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Turning Discoveries into Treatments: Immunology in Africa

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Abstract

An exemplar outcome of an immunology-based intervention is vaccine development; the current COVID-19 pandemic is a case in point. Can we build an immunology research ecosystem in Africa that nurtures discovery and enables translation? We see African immunologists as key agents of change and discuss obstacles and opportunities.

Technology Is Transforming the Pace of Immunology

The burden of malaria, tuberculosis, HIV/AIDS, and neglected tropical diseases in Africa is unacceptably high [1–3]. The relationship between infectious disease and cancer is well-established globally but significantly understudied where the burden is highest [4]. Vaccines are the most effective and cost-effective public health tools against infections. Historically, the scientific evidence underpinning successful vaccine development accrued following decades of dedicated clinical and applied research. Technological advances have created a complete paradigm shift; the coronavirus disease 2019 (COVID-19) pandemic is a case in point. Today, vaccine development is occurring at what has been described as ‘warp-like’ speed [5]. The urgency to generate and carefully scrutinize laboratory-based and immunological data has never been greater. Can we seize this incredible momentum and harness it to tackle the debilitating burden of infectious disease in Africa?

Training Scientists Takes Time …. More So in Africa

Although technological advances have revolutionized the speed of scientific discovery, an uncomfortable truth remains. It still requires decades to train the critical mass of immunologists that can have a palpable impact on the health of the continent. Science is a competitive field internationally and African trainees are disadvantaged from the start. From quality education, to research infrastructure and funding, to international exposure and

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inspiring mentorship, inequity is built into the very fabric of the scientific endeavor. To level the playing field and provide nurturing environments that develop critical scientific thinking and problem-solving attitudes, time and commitment are necessary. African graduates usually take on masters programs to consolidate specialized knowledge and compensate for gaps in their earlier training. Globally, outstanding trainees typically complete their PhD training in 3 to 5 years and undertake postdoctoral training for 2 to 7 years before they can compete effectively for funding as junior principal investigators and begin to drive their own science. This time is inevitably longer for African trainees and there are simply no quick fixes to investing in the type of training and support that will ultimately yield the transformative discoveries the continent needs.

Challenging Research Funding Terrains

Securing funding for research is challenging globally, but perhaps felt more acutely in Africa where funding options are limited and where, for many, the very concept of ‘tenure’ is foreign. Ambitious scientists shy away from university positions because of the limited time available for research, heavy teaching loads, modest remuneration, and often dysfunctional work environments. Although research institutions overcome many of these constraints, they rely heavily on competitive cycles of funding from international donors and cannot offer permanent positions. Internal institutional funding opportunities are consequently rare; researchers must secure funding to support themselves and their scientific activities and work aggressively to avoid funding gaps. It is often lamented that African governments have underestimated the transformative potential of health research and hence do not commit sufficient resources to the scientific enterprise [6]. Even with modest increases, local funding in most African countries is simply insufficient and cannot sustain internationally competitive research careers. We will continue to rely on international funding in the near to long term and must position ourselves and prepare our trainees to compete effectively.

Nurturing Research Environments

It goes without saying that strong institutions are absolutely vital for internationally competitive research. The infrastructure for research management as a whole is considerably weaker in typical African institutions and significantly impacts the ability to deliver on research projects in a timely fashion. This ranges from the efficiency of the ethical and scientific review processes to the administrative management of research budgets, grants support, and everything in between. In the context of immunology and related basic sciences, specific challenges arise due to the need for high-quality, well-functioning laboratories. Maintaining what appears to be standard scientific equipment is often challenging, as instruments are procured overseas and service contracts often require international travel and the complications therein. Few manufacturers provide in-country support and those that do often have to wait for spare parts to be shipped from parent companies in the West. Ensuring sufficient supplies of reagents to support laboratory-based research projects requires a high level of planning and leaves little room for the trial and error often needed to develop and optimize new cutting-edge experiments. Supervisors and students must constantly realign and adjust research activities to remain competitive.

Innovative approaches to overcome supply chain constraints and to limit ‘downtime’ due to the inability to maintain laboratory equipment are urgently needed.

