



### Introduction:

Our July issue of 2019, we focus on the launch of **Genomics Africa**, a **KRISP & DIPLOMICS** initiative to provide access to high-quality, output-driven, customer-centric and cost-effective genomics services in Africa.

In our newsletter, we highlight the Genomics Africa activities on Human Genomes, Animals & Plants and Pathogens & Microbes. We want to challenge the status quo and allow the genomics revolution to benefit Africa.

Please help us to challenge the status quo and create a scientific environment that drives innovations in global health and reverses the brain drain in Africa.

### Highlights:

Genomics Africa: **KRISP & DIPLOMICS** launch **Genomics Africa**

Genomics Africa: **Sequencing Human Genomes in Africa to Fight Disease & Record Human History**

Genomics Africa: **PACBIO, ONT, MGI-SEQ, Illumina and Sanger technology to sequence Animals & Plants in Africa**

Genomics Africa: **Internationally competitive prices and pipelines for viral and bacteria data generation and analysis in Africa**

New projects: **SAMRC funds KRISP & Oxford to sequence HIV positive Children who are able to control the virus and do not progress to AIDS**

New projects: **Decoding the South African Indian genome for diabetes and heart disease health risk**



UNIVERSITY OF  
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## Events: SPARK Breakfast & Talks at KRISP



**SPARK Breakfast: Clinical Pharmacogenomics: Developments & Opportunities for Efficacious Use of Medicines in Africa**

**Speaker:** Prof. Collen Masimirembwa, President: African Institute of Biomedical Science & Technology

**Date:** Tuesday, 30 July 2019

**Time:** 7:30am – 8:30am

**Venue:** Nelson R Mandela School of Medicine, UKZN

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**Talk: The Potential for Personalized microRNA Therapeutics in Cancer.**

**Speaker:** Prof. Frank Slack, Shields Warren  
Mallinckrodt Professor, Harvard University, USA

**Date:** Tuesday, 30 July 2019

**Time:** 11:00am – 12:00

**Venue:** Nelson R Mandela School of Medicine, UKZN



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## KRISP and DIPLOMICS associated laboratories launch Genomics Africa



Genomics Africa is a non-for-profit initiative that is working with key laboratories in Africa to provide affordable sequencing services to record Africa's animal, plant and microbial biodiversity. **We want to challenge the status quo and allow the genomics revolution to benefit Africa.** Genomics Africa provides access to high-quality, output-driven, customer-centric and cost-effective genomics services in Africa.

### The participating genomics laboratories include:

- Agriculture Research Council (ARC), Pretoria
- Centre for Genomics & Proteomics Research (CPGR), Cape Town.
- KZN Research Innovation & Sequencing Platform (KRISP), UKZN, Durban.
- National Institute for Communicable Diseases (NICD), Johannesburg.
- Sequencing Analytical Facility (SAF), Stellenbosch University, Stellenbosch.
- SA Medical Research Council Genomics Centre with BGI, Cape Town.

DIPLOMICS is a South African Research Infrastructure Roadmap (SARIR) program of the Department of Science and Technology (DST).

More information: <http://www.genomics.africa> & <http://www.diplomics.org.za>

## Genomics Africa: Human Genomes



### **SEQUENCING AND ANALYSING GENOMES IN AFRICA TO FIGHT DISEASE & RECORD HUMAN HISTORY**

Collectively, Africans are the most genetically diverse people in the world. They are also one of the most resilient populations to disease. It is on this continent that we expect the next breakthroughs in genetic research to happen. For example, in 2019, the world discovered that the African genome has an additional 300 million base pairs. **Now, there is a race to identify genes that can be used to develop better treatments, diagnostics and vaccines.**

To advance genetics research and bring state-of-art technology to Africa, we created Genomics Africa. **Genomics Africa is a not-for-profit initiative that can produce data in Africa at the same quality, price and speed as the international genomics centres.**

We have started a substantial training program in Africa in collaboration with international and national organisations. Consequently, we can now keep the sample on the continent and develop local capacity to sequence and analyse the data. For example, **Genomics Africa and its partners have already brought state-of-the-art equipment worth US\$ 10 million in equipment to Africa. We have also trained over 1,500 individuals in the last three years.** We are now in a position to provide sequencing at the most affordable price in the world. For example:

