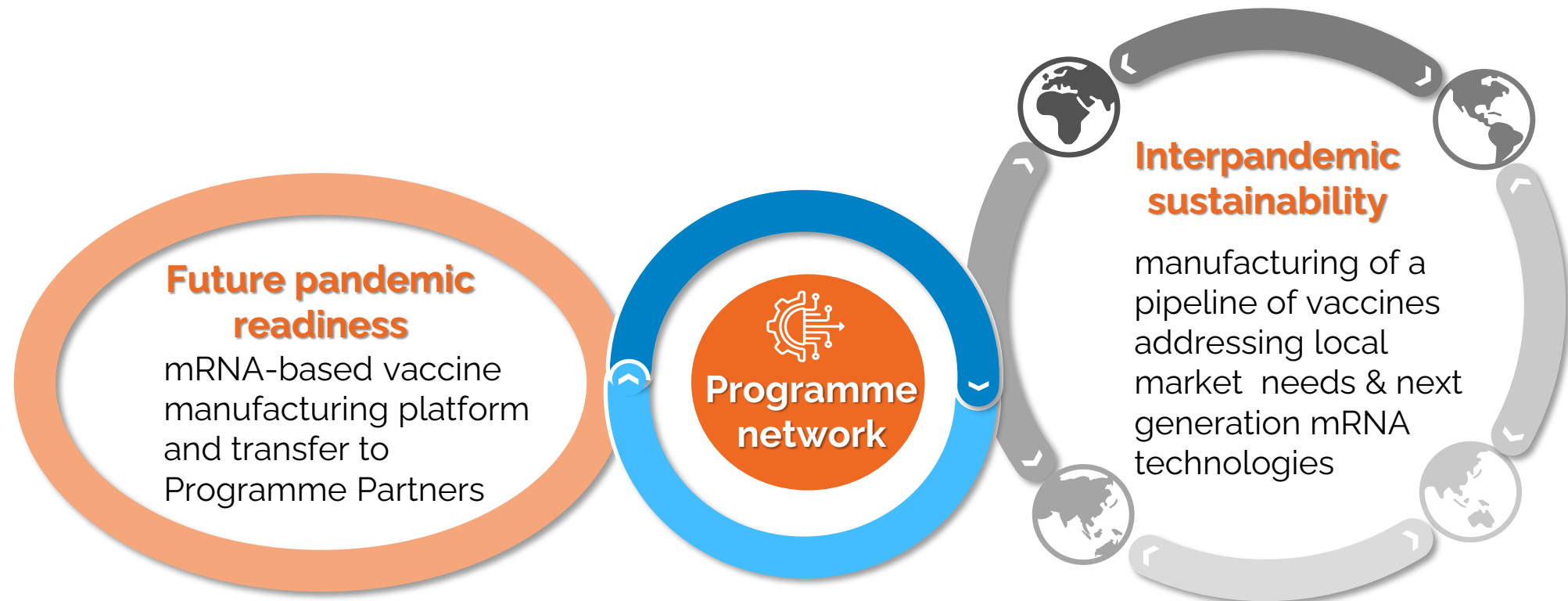
The mRNA Technology Transfer Program: 12 months to mobilize a network for sustainable future pandemic/epidemic preparedness and **vaccine equity**



mRNA Hub Programme Vision and Objectives

Vision

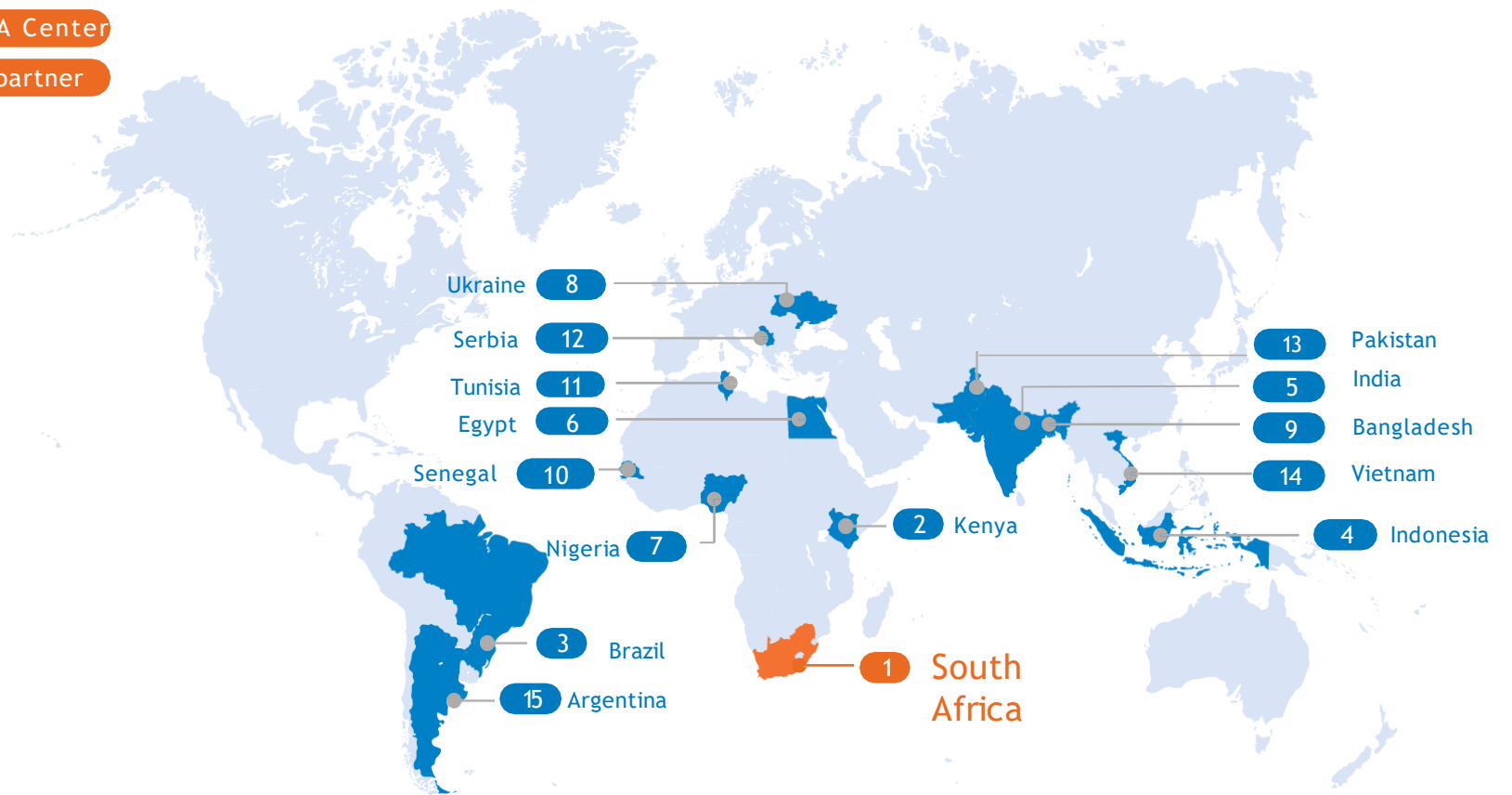
Improve health security in LMICs through local and/or regional production of mRNA vaccines



mRNA Technology Transfer Programme:

