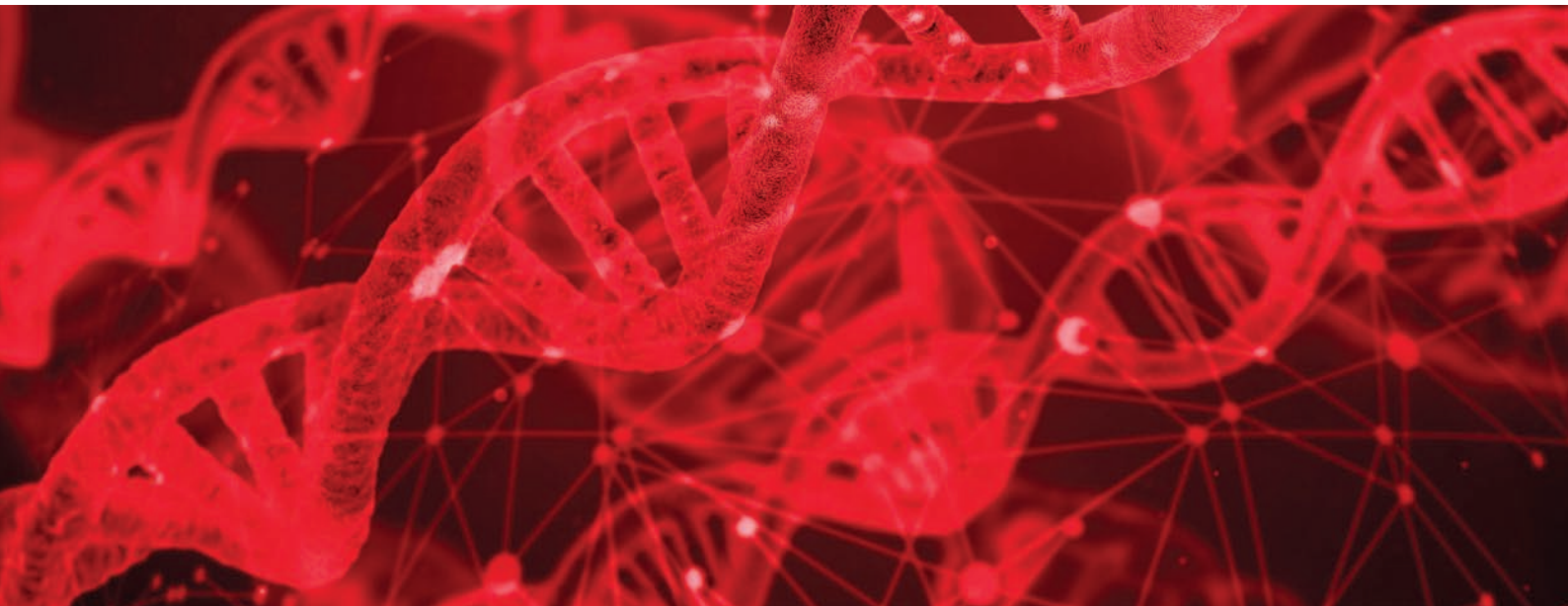
KRISP SALES BROCHURE

2019 - 2020



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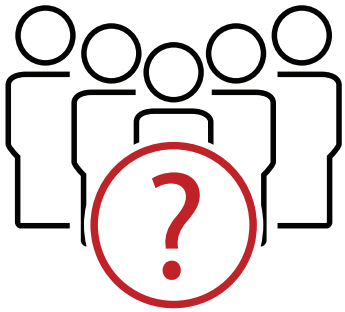


01. Introduction

Who we are

Established in 2017, KRISP is a cutting edge genomics centre offering a range of DNA sequencing, precision medicine testing, bioinformatics services and technologies to academic, industrial and commercial users.

Situated at UKZN's Nelson R. Mandela School of Medicine state-of-the-art K-RITH Building, KRISP is surrounded and supported by several world-class scientific facilities including the Centre for the AIDS Programme of Research in South Africa (CAPRISA), the African Health Research Institute (AHRI) and the Antimicrobial Research Unit (ARU).