**Human Whole Genome (WGS):** MGI-SEQ 2000 (from October at SAMRC Genomics Centre)

**Human Whole Exome (WES):** \$400 – TFS S51on

**African GeneChip:** \$80 – Illumina

**Sanger Sequencing (per amplicon):** from \$2 to \$5 – TFS ABI3730xl

Website: [www.genomics.africa](http://www.genomics.africa)

## Genomics Africa: Animals & Plants



### **SEQUENCING AND ANALYSING GENOMES IN AFRICA TO RECORD BIODIVERSITY LEVELS, ADVANCE RESEARCH AND CONSERVATION**

Africa is immensely rich in biodiversity. Its extremely varied biomes support diverse animal, plant and marine life. Its living organisms comprise around a quarter of the world's biodiversity, and it has the highest number of large mammals on earth, many of which roam freely. Africa's biodiversity is a precious global resource that is now under serious threat from both climate change and urbanisation. There are many initiatives to reduce and revert the loss of biodiversity. We are at a critical point in time, where genomics can help to record the biodiversity levels and advance research and conservation efforts.

Genomics Africa is a not-for-profit initiative that is working with major laboratories in Africa to provide affordable sequencing services to record Africa's animal and plant biodiversity

We believe that recording and analysing the genomic diversity of animals and plants in Africa can help conservation efforts. We also believe that this will open an avenue to use indigenous knowledge to generate products that can improve local economies.

We have technologies to sequence whole genomes, subgenomic regions, transcriptomes (i.e. RNA-seq), amplicons and microsatellites from animals and plants in Africa:

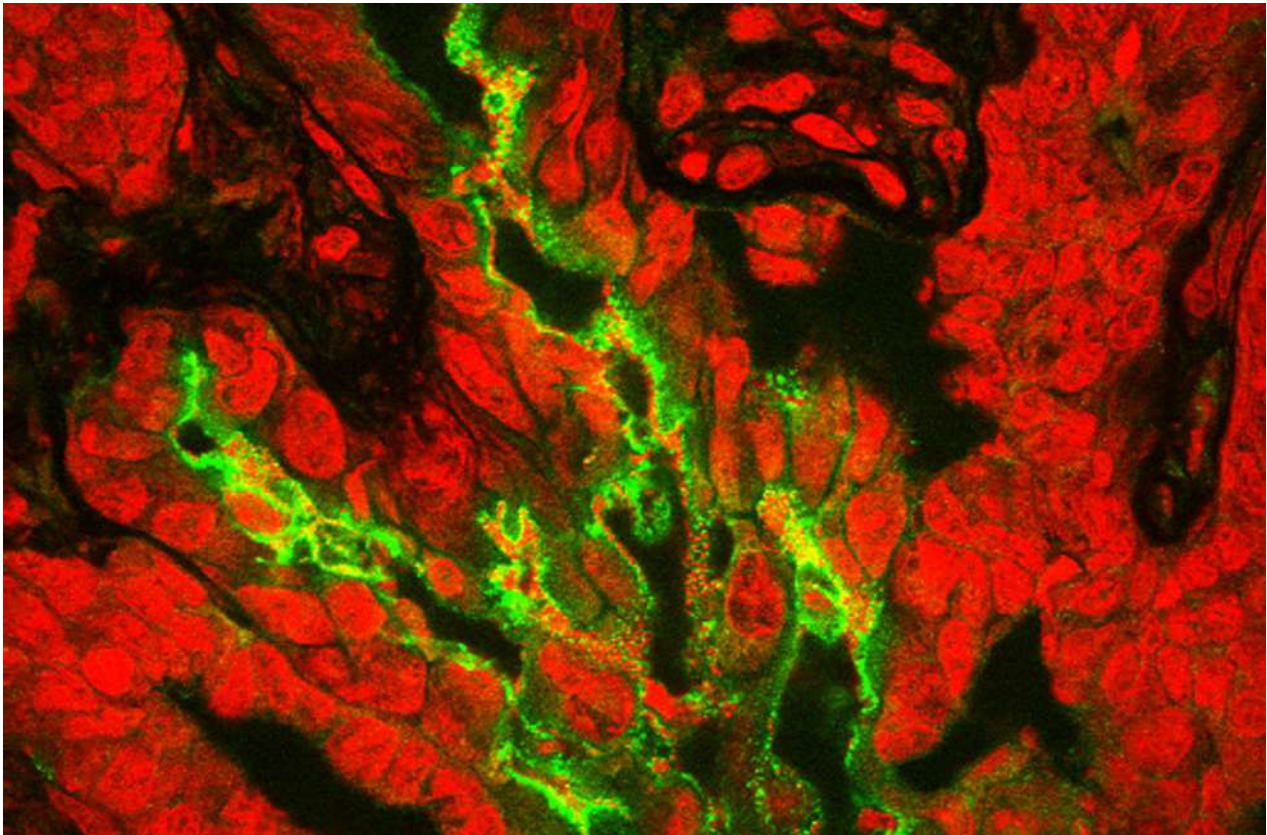
**Long-read technology:** PACBIO and Oxford Nanopore Technology