A partnership network straddling 4 continents and connecting 15 countries (LMICs)

1	Afrigen	mRNA Center
	Biovac	1 st partner
2	BioVax Kenya	
3	Bio-Manguinhos	
4	Biofarma	
5	BiologicalE	
6	BioGeneric Pharma	
7	Biovaccines Nigeria	
8	Darnitsa	
9	Incepta Vaccine	
10	Institut Pasteur de Dakar	
11	Institut Pasteur de Tunis	
12	Institut Torlak	
13	National Institute of Health	
14	Polyvac	
15	Sinergium Biotech	



Partner countries constitute ~3 billion people (~40% global population)

KEY ENABLERS FOR mRNA product innovation

mRNA Center at Afrigen case study

- ❑ FUNDING (the key role of WHO and MPP)
- ❑ THE RIGHT PEOPLE AND ENOUGH OF THEM
- ❑ PLATFORMS AND FACILITIES
- ❑ PROCESSES AND PRODUCTS
- ❑ REGULATORY AND QUALITY
- ❑ LOTS OF WISE ADVISORS
- ❑ DESIGNED FOR INNOVATION
- ❑ PARTNERS PARTNERS PARTNERS
- ❑ PURPOSE DRIVEN

FUNDING IS THE FIRST ENABLER

SA CONSORTIUM Funding sources



Norwegian
Government



KINGDOM OF BELGIUM
www.diplomatie.belgium.be



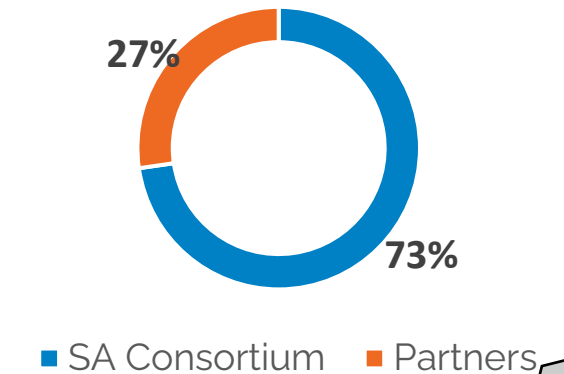
PARTNERS Funding sources



NOTES:

1. Afrigen, Biovac, SAMRC and Secretariat
2. Sites assessment, GxP bio-manufacturing training, critical equipment, regulatory strengthening
3. Exchange rates of 31Mar 2023

Overall funding mobilised:
US\$ 122m



IT IS ALL ABOUT THE PEOPLE !

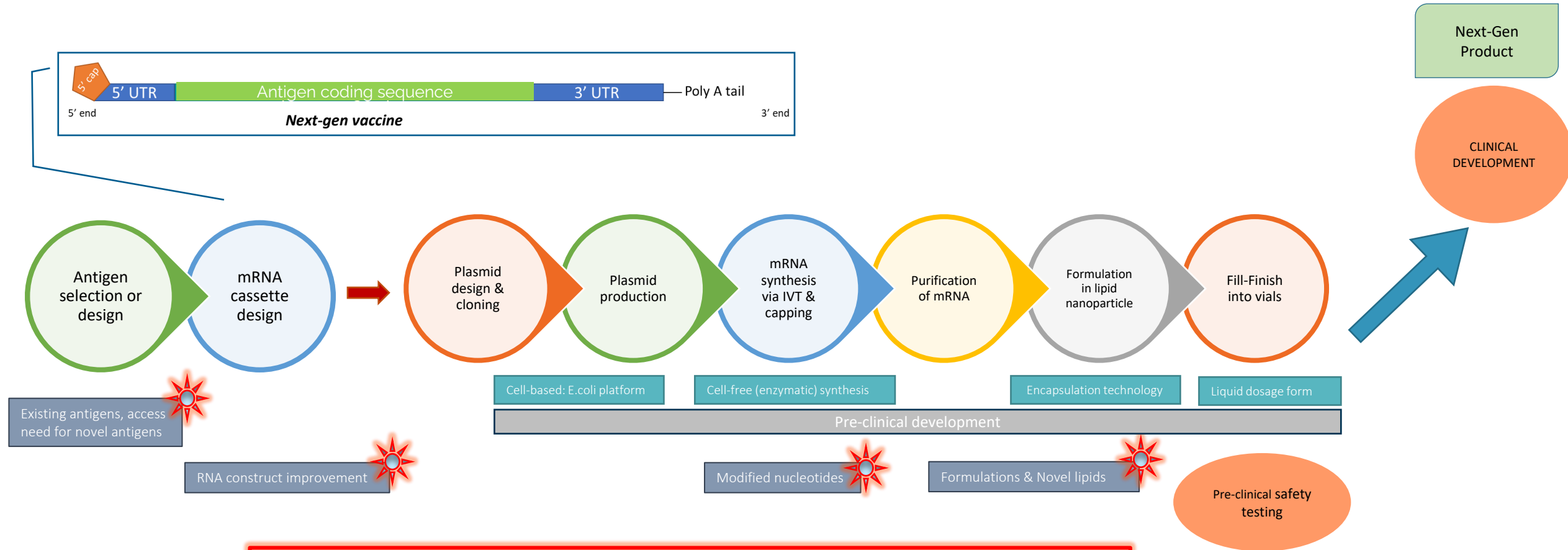
Employee Status & Projection



Aug 2020

Aug 2023

SARS-CoV2 vaccine development: The backbone for a sustainable platform and future product pipeline



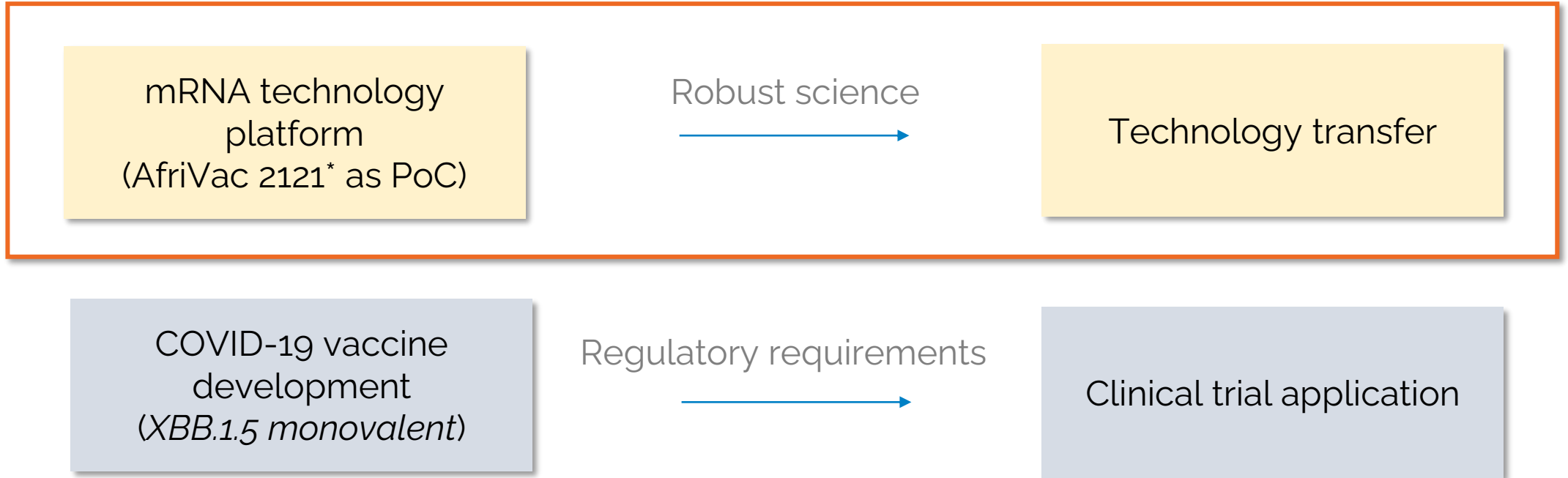
Second generation products and technologies addresses:

