Calestous Juma Science Leadership Fellowship
Focus Areas (2021)

Computational Approaches to Drug Design

The pandemic has highlighted the need to find new agents for treatment or prophylaxis of viral infections, particularly for pathogens such as SARS-CoV-2. Furthermore, there remains an urgent need for drugs to treat malaria and tuberculosis. Computational approaches play a major role in drug discovery. Structure-guided drug design has increased in prominence as more protein structures of validated drug targets become available, algorithms for drug design improve, and cloud computing power is more readily accessible. The application of artificial intelligence/machine learning to drug discovery is impacting the process at many steps, from identification of drug targets, selection of lead molecules through efficient lead optimization, and predicting optimal drug combinations. We are seeking to increase capacity in computational approaches to drug discovery. This work will be linked with teams having the resources to make and characterize molecules.

Data Science

Developing and validating approaches to foster improvements in public and global health is difficult due to the interaction of biological, environmental, and social factors. Furthermore, policy recommendations for such approaches frequently lack sufficient supporting scientific evidence. We believe there is now a key opportunity to accelerate impact by analyzing existing data arising from multiple sources, and we are looking for a cutting-edge data scientist to pursue innovative thinking to improve public health decision making in Africa. Although we will accept focus areas that are on strategy for the Gates Foundation, highest priority will be given to proposals that focus on Maternal, Newborn, & Child Health, SARS-CoV-2/COVID-19, or gender disparities in global health.

Female Sexual & Reproductive Health

Female sexual and reproductive health (SRH) is essential for gender equality and women's empowerment, but this public health issue has been neglected globally for decades. The existing data, although sparse, suggest a high toll and unmet need. One of the Gates Foundation's mission areas is focused on the discovery and development of biomedical interventions and technologies to address neglected needs in women's SRH.

Our team has prioritized portfolio opportunities based on those areas with greatest need and those that promise measurable impact: HPV/Cervical Cancer – to develop a Cervical Cancer prevention vaccine. This is a major new initiative and aims to identify appropriate vector constructs (e.g., AAV, other viral vectors, mRNA) and generate data in preclinical models, Ph1/Ph2a clinical studies, and epidemiology to inform clinical trial strategy. Novel non-hormonal contraceptives – to develop transformative, cost-effective contraceptive technologies with fewer side effects, leading to increased overall use and satisfaction. Vaginal microbiome interventions – to develop a microbial-based therapeutic that promotes stable *Lactobacillus*-dominant microbiomes linked to lower rates of HIV acquisition and preterm birth. The Data Initiative – to gain a better understanding of the true burden of SRH diseases, building on analysis of biobanks from existing cohorts (e.g., ECHO, ASPIRE, VOICE).

We are looking for talented African scientists with leadership potential working in the field of female SRH to help us to address these challenges.

Health Economics

Fundamentally, we are looking for a creative thinker to explore practical models and financing mechanisms for African governments to fund R&D from their national budgets. The goal is to catalyze the long-term investments and policies needed to build a thriving African science and technology sector that responds to the needs of the African people. To this end, rigorously defined exemplars of the long-term benefits of investments in R&D to African economies would underscore the fact that science and technology is a growth strategy. And new models could better align stakeholders across sectors so that African governments know that private sector partners are on board to help move discoveries through to delivery stages and conversely that private sector companies know governments and other funders are committed to building a sturdy R&D infrastructure on the continent. We believe expertise and partnership in this area would be extraordinarily valuable not only on its own, but also as a resource underpinning collaborative work with other Calestous Juma Fellows.

Immunology

COVID-19 has illustrated the power of reverse vaccinology – the use of detailed structural analyses, pathogen biology, and understanding what constitutes a protective immune response – to rapidly drive effective vaccine design. The recent emergence of novel SARS-CoV-2 variants highlights the need to further develop the capacity for African investigators on the continent to generate the critical knowledge needed for reverse vaccinology. With a growing pathogen surveillance community, paired with next generation sequencing, single cell analytics, and high-performance computing, we believe there is now a key opportunity to accelerate impact on vaccine design.

We are looking for an innovative thinker to pursue the use of cutting-edge technologies, such as antibody repertoire sequencing, monoclonal antibody discovery, and single-cell analytics, and capitalize on this momentum. We see opportunities for African investigators to apply innovative scientific tools to drive the narrative on: (1) the impact of African genomic diversity on innate immune responses, including single cell epigenetic analyses (relevant to optimizing adjuvant responses and minimizing side effects); (2) antibody and T cell responses to locally relevant pathogens as well as emerging pathogens and variants, including BCR/TCR repertoire analyses, mAb discovery and epitope mapping, single cell analytics; (3) assessment of impact of pathogen variation on protective immunity in local populations via polyclonal, monoclonal, and/or spatial genomics assessment.

Malaria Molecular Surveillance

Malaria Molecular Surveillance (MMS) is the use of molecular biology approaches to interrogate parasite and/or vector populations in order to derive epidemiologically actionable information. In addition to the laboratory techniques used, MMS also includes the bioinformatics tools and resources necessary to process, interpret, and share the resulting data. In order to eradicate malaria within a generation, National Malaria Control Programs (NMCPs) must be empowered to use MMS data to inform their malaria strategic planning, decision-making, program implementation, and evaluation.

There are numerous challenges to achieving this goal. These include building laboratory expertise and capacity for MMS, training and development of staff, analysis and reporting of MMS data, strengthening relationships between MMS laboratories and NMCPs, and integration of MMS data into NMCP activities.

We are looking for talented African scientists with leadership potential working in the field of malaria molecular surveillance to help us to address these challenges.

Maternal, Newborn, & Child Health Discovery & Tools

We are looking for a talented fellow with expertise in pregnancy and child health surveillance systems, especially someone with experience working with big data and novel technologies. Advances in the high-quality collection of large electronic health data sets, computational methods like AI/machine learning, and novel, connected devices and digital systems has led to the opportunity to build a "precision maternal health" approach in global health. Researching and developing these novel technologies along with discoveries in basic science (e.g., through omics platforms) could be transformational in better designing and targeting care, yielding improved experience and health outcomes for pregnant women as well as more effective allocation of limited resources across a health system.

Molecular Epidemiology

The Molecular Epidemiology focus area will provide funding for a cutting-edge thinker to pursue novel applications of next generation sequencing technologies and analytic tools to improve public health decision-making in Africa. Successful applicants will have experience using genomics to investigate critical epidemiological or clinical questions as well as interest in working with National Public Health Institutes to solve challenging problems. Experience working with pathogens with epidemic potential or those with significant endemic burden is preferred, but not required. Finally, access to senior mentors through the Africa Pathogen Genomics Initiative or similar national initiatives is highly encouraged.

Translational Sciences

We are seeking applicants with experience in clinical pharmacology and biomarker development who will become leaders in translational science and who will help to build a strong network of scientists bridging drug discovery to drug development in Africa. The rapid and effective development of novel interventions for global health requires the nimble translation of information produced by cellular and animal models to human disease and back again. This iterative process is essential for understanding mechanisms of action and to inform dosing for clinical trials. We believe there is an opportunity to apply a rigorous approach to the development of tools for intervention, starting during the discovery phase and extending through proof-of-concept clinical trials, with a clear view to future impact. We will focus on applicants with the knowledge of application of key translational tools, including identification of pharmacodynamic biomarkers for assessing target engagement, quantitative pharmacology, and innovative and efficient clinical trial design.