**Short-read technology:** MGI-SEQ 2000, Illumina (HiSeq, NextSeq, MiSeq), TFS S5 (S5Ion, S5Prime)

**Sanger technology:** ABI3730xl (96 capillaries, see), ABI3500xl, ABI3500

Website: [www.genomics.africa](http://www.genomics.africa)

## Genomics Africa: Pathogens & Microbes



### **PATHOGENS AND MICROBES SEQUENCING AND BIOINFORMATICS ANALYSIS:**

Genomics Africa has worked with collaborators and industrial players to decrease the cost of pathogen sequencing in Africa. Our technology, turn-around time and price are now internationally competitive.

**HIV drug resistance testing** (TFS/CDC protocol) – \$55/ ZAR 800

**Bacterial 16S** (Illumina) – \$67 / ZAR 950

**HIV whole genomes** (Illumina) – \$135 / ZAR 1,900

**TB whole genomes** (Illumina) – \$220 / ZA\$ 2,800

In addition to the previously mentioned pathogens, we also have protocols to sequence many other **Viruses** (e.g. Hepatitis A, B and C, Chikungunya, Dengue, Yellow Fever Virus, etc.) and **Bacteria** (e.g. *Listeria monocytogenes*, *Chlamydia*, *Gonorrhoea*, *E-coli*, *Syphilis*, etc.).

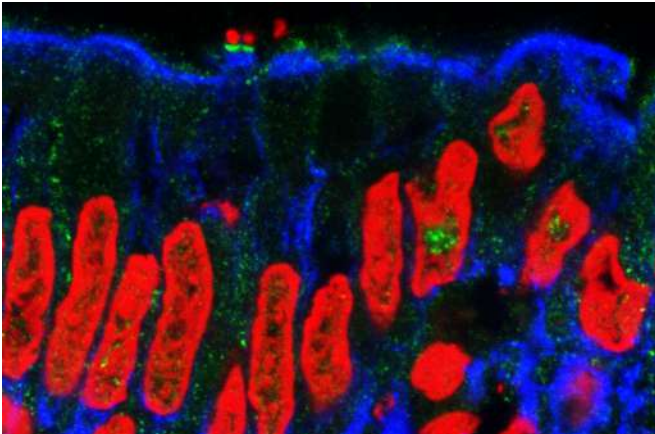
If a pathogen is not known, **We have metagenomics protocols running on Illumina and Nanopore** sequencers and qPCR/ddPCR pathogen panels for:

**Sexually Transmitted Infections (STIs)** (12 pathogens),

**Gastrointestinal infections** (38 pathogens)

**Respiratory infections** (34 pathogens).

## KRISP & Genomics Africa New Projects:



### **SAMRC FUNDS KRISP & OXFORD TO SEQUENCE CHILDREN GENOMES THAT ARE PROTECTED FROM HIV IN AFRICA**

In this study, we plan to sequence and analyse a large number of genomes on the African continent for the first time. In addition to identifying the genetic basis of protection to HIV, this project will set the benchmark for future genomic research in Africa by developing whole genome sequence (WGS) protocols and bioinformatics workflows.