- Potency, reactogenicity and thermostability
- Reduced cost of goods
- Freedom to operate

Ongoing research and innovation a priority (SAMVAC)

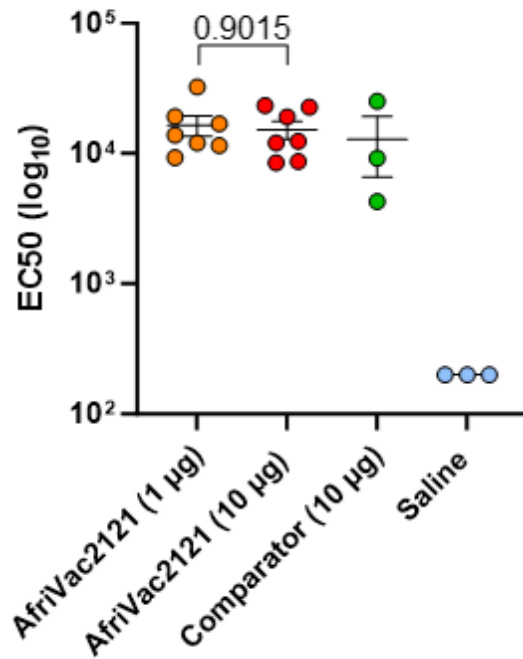
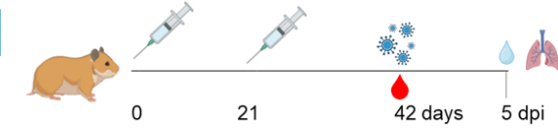


COVID-19 vaccine: mRNA platform vs product development

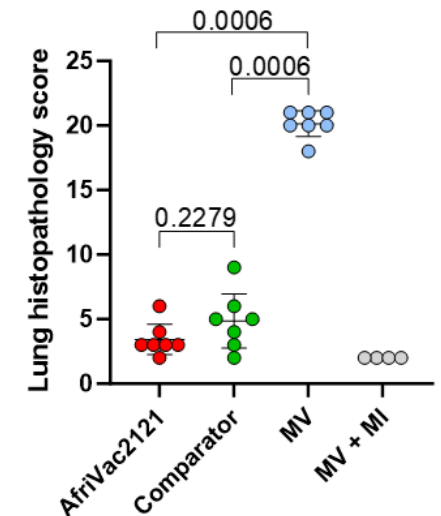
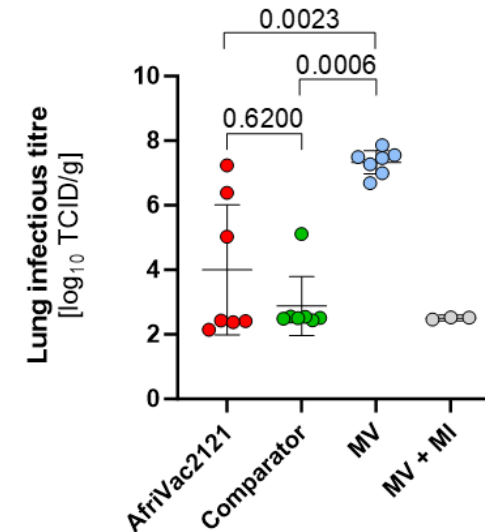
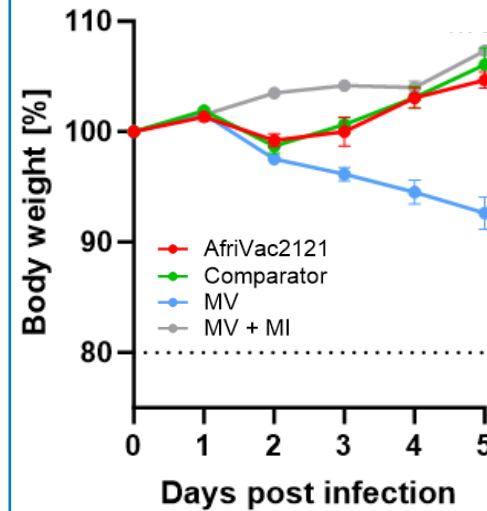


AfriVac2121 performs comparably in multiple end points to an approved mRNA SARS-CoV2 vaccine.