As a platform of the Technology Innovation Agency (TIA) and a flagship programme of the South African Medical Research Council (SAMRC), KRISP has invested millions of dollars establishing a world-class scientific infrastructure and experienced team of experts and researchers second to none in Africa. Our vision is to challenge the status quo and establish one of the worlds most advanced and respected genetic sequencing platforms, in order to enable and support world-class genomics research and diagnostics services in Africa.

Quality Statement

Our DNA sequencing services incorporate internal quality control (IQC), external quality assurance (EQA) and all procedures are validated and performed by HPCSA-accredited scientists.

02. Animal and Plant Sciences

Routine Lab Tests:

DNA and RNA extraction

KRISP laboratories provide nucleic acid purification services utilising three automated platforms, the PerkinElmer Chemagic 360 high-throughput system, the Thermo Scientific KingFisher Flex and the Qiagen QIAcube Purification System. The system offers automated magnetic-particle purification and extraction, thus providing excellent reproducibility and quality. The extractions are highly automated and processed in a 8, 24 or 96-well high-throughput format.

> **Input:** High quality DNA and RNA can be isolated from various sample types including plant material (leaves or roots), blood, tissue, stools and cells.
>
> **Application:** The high-quality DNA or RNA can be used for downstream applications such PCR, genotyping and sequencing.
>
> **Turn-around time:** Four days

DNA and RNA quantification

KRISP also offers quantification services using the Thermo-Fisher Qubit 2.0 Fluorometer. The Qubit Fluorometer uses fluorescent dyes to determine the concentration of nucleic acids and proteins in a sample. The UV-absorbance method uses a spectrophotometer to measure the natural absorbance of light at 260 nm (for DNA and RNA) or 280 nm (for proteins). The more DNA, RNA or protein in the sample, the more light is absorbed.

> **Input:** Extracted DNA, RNA or amplicons.
>
> **Application:** Used to determine the concentration of DNA or RNA present in a sample following extraction or for downstream applications
>
> **Turn-around time:** One day

LabChip Fragment Analysis

KRISP has also invested in an automated capillary electrophoresis separation system for the quantitation and sizing of DNA, RNA and PCR amplicons. The PerkinElmer LabChip GX Touch System uses microfluidics technology that performs reproducible, high-resolution, analysis of fragment sizes.. The LabChip GX Touch is also an invaluable tool to simplify and accelerate CRISPR-Cas9 experiments and analysis.

> **Input:** Extracted RNA and DNA, PCR amplicons
>
> **Application:** We have a variety of assay kits available to automate DNA and RNA sizing and quantitation of both fragments and smears to address multiple input concentration ranges.
>
> **Turn-around time:** One day

Sanger Sequencing

KRISP boasts two Sanger Sequencers, including the novel Applied Biosystems 3730xl Genetic Analyzer, which is one of only three currently in use in the world. This is the highest throughput capillary electrophoresis instrument, where the 96 capillary format is able to produce over 2500 sequences per day!

This system is backed by an ABI 3500, which is an eight capillary electrophoresis instrument for the medium throughput laboratories.

Together, the ABI3730xl and ABI3500 allows KRISP to offer industry-leading performance, plus sophisticated automation capabilities enabling researchers to save time, reduce costs and increase productivity. We offer Sanger sequencing services for animal, bacterial, fungal, plant and viral DNA.

> **Service Options**
>
> 1. Full Sequencing Service – non-purified product & primers are provided by the customer and KRISP will perform the PCR purification and quantification of the template, followed by the sequencing
> 2. Basic Sequencing Service – Basic Sequencing Service - KRISP will perform the cycle sequencing and capillary electrophoresis
> 3. Simple Sequencing Service – sequencing reaction is provided (capillary electrophoresis only)

We are currently running a promotion on Sanger sequencing (for more information, please see page 38).