**The SAMRC has committed ZAR 6 million to fund this project in its first award. The focus of the project is on the identification of human genetic variation that can protect children from developing HIV disease (i.e. AIDS).**

HIV-host genetics is one area that offers the potential for new treatment strategies and is receiving significant attention. Substantial advancements in next generation sequencing (NGS) methods allow researchers to sequence the entire human genome in a few days.

A recent collaboration with the SAMRC and the Beijing Genomics Institute (BGI) will bring this technology to Africa for the first time. This will enable researchers in South Africa and other parts of Africa to explore the role the human genome plays in local diseases.



### **DECODING THE SOUTH AFRICAN INDIAN GENOME FOR DIABETES AND HEART DISEASE HEALTH RISK**

Diabetes is a growing problem in South Africa, but South African Indians are at three times the risk of other race groups. What is more, Diabetes and Ischaemic Heart disease occur at least a decade younger in Indians than in other populations in South Africa. Both these diseases are the leading cause of death within the Indian population. Apart from poor diet and exercise there is a genetic component that leads to increased disease risk.

*Decoding the South African Indian Genome for Health Risk is an initiative that aims to produce and analyze whole genomes in order to understand the genetic basis of Diabetes and Heart disease.*

**"The objective is to promote awareness of the leading causes of mortality in South African and provide the opportunity for individuals, business and funders to make contributions to this medical research project."**

As part of the initiative, we have organized a Business Breakfast Event on the 19th July (Sponsored by Standard Bank and Coastland Hotels). Our keynote speaker was be Prof. Salim A Karim and Prof. Ayesha Motala. 200 guests attended the event.

Website: [www.genomics.africa](http://www.genomics.africa)

# Curbing the scourge of diabetes

*Professor Salim Abdool Karim has appealed to the Indian community to help identify their genetic markers*

TANYA WATERWORTH  
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TEN years from now, the practice of medicine and the health system as we know it will have radically changed – and the next few years must include combating the unusually high prevalence of diabetes and heart disease found within the Durban Indian community.

At a business breakfast in Durban yesterday morning, one of the country's most eminent scientists, UKZN's Professor Salim Abdool Karim, appealed to the Indian community to "join hands with the university" to take on the scourge of diabetes and related conditions and diseases.

The university has begun research to identify genetic markers which could predict the risk of the disease at an individual level.

"Medicine is on the march and is being built on the very fundamental premise – DNA, on which the whole of life is built and on which the world's genome is based. It also determines whether you will get diabetes or not," said Karim.

"In 10 years from now, each of you will give a drop of blood, a swab from the mouth or a piece of hair and your entire DNA will be known, we will tell you what diseases you will get. That is the future of medicine.

"We are getting in on the ground floor of this and want to be ahead of the game in understanding DNA," said Karim.

He added that diabetes took second place in the country's top 10 causes

of death, saying "as a killer in our community, diabetes is right up front".

He said two out of three people attending the breakfast would be pre-diabetic and at high risk of developing diabetes.

Health expenditure for diabetes in South Africa was projected to increase by 50% between 2010 and 2030, reaching R830 billion a year. The greatest impact is going to be on the Indian population.

Chronic complications linked to diabetes are heart and kidney disease, blindness, strokes, neuropathy and vascular problems and 76% of diabetes deaths in sub-Saharan Africa occur in people younger than 60, the most active segment of the population.

While lifestyle changes such as diet and activity, played a key role in keeping diabetes at bay, identifying a genetic component could predict the risk of the disease from developing from the outset.

While very little genetic research had been done into the South African Indian population, researchers at the KZN Research, Innovation and Sequencing Platform at the Nelson Mandela Medical School have recruited leading world experts to take on the task of decoding the SA Indian genome for diabetes and heart disease risk.

Head of the Department of Diabetes and Endocrinology at the Nelson R Mandela School of Medicine at the university Professor Ayesha Motala warned of the dangers of a pre-diabetic condition, saying research had shown that within four years, a pre-diabetic person would develop



At a Durban business breakfast titled Decoding the SA Indian Genome for Health Risk yesterday are UKZN's Professor Tulio de Oliveira, Professor Anesh Maniraj Singh, Professor Ayesha Motala and Professor Salim Abdool Karim. | ZANELE ZULU African News Agency (ANA)

diabetes, many of those within one year. "There is a great need for further study, the burden is high and

is increasing," she said adding that prevention and control strategies were needed.