DATA IS KING

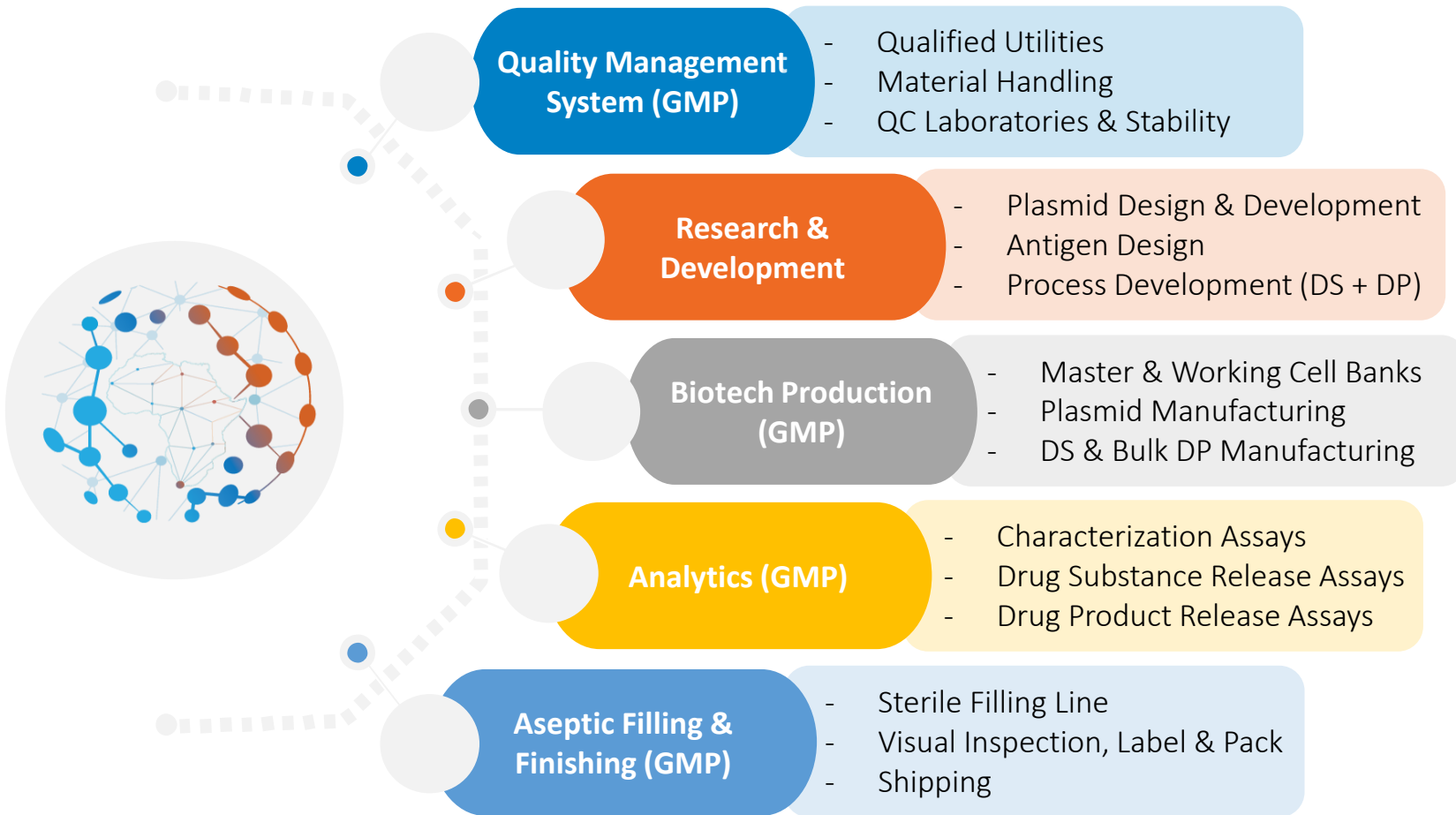


Live viral neutralisation titers in mice 2 weeks post 2-dose vaccination

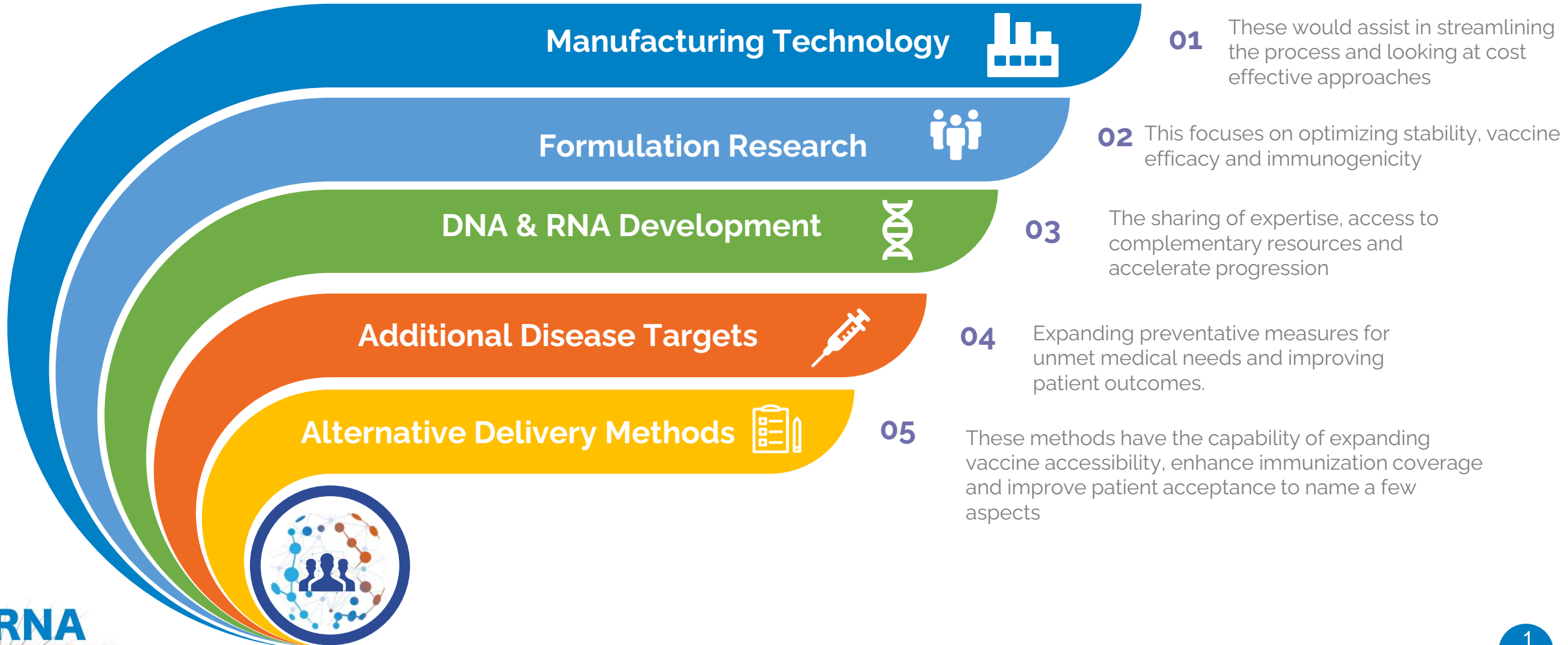


Body weight, lung viral burden and lung histopathology after SARS-Cov2 viral challenge of vaccinated Syrian hamsters

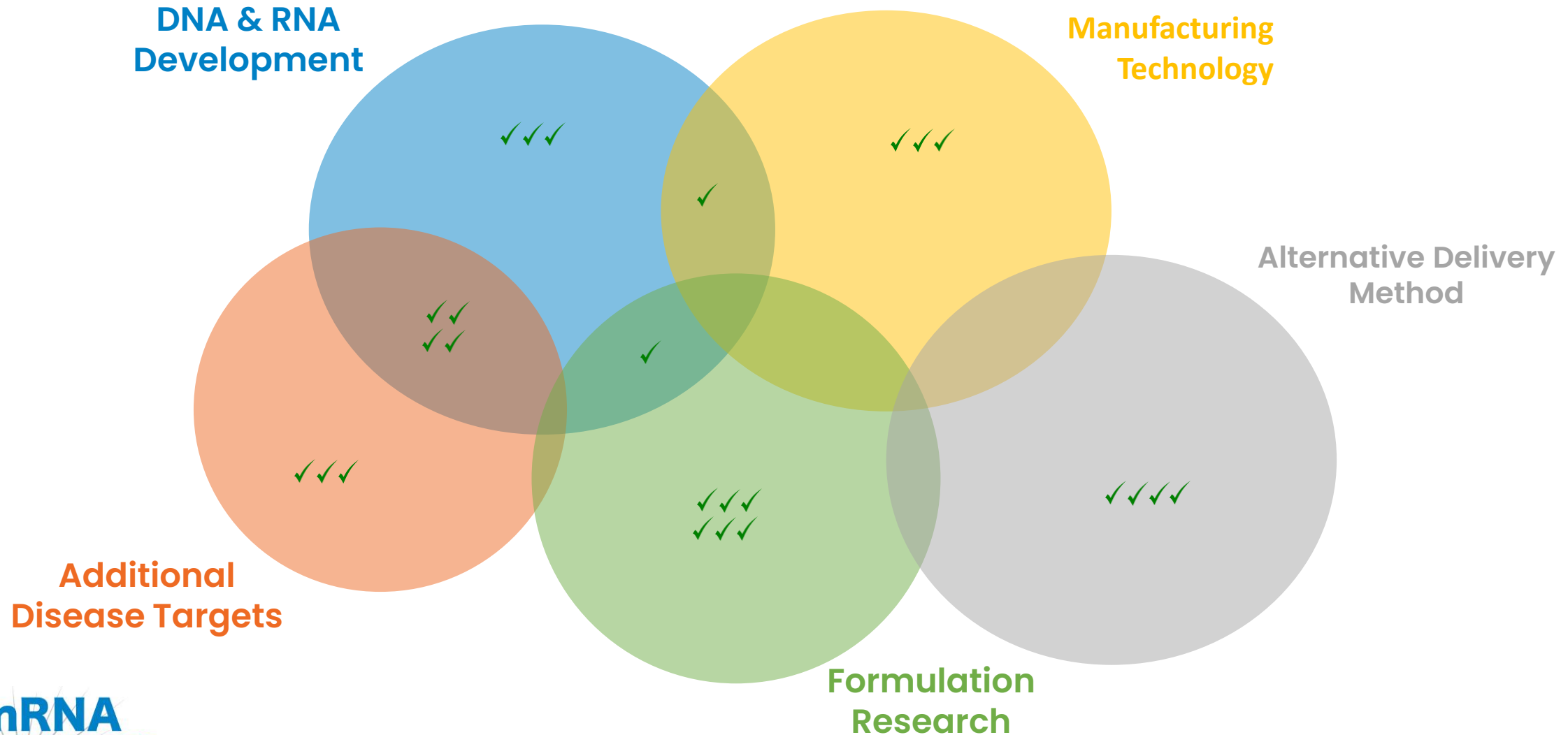
BUILDING End-to-End Capabilities COST COMPETITIVENESS AT HEART



