Impact Objectives

- Gain a greater understanding of the behaviour of disease-causing agents/pathogens to ultimately outsmart them and break down their transmission between animals and people
- Identify pathogens which have become resistant to antibiotics and develop appropriate surveillance for resistant pathogens and strategies for responsible antibiotic use
- Develop a dynamic community of African researchers specialising in molecular biology and analytical epidemiology, whose skills will be utilised in the battle against infectious diseases

An innovative approach

Professor Mark Rweyemamu, *Executive Director of the* ***Southern African Centre for Infectious Disease Surveillance (SACIDS),*** *discusses how his team is harnessing innovations from science and technology to develop capacity in Africa for the detection, identification and monitoring of infectious diseases*

Could you begin with an introduction to your background and key research interests?

I am the Executive Director of the Southern African Centre for Infectious Disease Surveillance (SACIDS), a visiting professor at Sokoine University of Agriculture (SUA) in Tanzania, and the Principal Investigator and Deputy Leader of the SACIDS Africa Centre of Excellence for Infectious Diseases. I am also a visiting professor at the Royal Veterinary College, University of London, UK.

My current research interests focus on the application of One Health approaches to studying infectious diseases of humans and animals in the endemic settings of Africa.

How did you come to work in this field?

My interest in infectious diseases began while I was still in primary school, when my father lost his entire herd of cattle due to a disease called rinderpest or cattle plague. That made a great impression on me, more than an outbreak of measles in my school. I therefore grew up through secondary school with the notion of becoming either a veterinarian or a physician.

Could you introduce the SACIDS initiative?

We established SACIDS in 2008 and celebrated our tenth anniversary in January of this year. It was formed as a joint initiative by medical and veterinary academic and research institutions in five Member States (Democratic Republic of Congo (DRC), Mozambique, South Africa, Tanzania and Zambia) of the Southern African Development Community (SADC) that were involved with infectious diseases of humans and animals in the ecosystems of Southern and East Africa.

Sokoine University of Agriculture was peer elected to host the SACIDS headquarters. This was in the wake of the 2006 report of the UK Managed Global Foresight Study on future risks from infectious diseases, for which I was privileged to have coordinated the Africa strand. This study had shown Africa to have a high burden of infectious disease and to be acutely exposed to future risks to emerging and re-emerging diseases, and yet had a relatively low capacity and preparedness for managing such risk.

What are the objectives of SACIDS?

We set up SACIDS with the overriding objective of harnessing innovations from science and technology to develop capacity in Africa for the detection, identification and monitoring of infectious diseases, with the view of managing the risk posed by them. Our primary target was those infectious diseases of either humans or animals that were of an epidemic nature, irrespective of whether they were emerging or conventional. So, we adopted the One Health approach right from the outset.

Prior to the formation of SACIDS, what approach were East and Southern African countries taking in terms of risk management of infectious diseases and where was their approach failing?

For a variety of reasons, public and animal health were dealt with in silos by sector, by institution and by governance. Up to the mid-1990s, Southern Africa was a compartmentalised region with relatively low cross-border movement of people and commodities. Now this is a highly integrated region with cross-border and regional movement being dictated by economic gradients. This alone requires increased cross-border collaboration. The One Health initiatives by SACIDS and others are in tune with such collaboration and also improve cross-sector and cross institutional collaboration.

What are your hopes for the future of the infectious diseases field?

The fundamental challenge we face is that, as a society, we need bold moves to outsmart the pathogen in a proactive, rather than reactive, mode.

The hope is that tackling infectious diseases at source will progressively become an overriding objective that is followed through to its logical conclusion.

Armed in the fight

At the cutting-edge, ***Southern African Centre for Infectious Disease Surveillance (SACIDS)*** *researchers are using the One Health approach in the fight against infectious disease*

Infectious diseases in animals and humans in Southern and East Africa are extremely prevalent and new methods are required to better manage their risk. Professors Mark Rweyemamu, Gerald Misinzo, Janusz Paweska and Esron Karimuribo are part of the Southern African Centre for Infectious Disease Surveillance (SACIDS) initiative; a One Health virtual centre which links academic and research institutions in Southern Africa. The Centre is working to develop innovative approaches to combat infectious diseases in animals and humans.