For more information on con-

tributing to this groundbreaking research and/or to have your genome sequenced, please email Professor Anesh Singh at [singham@ukzn.ac.za](mailto:singham@ukzn.ac.za)

## Manuscript: Space-time clustering of recently diagnosed tuberculosis and impact of ART scale-up: Evidence from an HIV hyper-endemic rural South African population

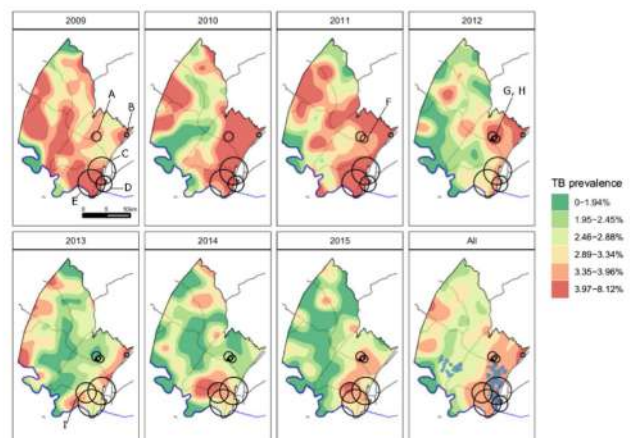
Authors: Andrew Tomita, Catherine M. Smith, Richard J. Lessells, Alexander Pym, Alison D. Grant, Tulio de Oliveira, & Frank Tanser

Journal: **Scientific Reports (2019) 9:10724 | <https://doi.org/10.1038/s41598-019-46455-7>**

In HIV hyperendemic sub-Saharan African communities, particularly in southern Africa, the likelihood of achieving the Sustainable Development Goal of ending the tuberculosis (TB) epidemic by 2030 is low, due to lack of cost-effective and practical interventions in population settings.

We used one of Africa's largest population-based prospective cohorts from rural KwaZulu-Natal Province, South Africa, to measure the spatial variations in the prevalence of recently-diagnosed TB disease, and to quantify the impact of community coverage of antiretroviral therapy (ART) on recently-diagnosed TB disease.

We identified for the first time the clear occurrence of recently-diagnosed TB hotspots, and quantified potential benefit of increased community ART coverage in lowering tuberculosis, highlighting the need to prioritize the expansion of such effective population interventions targeting high-risk areas.



**Figure:** The study area with high-risk, overlapping space-time recently-diagnosed TB clusters ( $p < 0.05$ ) identified in peri-urban communities near the National Road. Panels show locations of TB clusters through the entire study period, overlaid on the average prevalence of recently diagnosed TB.



**Space-time clustering of recently diagnosed tuberculosis and impact of ART scale-up: Evidence from an HIV hyper-endemic rural South African population.**

Tomita A, Smith CM, Lessells RJ, Pym A, Grant AD, de Oliveira T, Tanser F, *Scientific Reports* (2019), <https://doi.org/10.1038/s41598-019-46455-7>:



**Whole genome sequencing for drug-resistant tuberculosis management in South Africa: What gaps would this address and what are the challenges to implementation?**

Dlamini MT, Lessells R, Iketleng T, de Oliveira T, *Journal of Clinical TB and Other Mycobacterial Dis* (2019), <https://doi.org/10.1016/j.jctube.2019.100115>:



**Effects of genetic variability on rifampicin and isoniazid pharmacokinetics in South African patients with recurrent tuberculosis.**

Naidoo A, Chirehwa M, Ramsuran V, McIleron H, Naidoo K, Yende-Zuma N, Singh R, Ncgapu S, Adamson J, Govender K, Denti P, Padayatchi N. *Pharmacogenomics*. 2019 ;20(4):225-240. doi: 10.2217/pgs-2018-0166.

## KRISP Training

**BIO Africa Convention**, Inkosi Albert Luthuli International Conference Centre (ICC), Durban, 27-29 August 2019

**24th International Bioinformatics Workshop on Virus Evolution and Molecular Epidemiology (VEME)**, The University of Hong Kong, 4-9 August 2019

**Unlocking Informatics in Virology**, PathRed 2019 Conference, Ekurhuleni International Conference Centre, Johannesburg, 18-20 July 2019

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