Next Generation Sequencing (NGS)

*For the first time in Africa, KRISP is in the position to generate NGS sequencing data at a similar **price, quality and speed** as the leading international genomics centres!*

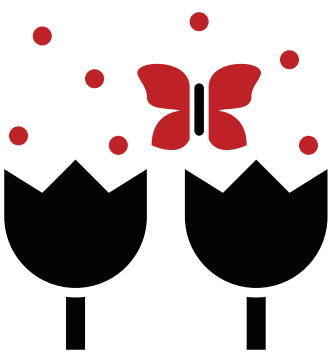
Africa's biodiversity is an extremely valuable global resource which is now under serious threat from both climate change and urbanisation. There are many initiatives to reduce and reverse the loss of biodiversity. We are at a critical point in time, where genomics can help to record the biodiversity levels and advance scientific research and conservation efforts.

KRISP is partnering with key laboratories in Africa to provide affordable sequencing services to record Africa's animal and plant biodiversity. Furthermore, we have also invested in large bioinformatics systems that can help to analyse the data on the continent. We believe that recording and analysing the genomic diversity of animals and plants in Africa will help conservation efforts and also open up avenues to use indigenous knowledge to generate new or untapped products and materials that can improve local economies and the world.

The following sequencing technologies are available to sequence whole genomes, sub-genomic regions, transcriptomes (i.e. RNA-Seq), amplicons and microsatellites from animals and plants in Africa. **Short-read technology:** Illumina (HiSeq, NextSeq, MiSeq) and TFS S5 (S5Ion, S5Prime) and **Long-read technology:** Oxford Nanopore Technology and PACBio (available by Genomics Africa partners)

Illumina MiSeq, NextSeq and HiSeq Platforms

Illumina has developed high-throughput sequencing systems that produce high quality data, for varied mid-throughput or high-throughput applications including whole-genome sequencing (WGS), whole-transcriptome sequencing (RNA-Seq), exome sequencing, metagenomics 16S, small RNA sequencing, targeted DNA resequencing, environmental DNA (eDNA) sequencing and amplicon sequencing. KRISP, in collaboration with the DIPLOMICS initiative, has access to 2 MiSeq platforms, 2 NextSeq platforms and a HiSeq platform. In an effort to advance agricultural genomics in Africa we provide affordable sequencing services to assist researchers and breeders to develop healthier and productive crops and livestock.



Thermo-Fisher Ion S5 Sequencing System

We offer 16S Metagenomics sequencing on the Thermo-Fisher Ion S5 Sequencing System. The protocol is designed for rapid, comprehensive and broad-range analyses of mixed microbial populations using the Ion Torrent semi-conductor sequencing workflow. The 16S Metagenomics Kit permits PCR amplification of hypervariable regions of the 16S rDNA gene from bacteria. Sequences generated can be directly analysed using the Ion Reporter software enabling a rapid and semi-quantitative assessment of complex microbial samples. We also offer deep-coverage whole-genome sequencing of microbial organisms for discovering the full range of genetic variations, including SNPs, insertions, deletions, inversions and complex rearrangements. Whole-genome sequencing is used to characterise and discover new organisms or to type specific bacterial and viral organisms.

ThermoFisher SCIENTIFIC

illumina®

Oxford Nanopore Technologies

As one of the only laboratories in South Africa to offer it, KRISP has invested in portable real-time DNA and RNA sequencing device called the MinION (x5). This system generates up to 30 gigabases (Gb) of sequence data (equivalent to 7-12 million reads for RNA analysis. The portable sequencer produces ultra-long reads (tens to hundreds of kilobases (Kb) which enables the assembly and accurate characterisation of complete genomes, pathogen detection/microbiome analysis. This sequencing power therefore has the potential to deliver new insights into many scientific research areas including plant biology, animal health and environmental research.