mRNA technology innovation strategy



Collaborations are critical to the continued building the mRNA platform



Process Innovation Partnerships :Early Adopters



Afrigen DS comparability study

mRNA Review

Confidential presentation

Nivelles, September 20 2023

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Afrigen Drug Substance comparability study

QUANTOOM ANALYSIS RESULTS

- Similar RNA integrity results
- 78% of capping efficiency for P220016, close but below the specification of 80%, DS23001 and DS23002 present capping efficiency above 90%
- Similar PolyA tail length results
- Higher level of rpDNA (GOI & KAN), above the specification of 100 ng/mg RNA
- dsRNA results are below the LOQ
- Low ratio of Protein/RNA, 0.11% for P220016 and <LOQ for DS23001 and DS23002*

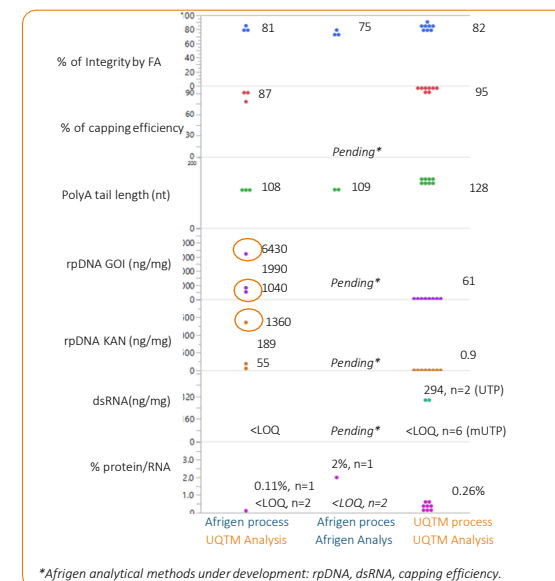
*Different methods used at UQTM and Afrigen

Similar results are obtained by both Analytical teams on Afrigen DS

- ✓ Residual NTPs results: <LOQ,
- ✓ Endotoxin: <LOQ,
- ✓ Spike protein expression: positive
- ✓ RNA Sequence matches description (UQTM >99.9%),
- ✓ pH

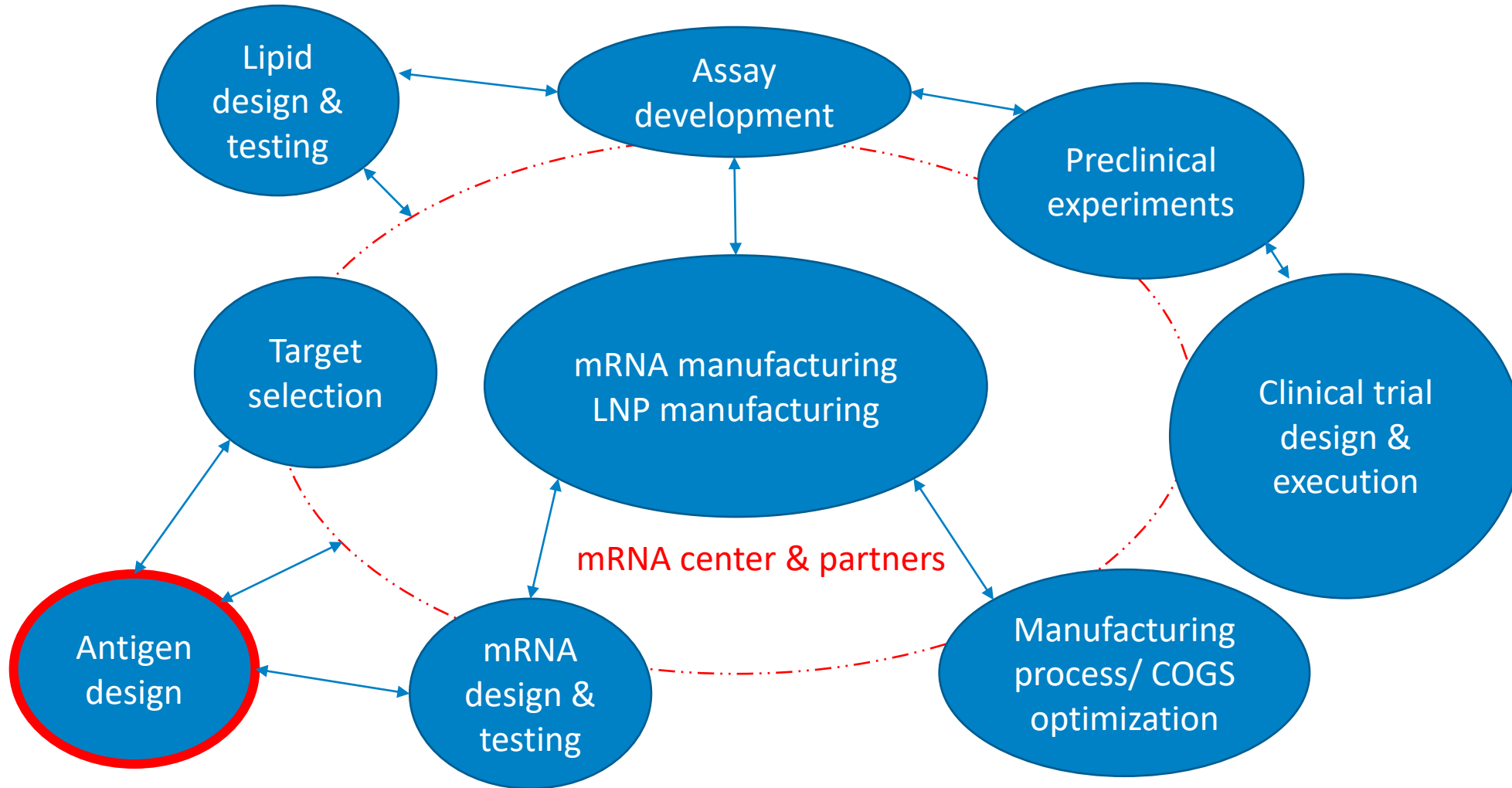
Process performance comparison

	AFRIGEN process	UQTM process
IVT mRNA yield (mg/ml)	2,46 (Post 1 st TFF)	5
Active mRNA pre purification & post capping (mg/ml)	1,73	3,9
Active mRNA post purification (mg/ml)	1,1	3,15 → ≈ 3x