The Centre is headquartered at the Sokoine University of Agriculture (SUA), Tanzania and involves the participation of: Muhimbili University of Health and Allied Sciences, Tanzania; Tanzania National Institute for Medical Research; University of Zambia; University of Kinshasa, DRC; DRC Institute for Biomedical Research; South African National Institute for Communicable Diseases; Mozambican National Institute of Health; and Eduardo Mondlane University, Mozambique. In the UK, key participants are: the Royal Veterinary College; London School of Hygiene and Tropical Medicine; and The Pirbright Institute.

Rweyemamu, who heads up SACIDS, explains what interests him about this work: 'During the last 10 to 15 years, I have directed and contributed to research on a wider front for infectious diseases across the public health and animal health sector. I am concerned by the risk posed by infectious diseases to the socioeconomic development of Africa and how we can use the knowledge of the disease-causing agents/pathogens and their behaviour, to outsmart them and break down their transmission between animals and people, whilst also identifying those pathogens that have become resistant to antibiotics and understand the role of climate change and globalisation that leads to an increasing risk of the wide scale spread of infection, even across continents,' he says.

HARNESSING INNOVATIONS

SACIDS was set up with a view to harnessing innovations from science and technology in order to develop Africa's capacity to manage the risk posed by infectious diseases. To this end, the team is making use of the One Health approach, a concept that seeks to improve health and wellbeing through the prevention of risks and the mitigation of effects of crises that originate at the interface between humans, animals and their various environments. 'This made sense to us because it was already clear that the majority of infectious pathogens had the capacity to spread across the host species barrier, including between people and animals,' Rweyemamu explains. 'We also adopted the virtual centre and smart partnership with institutions of research and training excellence, such as the Royal Veterinary College and the London School of Hygiene and Tropical Medicine, both of the University of London, and The Pirbright Institute, as part of our strategy to accelerate the capacity for developing a critical mass of African scientists.'

The researchers are using One Health as a holistic and integrative approach to human, animal and environment health, especially with respect to infectious diseases. The One Health initiative was borne from the emergency of SARS and avian influenza, and their sudden international spread in 2003/4. For the SACIDS team, the approach extends beyond dealing with epidemics of emerging zoonotic diseases, as Rweyemamu highlights: 'We have taken a view that for Africa, One Health probably needs to be core to our approach to dealing with infectious diseases, irrespective of whether zoonotic or not, or whether emerging or conventional,' he states. 'We realise that we operate within the African ecosystems, where infectious diseases tend to be endemic. Therefore, we have described our focus on One Health as: "a collaborative effort between natural and social sciences to advance the understanding of interactions between humans, animals and the environment to improve public and animal health."'

SACIDS was therefore formed as a joint initiative spanning different sectors including human, animal and environment, and across the institutional settings of academic and national research institutes across the five countries of the Centre's founding member institutions in the Democratic Republic of Congo (DRC), Mozambique, South Africa,

RESPONDING TO CRISIS

In December 2013, the largest outbreak of the Ebola virus since it was first recognised in 1976, swept across West Africa. In countries already ravaged by civil war, under-resourced health facilities, unsafe burial practices and poor infection control resulted in the delay in the initial detection and specific diagnosis of the disease and in an ineffective response to the outbreak. The lack of preparation and poor response to the crisis prompted a need for transformation of the existing African health systems and for improved rapid diagnostic capacity. The team at the Centre for Emerging and Zoonotic Diseases of the South African National Institute for Communicable Diseases (CEZD-NICD), led by Professor Janusz Paweska, established a field-operated, modular high biosafety facility for rapid Ebola molecular diagnosis near Freetown. The high standards of biosafety and portability of the laboratory offered a cost-effective and practical response to the Ebola crisis. The lab remained fully operational until Sierra Leone was declared free from Ebola.

"We have taken a view that for Africa, One Health probably needs to be core to our approach to dealing with infectious diseases"

Tanzania and Zambia. Having undertaken a gap assessment of expertise in Southern and East Africa, the researchers identified molecular biology, analytical epidemiology and societal sciences as the strategic areas of expertise for their mission, but equally those with the greatest shortage in their part of the world.

Some of the research strands underway at the Centre include: One Health Disease Surveillance – Developing mobile technology app – AfyaData, which is led by Esron Karimuribo and Eric Beda; Mobile laboratory response to formidable outbreaks (e.g. during the Ebola epidemic in West Africa), led by Janusz Paweska; Developing Ebola field diagnostics, handled by a SACIDS PhD student turned Postdoc, Katendi Changula; work on African swine fever, which is led by Gerald Misinzo; Analysing the genetic variation of foot-and-mouth disease virus, led by Christopher Kasanga; work on emerging and vector-borne diseases, which is led by Leonard Mboera, Aaron Mweene and Janusz Paweska; and One Health genomic surveillance for antimicrobial resistance, which is led by Mecky Matee and Stephen Mshana.