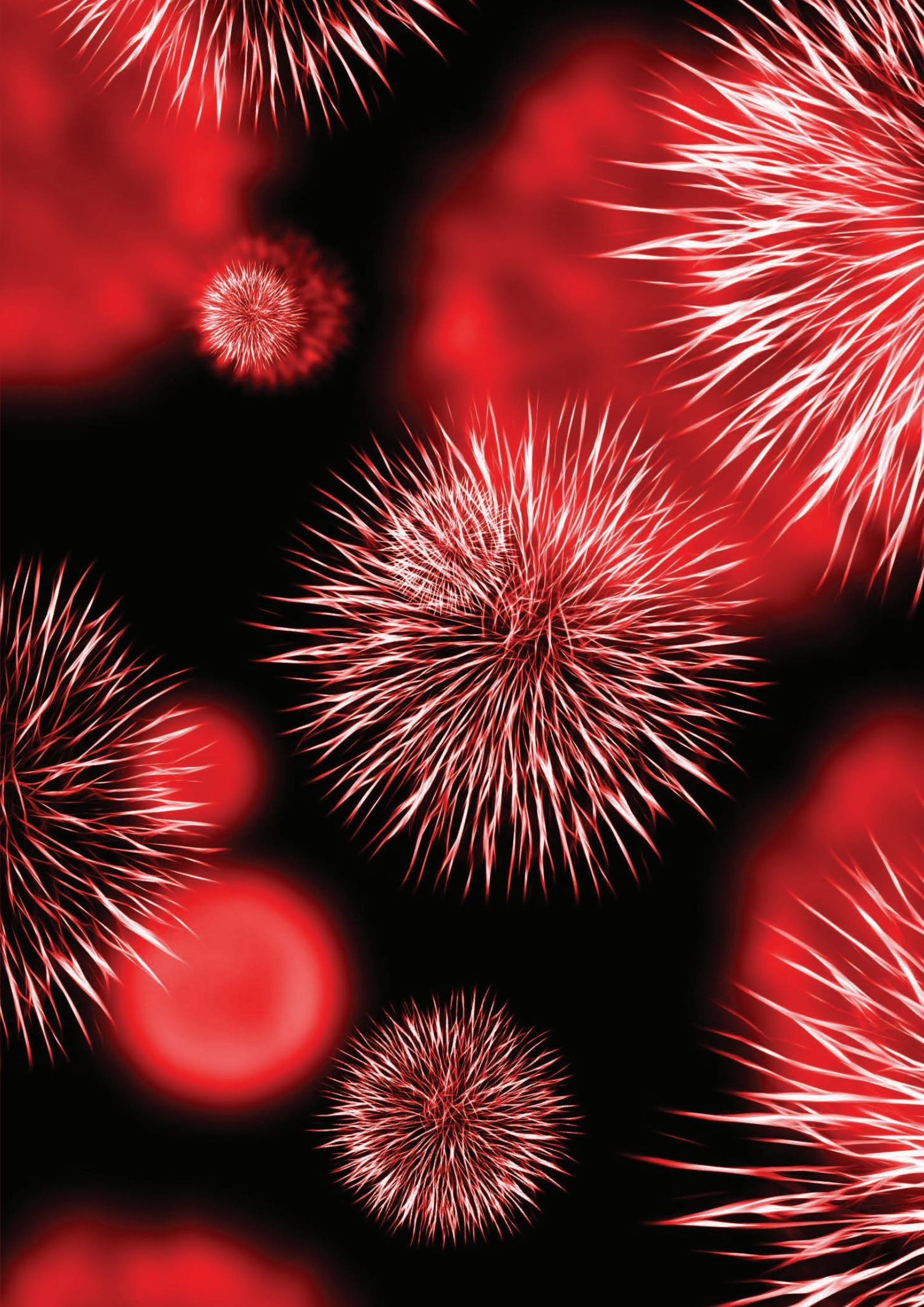
PacBio's Single Molecule, Real-Time (SMRT) Sequencing

We give customers access to another affordable long read sequencing technology, the PacBio Sequel System, which is currently available via Genomics Africa at the National Institute for Communicable Diseases (NICD). The system is based on Single Molecule, Real-Time (SMRT) sequencing technology which produces long reads with high accuracy. The PacBio Sequel System provides a comprehensive view of the genetic composition of microbes, plants and animals. It further produces the accuracy required to identify and resolve complex populations in viral and bacterial communities.

Sample collection and shipment service

We strive to provide convenient services to all our customers. As part of our field support, we offer sample collection regionally, nationally and internationally using our courier fleet and contracted courier partners. Our drivers have been trained and accredited by IATA for transportation of infectious substances and biological samples. For more information about shipment range or to arrange a timely sample pick-up that suits your needs please contact one of us.