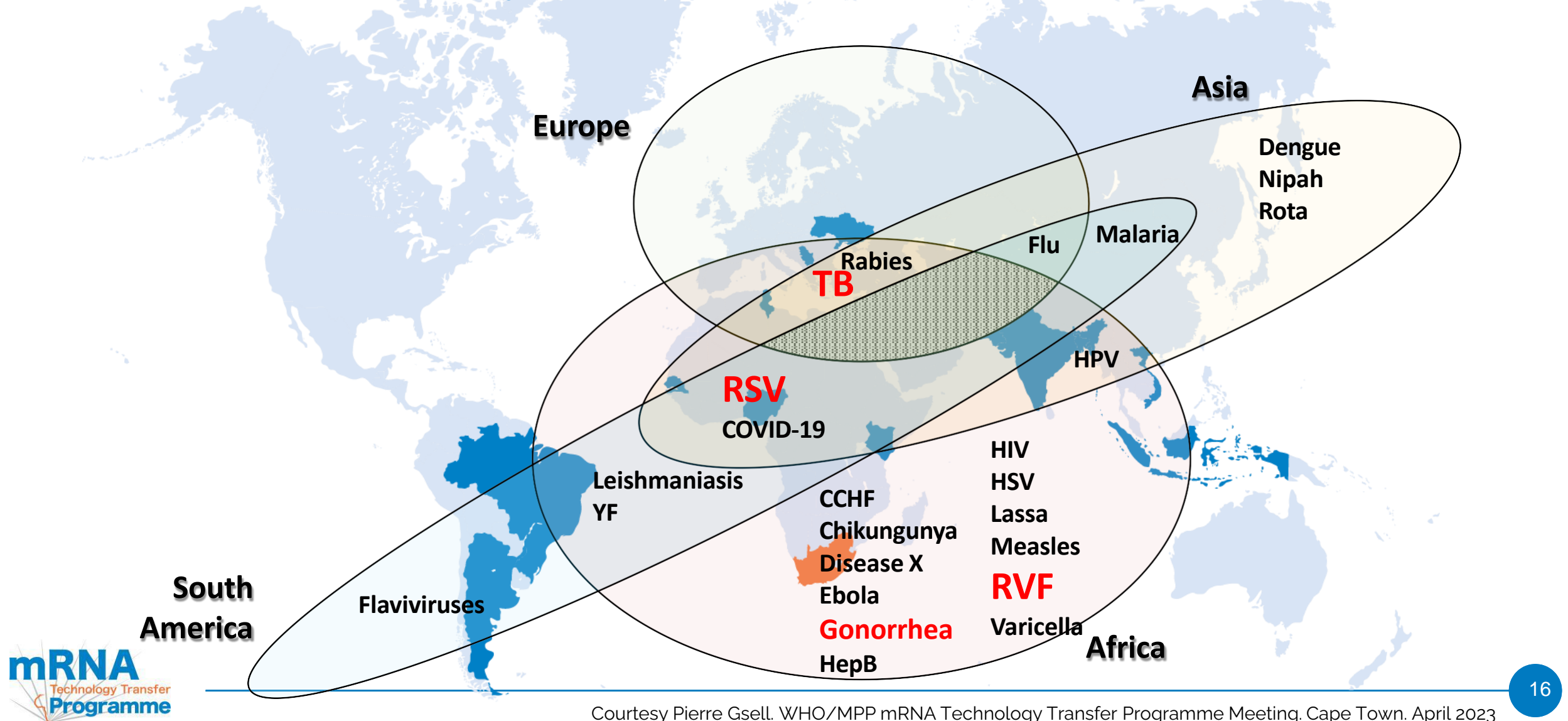


*Afrigen analytical methods under development: rpDNA, dsRNA, capping efficiency.

Building an end to end R&D and manufacturing ecosystem to leverage the power of mRNA



Pipeline development and partnerships for sustainability and **public health impact**



Summary of PTRS/PPDP assessment in LMICs

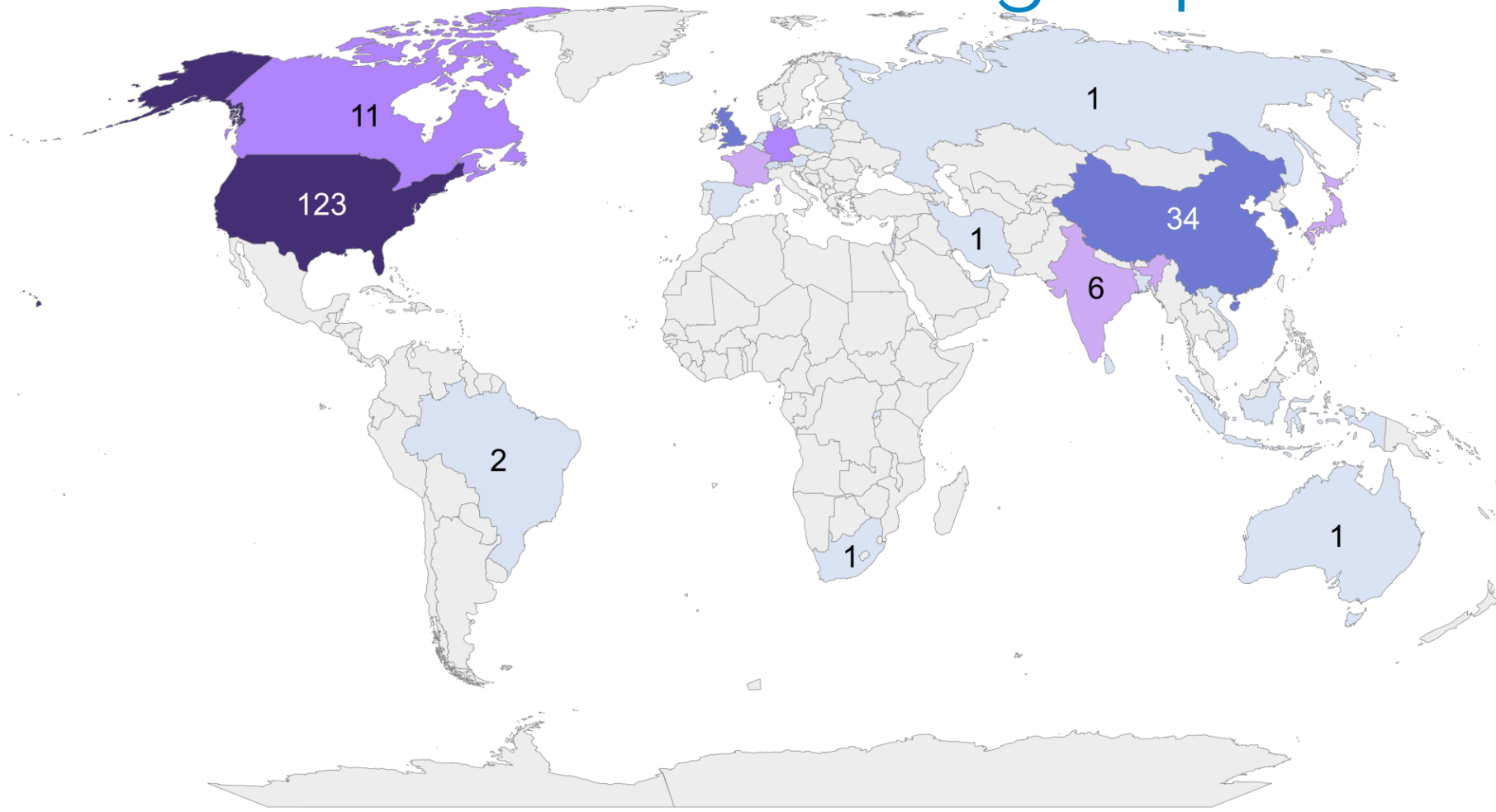
	HIV	Tuberculosis	Malaria	RSV	Influenza	Flaviviruses - JEV	Flaviviruses - others	EID (e.g. Ebola, Lassa)	Tx HPV	HSV	Gonorrhea	Polio	Leishmaniasis	Rabies
PTRS	Red	Yellow	Yellow	Green	Green	Green	Yellow	Yellow	Red	Red	Yellow	Yellow	Yellow	Green
PPDP	Green	Green	Green	Green	Yellow	Yellow	Green	Green	Green	Yellow	Yellow	Green	Yellow	Yellow