Colonial Legacies and Cultural Divides

The cultural diversity and norms within the continent add an enriching but often challenging dimension to training that is augmented by colonial lineages affecting trainees, supervisors, and African research institutions. Broadly speaking, we find stark differences in the approach to science, in the quality and adaptability of trainees from different regions of Africa. Given that English is the most widely accepted language for communication in science, trainees from Francophone and Lusophone Africa find themselves at an immediate disadvantage and struggle to compete with their Anglo-phone counterparts. International funding is intricately connected to colonial legacies that self-perpetuate and create structural barriers to career advancement. As is indeed the case in many Western countries, cultural norms favor males as breadwinners and leaders, while females are often relegated to ‘supportive’ roles. Africa is no exception and deeply ingrained norms influence both men and women long before they enter the workplace and preset their ambitions. Empowering African women from all cultures to step-up and lead in science is thus a major undertaking and requires broad societal support. Fortunately, the tide is already turning and funders and research communities have introduced measures to reduce the gender gap [7].

Dearth of Ambition: From Epidemiology to Mechanistic Studies and Translation

Interwoven into cultural norms is often a subtle and sometimes blatant lack of ambition. Whilst its origins are undoubtedly multi-factorial, the environments that most African scientists find themselves create barriers for their success. The American astronaut Sally Ride famously said, ‘you cannot be what you cannot see’. What do African trainees see? Immunology in most of sub-Saharan Africa is skewed towards sample collection and sero-epidemiological descriptions on the one hand, to measuring basic immune responses to vaccines or drugs in clinical trials, on the other. Mechanistic studies that could guide the design of vaccines and therapeutics lag far behind those in the West [8]. Although many argue that Africa simply lacks the infrastructure to support fundamental immunology, significant capacity now exists in centers of excellence in many African countries [9]. In rare cases, the laboratories are even better equipped than those in Western countries, but challenges remain. Many African trainees struggle to rise above supervisors whose own horizons were limited to sample collection and basic assays. The vicious cycle must be broken with African role models on the continent inspiring the next generation to do more and be more!

Building Strategic Partnerships: International Collaboration

Whilst we acknowledge the ongoing healthy discourse over equity in global scientific partnerships [10], we focus here on the benefits of international collaboration for the intellectual development of competitive and resilient African scientists. International mobility is a well-recognized component of scientific training globally. For African students

in particular, it enables them to broaden their scientific scope, gauge themselves against international counterparts, generate cutting-edge data using high-end technology that is often lacking at home, and helps to foster new ideas and collaborations. International immunologists are a rich source of mentors, supervisors, and trainers and can help to secure much-needed funding through multiple mechanisms, including collaborative research grants. Much has been said about brain-drain and the fact that given the opportunity, many African scientists choose to remain outside the continent. We are of the view that 'brain-circulation' is vital for successful career development in immunology. African trainees should be allowed to choose the environments that enable them to realize their fullest scientific potential. We embrace African scientists in the diaspora and encourage them to stay connected to science in Africa and to contribute to supporting the next generation of immunologists. Building strategic partnerships enables African immunologists globally to come together to solve the pressing health challenges the continent faces (Figure 1).

The Next 20 Years of Immunology in Africa

The coming decades hold a lot of promise for African immunologists. As active leaders and members of the Federation of African Immunological Societies (FAIS), we have witnessed the steady growth of the immunological landscape since the first FAIS meeting almost 30 years ago and the momentum is stronger than it has ever been. With the generous support of the International Union of Immunological Societies (IUIS) (https://iuis.org), we launched the FAIS legacy project (https://faislegacyproject.com) to provide additional training for African scientists [11]. Opportunities for funding are increasing, such as those spearheaded by the Alliance for Accelerating Excellence in Science and hosted at the African Academy of Sciences. Young universities are embracing research and creating flexible new career opportunities for immunologists and scientists in general. For the first time in its nearly 50-year history, the IUIS will host its major triennial conference in Africa. Branded 'turn discoveries into treatments', we see this as a watershed moment that will foster meaningful partnerships and inspire Africans and international delegates for generations to come. There has never been a better time to be an African immunologist (Box 1).

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Box 1.

Opportunities in Africa

Trainees

- Increased funding opportunities internationally, continentally, and nationally
- High disease burdens present opportunities for major impact
- Increasing gender sensitivity, awareness, and opportunities for women
- Numerous opportunities for enriching interdisciplinary scientific collaborations
- Join your national immunological society
- Are you in the diaspora? Stay connected to Africa!

Supervisors

- Build empowering international partnerships
- Build strong teams
- Inspire, motivate, and support trainees to achieve their potential
- Secure lots of funding!
- Support your national immunology society

Institutions

- Bridging funding
- Innovative supply chains
- Promote research culture and create research conducive environment
- Innovative funding mechanisms

Governments

- Invest more into research
- Embrace human capital
- Empower the next generation

Figure 1.
Immunologists Do Not Always Wear White Lab Coats.