03. Pathogen, Microbes and Human Genomics



DNA/RNA extraction

KRISP laboratories provide nucleic acid purification services (DNA and RNA extraction) utilising the Thermo Scientific KingFisher Flex Purification System. The system offers automated magnetic-particle purification and extraction, thus providing excellent reproducibility and quality. The extractions are automated and processed in a 96-well high-throughput format. High quality DNA and RNA can be isolated from various sample types including blood, tissue and cells. The high-quality DNA or RNA can be used for downstream applications such PCR, genotyping and sequencing.

> **Input:** High quality DNA and RNA can be isolated from various sample types including plant material (leaves or roots), blood, tissue and cells.
>
> **Application:** The high-quality DNA or RNA can be used for downstream applications such PCR, genotyping and sequencing.
>
> **Turn-around time:** Four days

DNA/RNA quantification

In addition to the DNA/RNA extraction service, we also offer quantification services using the Thermo-Fisher Qubit 2.0 Fluorometer. The Qubit Fluorometer uses fluorescent dyes to determine the concentration of nucleic acids and proteins in a sample. The UV-absorbance method uses a spectrophotometer to measure the natural absorbance of light at 260 nm (for DNA and RNA) or 280 nm (for proteins). The more DNA, RNA or protein in the sample, the more light is absorbed. Samples may be submitted for quantification prior to sequencing.

> **Input:** Extracted DNA or amplicons
>
> **Application:** Samples may be submitted for quantification prior to sequencing.
>
> **Turn-around time:** One day

LabChip Fragment Analysis

KRISP has also invested in an automated capillary electrophoresis separation system for the quantitation and sizing of DNA, RNA and PCR amplicons. The LabChip GX Touch Electrophoresis System uses microfluidics technology that performs reproducible, high-resolution, electrophoretic separations. We have a variety of assay kits available to automate DNA and RNA sizing and quantitation of both fragments and smears to address multiple input concentration ranges. The LabChip GX Touch is also an invaluable tool to simplify and accelerate CRISPR-Cas9 experiments and analysis.

> **Input:** Extracted RNA and DNA, PCR amplicons
>
> **Application:** We have a variety of assay kits available to automate DNA and RNA sizing and quantitation of both fragments and smears to address multiple input concentration ranges.
>
> **Turn-around time:** One day

Antimicrobial Resistance (AMR)

AMR drug resistance testing sequencing can rapidly and accurately identify drug-resistant bacteria and viruses and mobile genetic elements in human, animal or environmental samples. For this process, whole genome sequences (WGS) are produced.

HIV Whole Genome Sequencing

Our next generation sequencing (NGS) technology allows us to sequence the whole viral genome at a greater depth. It also allows high-throughput production of data at a fraction of the cost of traditional sequencing methods. The turnaround time for this test is ten days.

The KRISP protocol produces around 150,000 reads for each whole genome (mean depth of > 1,000 reads per nucleotide position). We have generated over 1,200 genotypes as part of the PANGEA_HIV consortium in South Africa.

KRISP also offer NGS sequencing for drug resistance analysis by sequencing the protease (PR), reverse transcriptase (RT) and integrase (IN) genes of HIV. The data is analysed for drug resistance minority strains at 2%, 5%, 10% and >20% levels.

In addition, KRISP in collaboration with Applied Biosystems and Thermo Fisher Scientific are assisting to bring Africa one step closer to realizing the 2020 UNAIDS 90-90-90 target, by introducing a rapid, reliable, and cost-effective HIV-1 drug resistance genotyping service in Africa.

Using the Sanger sequencing technology, the HIV-1 Genotyping Kit is being used to amplify and reliably sequence the diverse and rapidly evolving HIV-1 virus. As part of this initiative, KRISP is currently running a promotion per genotyping test (for more information please see page X).

Testing can be done with plasma or DBS samples, with a turn-around time of seven working days.

TB Whole Genome Sequencing

Using extracted DNA, Mycobacterium Tuberculosis whole genome sequencing (WGS) can be performed. Normally the test sequences between 95 and 99% of the whole genome with a turnaround time of seven days.