PTRS: *Probability of Technical and Regulatory Success*
PPDP: *Probability of Policy Development and Procurement*

- Based on potential targets of interest
- To inform vaccine mRNA pipeline for the 15 Partners
- Needs to take into account regional considerations



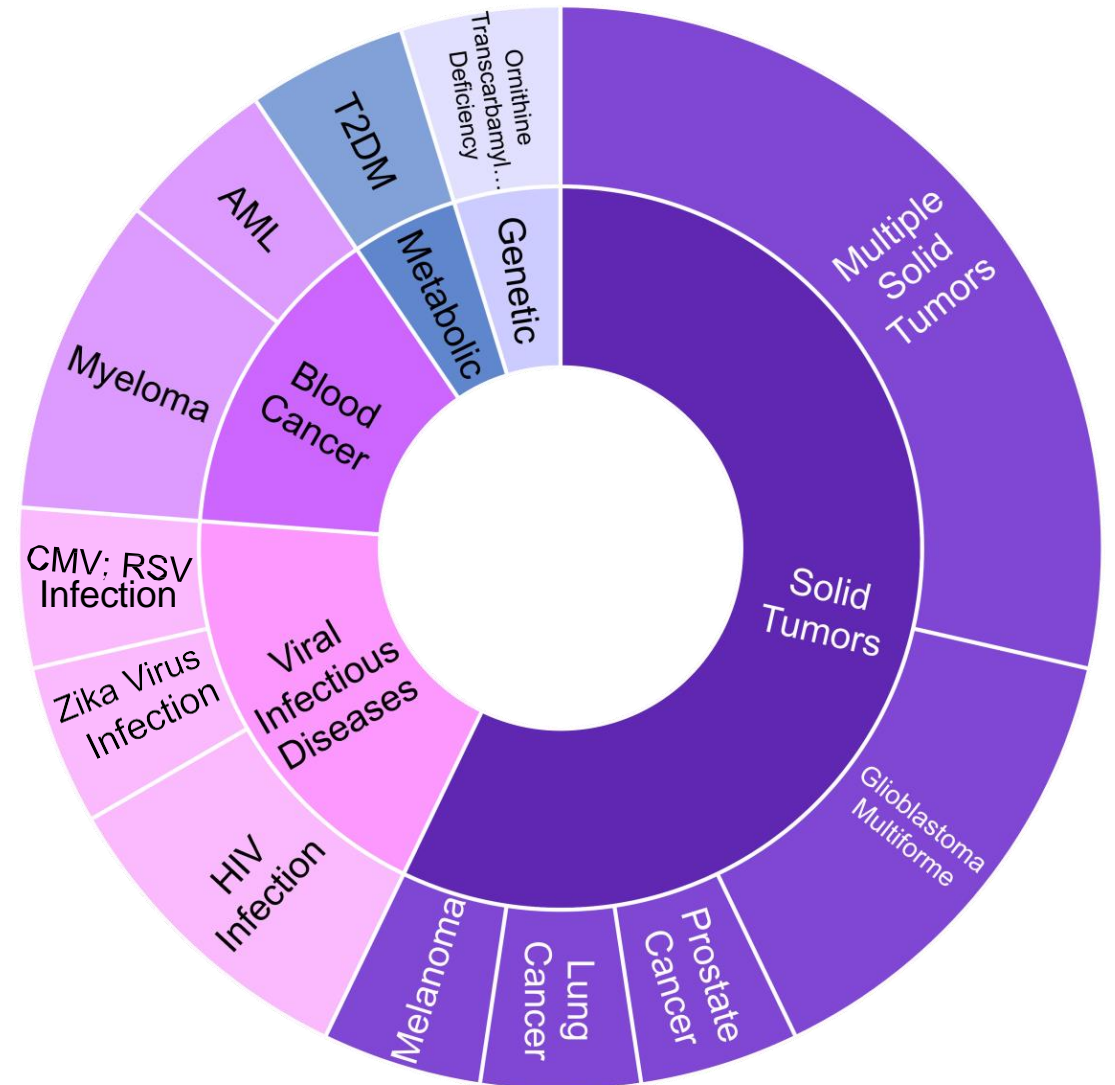
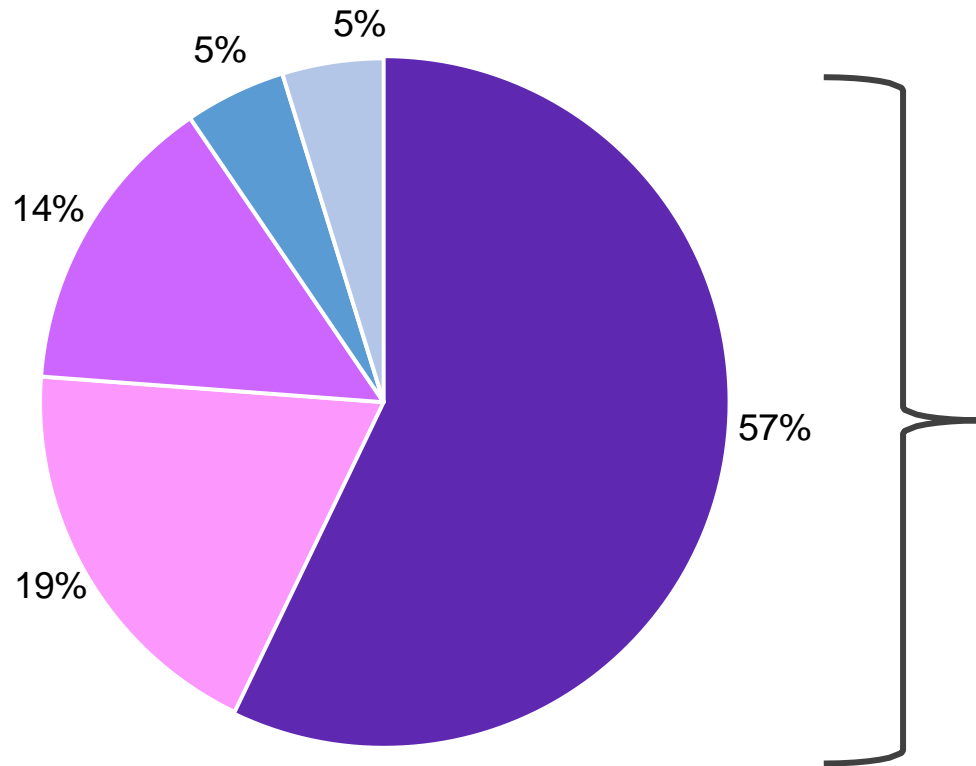
mRNA Companies and Locations: Evolving at speed.



