

mRNA Technology Transfer Programme First Face-to-Face meeting, hosted by WHO and Medicines Patent Pool

17–21 April 2023

Cape Town, South Africa

Executive summary

In 2021, WHO and the Medicines Patent Pool (MPP) established a technology transfer programme for mRNA vaccines, in order to build mRNA-based vaccines manufacturing capacity in low- and middle-income countries (LMICs). The principal aim of the Programme is to **strengthen health security by enhancing regional capacity to develop and manufacture mRNA vaccines**, starting with vaccines for Covid-19.

The origins of the initiative lie in the experience during the Covid-19 pandemic, when many LMICs struggled to access vaccine supplies especially early in the pandemic. Boosting regional manufacturing capacity is potentially one way in which access to pandemic vaccines could be expedited and expanded in the future. In particular, the mRNA vaccine technology is particularly suitable to be used as a platform for pandemic response vaccine manufacturing as it is a proven technology, requires comparatively low initial capital investment, and is highly adaptable as variants evolve, potentially allowing rapid development and scale-up for production of vaccines for new pandemic pathogens. In addition, the mRNA technology has potential applications for routine vaccination, as well as in the therapeutic area which could contribute ensuring that facilities constructed for outbreak response remain active and viable between pandemics, and therefore enabling interpandemic sustainability to the facilities implementing this technology.

The mRNA technology transfer programme, co-led by WHO and MPP, is based on a South African consortium establishing and validating an mRNA manufacturing platform (process and analytics) at a central site (the ‘hub’) and transferring the technology platform for free to partners in an initial 15 countries in all six WHO regions. The South Africa hub comprises the biotechnology company **Afrigen** which undertakes the process development at a scale suitable for vaccines manufacturing for early Phase clinical trials and technology transfer, the vaccine manufacturing company **Biovac**, which undertakes the scale-up to commercial scale and the validation of the technology platform and the **South African Medical Research Council** which coordinates and leads on research on improved mRNA technologies and application to non-Covid-19 targets relevant for LMICs. WHO and MPP support the programme through the provision of technical expertise and workforce training to the hub and partners, IP management, regulatory guidance and capacity building, as well as raising funds for the programme. The programme is currently funded by Belgium, Canada, European Commission, ELMA, France, German Cooperation, Norway, South African Government and South African Medical Research Council (SAMRC).

In April 2023, the programme organized the first in a planned series of **face-to-face meetings** of programme partners and international stakeholders. Over 220 participants took part in-person in Cape Town with 50 attending on-line; the meeting brought together the representatives from the 15 programme partners, technical experts, industry, civil society representatives and funders. The aim of the meeting was to review the programme’s progress to date, discuss mRNA vaccine technology and its potential applications within the network, and to discuss issues related to the development of the Programme network (including the Partners, research institutions located in the Partners countries, the South African consortium, etc.) and its future activities. A key challenge that all programme partners face is how to ensure sustainability of their future mRNA manufacturing capacity. As the demand for Covid-19 vaccines declines, it is essential that alternative applications are developed and commercialised. This meeting therefore focused heavily on the technical and

commercial feasibility of applying the mRNA technology to develop vaccines against infectious diseases of importance in low- and middle-income countries.

Presentations and discussions highlighted several key themes:

1. Excellent progress has been made at the central site in South Africa and in transfer of the first technical packages to programme partners.

Following the launch of the programme in 2021, **Afrigen** has successfully developed mRNA vaccine technology manufacturing capabilities. It has produced a COVID-19 mRNA vaccine candidate that, in animal models, is highly protective and shows comparable performance to commercial mRNA-based vaccines.

Following a competitive process with independent review in 2022, **15 programme partners**¹ have been selected and are currently active in the programme. 13/15 partners have already signed the mandatory technology transfer agreement, which will ensure that new discoveries and technological advances will be shared across all programme partners. An initial technology transfer package has been made available by Afrigen. While Afrigen are in the final stages of confirming the technology platform suitable for Phase I/IIa clinical trial material manufacturing, technical support will be provided to the partners in framing their implementation strategy, identifying specific gaps and needs followed by the initiation of a technology transfer plan with MPP made within the context of the Programme

2. Capacity for pandemic responses will depend on ongoing use of manufacturing facilities and R&D capabilities

Although development of vaccines for pandemic scenarios was the principal rationale for the establishment of the Programme, the network also provides scope for the development and manufacturing of other vaccines to meet national and regional needs that would guarantee interpandemic sustainability. Indeed, the consensus at the meeting was that **preparedness for pandemic responses would be supported by high levels of ongoing activity to maximise retention of generated capacity** – experience suggests that, at the onset of a pandemic, activation of facilities that are just kept ‘warm’ (i.e. with minimal and discontinuous operations that do not include all manufacturing process steps and related operations within a particular facility) during a pre-pandemic period is unlikely to be a sufficiently effective strategy and further manufacturing applications are needed.