A DYNAMIC COMMUNITY

The team also runs a training programme through which it is seeking to develop a dynamic community of African researchers in the application of molecular biology, analytical epidemiology and societal sciences to the understanding and management of infectious diseases. To do so, they use a tiered postgraduate training programme. 'The Centre provides challenging programmes and innovative learning experiences through interdisciplinary teaching and research, and a dynamic community of multicultural learning. Our philosophy resonates around problem-based learning that develops knowledge, abilities and skills through participation, collaborative investigation and the resolution of authentic problems,' explains Misinzo.

'Our strategy for improving content or curriculum delivery emphasises on-course modularisation to allow for block teaching and e-learning, which comprises electronic archiving of teaching materials and application of ICT-in-learning.'

The training consists of seven strands: enhanced MSc training; research training through MPhil/MSc research; PhD development; postdoctoral development; skills enhancement short courses (CPD) for students and practicing professionals; One Health driven short course in the form of a summer school; and developing research leadership and management skills. In order to achieve research excellence, the Centre is seeking to develop world-class students. 'We aim to develop researchers with skills in new technologies to interrogate the natural history of disease at source and within endemic African settings,' Misinzo says. 'Our overall strategy is centred on adoption of themed research, by which students and fellows in the same theme, together with their supervisors and mentors, operate as a Community of Practice (CoP). This ensures that each student will have a dedicated supervisory team of specialists from MUHAS/SUA/NIMR, plus regional and international partner institutions.'

EXTENDING EXPERTISE

Looking ahead, the Centre looks set to continue tackling infectious diseases at source. It is extending its collaborative base within Africa and also plans to target new south-south-north partnerships. Its focus will be on helping make the One Health approach centre stage of policy and strategy, recasting infectious disease and pathogen surveillance to the most likely source, using digital technology, genomics, data mining and horizon scanning to optimise disease and pathogen surveillance at potential source, and developing expertise and leadership *in situ* within the endemic settings of infectious diseases.

Project Insights

FUNDING

The major funding organisations for SACIDS have been: Wellcome Trust • Rockefeller Foundation • Google Foundation • Skoll Global Threat Fund (Ending Epidemics) • World Bank • International Development Research Centre (IDRC) of Canada • African Development Bank • European-Developing Countries Training Programme (EDTCP) • The PASET Regional Scholarship Innovation Fund. SACIDS has also received funding from various sources (especially Rockefeller Foundation, Bill & Melinda Gates Foundation and Skoll Foundation) through CORDS.

COLLABORATORS

Professors Gerald Misinzo & Esron Karimuribo – Sokoine University of Agriculture, Tanzania • Professor Janusz Paweska – South African National Institute for Communicable Diseases of South Africa • Professor Mecky Matee – Muhimbili University of Health and Allied Sciences, Tanzania • Dr Leonard Mboera – Tanzania National Institute for Medical Research • Professor Aaron Mweene – School of Veterinary Medicine, University of Zambia • Prof Jean-Marie Kayembe – School of Medicine, University of Kinshasa, Democratic Republic of Congo (DRC) • Prof Jean-Jacques Muyeambe – DRC Institute for Biomedical Research • Drs Ilesh Jaani & Eduardo Sam Gudo – Mozambican National Institute of Health • Professor Darcia Correia – Eduardo Mondlane University, Mozambique • Professors Richard Kock, Fiona Tomley & Jonathan Elliot – Royal Veterinary College, UK • Professors Hazel Dockrell & Taane Clark – London School of Hygiene and Tropical Medicine, UK • Professors Donald King, David Paton & Satya Parida – The Pirbright Institute, UK

CONTACT

Professor Mark Rweyemamu
Executive Director, SACIDS

T: +255 732931717
E: secretariat@sacids.org
E: mark.rweyemamu@sacids.org
W: www.sacids.org

PROJECT COORDINATOR BIO

Professor Mark Marini Rweyemamu BVSc, PhD, FRCVS and Executive Director SACIDS is a Tanzania veterinarian and specialist in infectious diseases. He has worked and published on the major infectious diseases of animals, such as rinderpest and foot and mouth disease. He has been awarded medals by FAO and OIE for services to the control of infectious diseases, and in 2012, he was awarded the Theiler Medal for services to veterinary science in Africa.