Country	Companies
United States	123
China	34
South Korea	21
United Kingdom	16
Germany	11
Canada	11
Japan	7
India	6
Switzerland	5
Netherlands	5
France	5

mRNA Disease Landscape – What's Next?

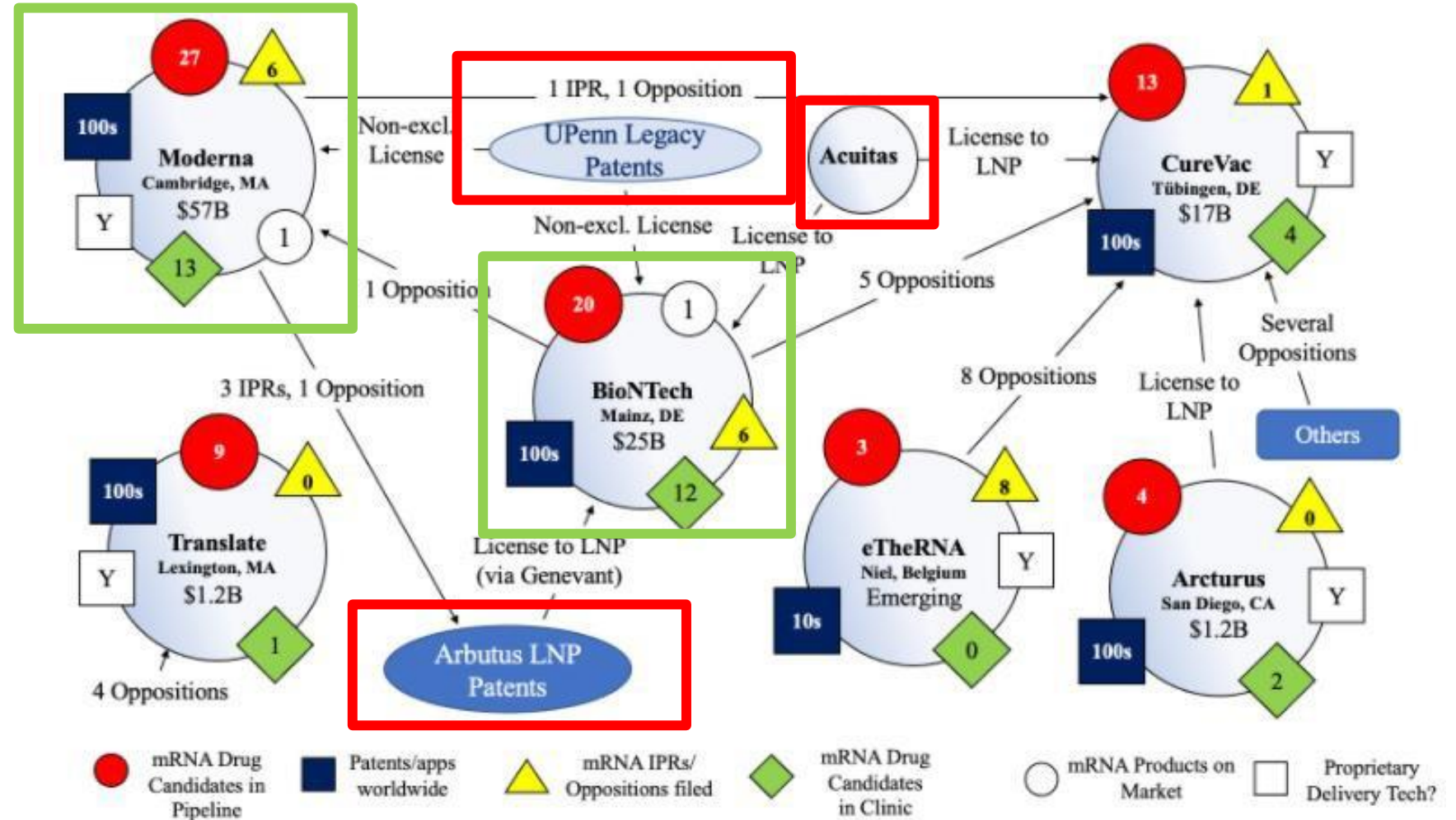
- Solid Tumours
- Infectious Diseases
- Blood Cancers
- Metabolic Diseases
- Genetic Disorders



mRNA/LNP IP competitive landscape

FTO is key to sustainability

The mRNA IP and Competitive Landscape are in a **constant state of flux and subject to significant ongoing change** (e.g., market capitalization, opposition and IPR filings, regulatory candidates, alliances, etc. are all constantly changing and will continue to do so on an ongoing basis).



Source: <https://www.jdsupra.com/legalnews/the-mrna-patent-and-competitive-7682620/>

Closing thoughts...

- There is no doubt that RNA technology and innovation platforms will make a significant contribution to health product development and delivers positive public health benefits.
- Global access to these products needs to be a world priority.
- Lower barriers to entry for mRNA technology provides an opportunity for LMIC's to become self-sufficient for many vaccines in terms of manufacturing of drug substance and drug product.
- Manufacturing alone is insufficient for sustainability, we must develop the know-how, capability and capacity for vaccines from concept, design, testing/optimization, manufacture and clinical development/registration to ensure sustainable access.
- Success will come more easily through genuine partnership and mutual support through an mRNA/LNP R&D and manufacturing ecosystem.
- RNA has applications beyond vaccines – in human, veterinary and agricultural applications.

RECOGNITION AND APPRECIATION

WHO.
Medicines Patent Pool(MPP).
Funders: France, Belgium, Germany,
Norway, Canada, Switzerland,
South Africa, EC/EU. Alma 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.
Afrigen Team and Supporting
Stakeholders and Shareholders.





Afrigen

Biologics & Vaccines

An Avacare Health & IDC Company

THANK YOU