3. Each programme partner needs to be part of a functioning local R&D ecosystem in order to fulfil its pandemic preparedness role

The establishment of manufacturing facilities will not by itself be sufficient to achieve pandemic preparedness. Ongoing development and production of mRNA vaccines will be required to achieve sustainability of their facilities, which will depend on a **functioning local R&D ecosystem**, including research collaborations, appropriate regulatory and legal capacity, and a suitably trained workforce. This will require strong commitments from countries, regional actors and global bodies, beyond the immediate scope of the programme.

4. Country commitments to vaccine purchasing and regional procurement mechanisms will be required to ensure sustainability of the network

Although mRNA manufacturing facilities at modest scale are inexpensive to build compared to conventional vaccine facilities, operational costs can be high due to the cost of raw materials. Initially at least, mRNA vaccines developed through the programme may be more expensive than existing or equivalent products, due to the

¹ For list of partners see <https://medicinespatentpool.org/what-we-do/mrna-technology-transfer-programme>

advantages that large (northern based) pharmaceutical manufacturers have in terms of scale of production. Procuring countries will therefore need to take into account the **additional value offered by the programme's contribution to health security and pandemic preparedness, and the value of regional manufacturing** when making vaccine purchasing decisions, adapting procurement policies when necessary. Similar trade-offs need to be considered by bodies responsible for regional pooled procurement mechanisms.

5. Intellectual property issues do not currently present a barrier in most of the LMICs

MPP provided partners with an IP landscape analyses focused on the technology under development. While there are many patents on mRNA technology that have been filed and granted in high-income territories, in most of the LMICs there are no patent barriers to manufacturing mRNA vaccines. A few key patents have been identified in one or two of the partner countries that may require technical modification to the current mRNA composition for application beyond Covid-19. Future patent applications may present additional barriers. Significant advancements are being made to mRNA technology, in terms of lipid nanoparticles, mRNA composition, processes etc. These improvements may also be subject to IP barriers in the future.

6. Collaboration across the network will deliver efficiencies and facilitate a focus on regionally prioritized pathogens

Use of available resources can be optimized by **collaboration across programme partners**, for example on R&D relating to specific pathogens and by sharing of technological advances and know-how among programme partners. This could include collaborative work on regionally important pathogens that may not be a high priority for global manufacturers.

7. Other applications of mRNA vaccine technology could be explored within the network of programme partners

As well as prevention of infectious disease, mRNA vaccine technology has other possible applications. These include development of **therapeutic vaccines**, potentially for viral infections such as human papillomavirus (HPV) and herpes simplex virus (HSV), as well as other treatment of conditions such as cancer. There may therefore be opportunities for the network to develop products that address additional unmet needs in LMICs. These potential additional applications also have value in maintaining production capacity, providing further options to utilise the mRNA manufacturing capacity during inter-pandemic periods therefore supporting long-term capacity retention.

In terms of **scientific opportunities for new vaccine development**, discussions at the meeting suggested that the mRNA vaccine platform could be applied to several known pathogens where currently either no vaccines are available, or the available vaccines are poorly efficacious. For each of the key disease areas the meeting reviewed what is currently known about mechanisms of immune protection, and whether there was a reasonable probability of technical success in developing a mRNA candidate vaccine and getting it approved (PTRS: probability of technical and regulatory success). In addition, the participants discussed the likelihood of policy to use the vaccine being generated, and procurement by governments (PPDP: probability of policy development and procurement). For this later discussion, topics such as safety, efficacy, cost, thermostability etc. compared to existing vaccines were considered.

The disease areas reviewed included: high-burden unmet needs such as HIV, tuberculosis and malaria; respiratory viruses such as respiratory syncytial virus and influenza, flaviviruses such as dengue, yellow fever; emerging infectious diseases such as Ebola, Lassa, Rift Valley fever etc; sexually transmitted diseases such as human papillomavirus, herpes simplex virus and gonorrhoea; neglected tropical diseases including leishmaniasis

and rabies. The data presented suggested that for many of these there was a moderate-to-high likelihood of PTRS and that for many of those where there are currently approved vaccines the PPDP was moderate. An exception was RSV for which a high likelihood of development and procurement is predicted. A detailed review of the data will be published shortly.

The data presented provided the mRNA Programme partners with an assessment of which disease targets could become commercially viable products to ensure sustainability of the programme partners mRNA manufacturing base. For all targets a significant R&D process will be required, necessitating collaborations between programme partners and research centres.

Concluding remarks

In just two years, the mRNA technology transfer programme has made remarkable progress, producing a functional mRNA vaccine candidate product which is being evaluated in pre-clinical immunogenicity and efficacy studies. 11/15 programme partners have received a first introductory training to the mRNA technology and the remaining trainings will be organised by the end of 2023. Possible targets for new vaccine development are being discussed by each programme partner, with initial R&D collaborations already initiated in South Africa.

While the programme itself is establishing a unique global network for mRNA vaccine manufacturing, its success will also depend on extensive **scientific and technical collaborations** outside the network, as well as **political commitments** to strengthen R&D ecosystems and to establish appropriate procurement policies. With this in place the programme has the potential to be not only a powerful resource for when the next pandemic arrives but also a major player in the delivery of much-needed vaccines for LMICs.