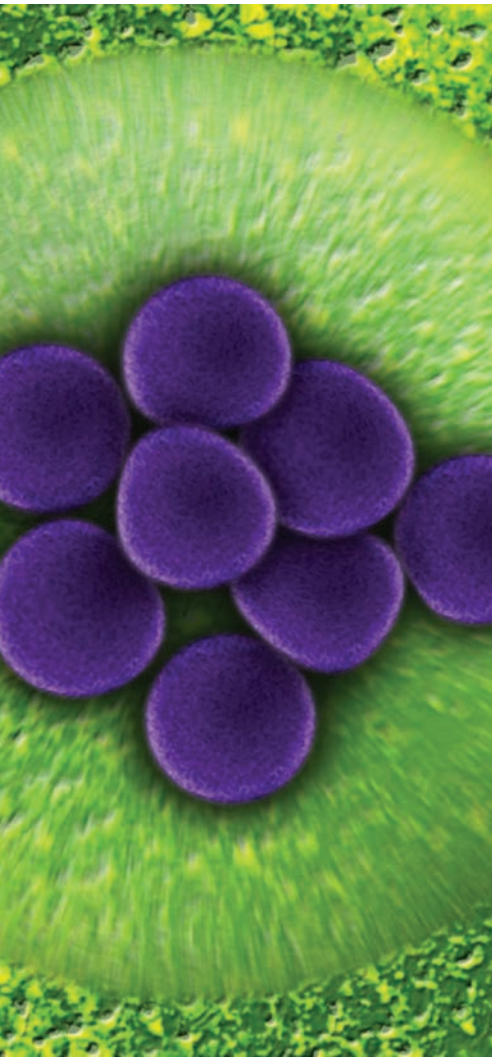
Pathogen Detection with qPCR

KRISP offers a range of respiratory and gastrointestinal syndromic panels, as well as the detection of Sexually Transmitted Diseases (STIs) with a turnaround time of three days.

Using the qPCR system we can accurately quantify the number of copies from microbes, genes, copy numbers, and rare mutants. We have validated qPCR TaqMan Array Card for many common pathogens.

Microbes that can be detected with the Respiratory Panel include:

- Adenovirus
- Bocavirus
- Enterovirus
- Human metapneumovirus
- Parainfluenzavirus (1-4)
- Parechovirus
- Rhinovirus
- Influenza (A and B)
- Measles
- Coronavirus_229E
- Coronavirus_HKU1
- Coronavirus_NL63
- Coronavirus_OC43
- Middle East respiratory syndrome (MERS)
- Severe acure respiratory syndrome (SARS)
- Mumps
- Respiratory syncytial virus (A and B)
- Human herpesvirus 3 (VZV)
- Human herpesvirus 4 (EBV)
- Human herpesvirus 5 (CMV)
- Human herpesvirus 6
- *Coxiella burnetii*
- *Bordetella pertussis*
- *Bordetella holmesii*
- *Chlamydophila pneumoniae*
- *Haemophilus influenzae*
- *Klebsiella pneumoniae*
- *Legionella pneumophila*
- *Moraxella catarrhalis*
- *Mycoplasma pneumoniae*
- *Staphylococcus aureus*
- *Streptococcus pneumoniae*
- *Pneumocystis jirovecii*



Microbes that can be detected with the Gastrointestinal Panel include:

- Adenovirus
- Astrovirus
- Bacteroides fragilis
- Blastocystis hominis
- Campylobacter coli
- Campylobacter jejuni
- *Campylobacter laridis / lari*
- *Campylobacter upsaliensi*
- *Campylobacter spp.*
- *Clostridium botulinum*
- *Clostridium difficile*
- Cryptosporidium
- *Cyclospora cayetanensis*
- *Dientamoeba fragilis*
- *Entamoeba histolytica*
- *Enterobacter sakazakii*
- Enterobius vermicularis (Pinworm)
- Enterovirus
- Enteropathogenic *E. coli*
- Enterotoxigenic *E. coli*
- Giardia lamblia
- *Helicobacter pylori*
- *Listeria monocytogenes*
- Norovirus GI
- Norovirus GII
- Parechovirus
- Plesiomonas shigelloides
- Rotavirus A and B
- Salmonella spp
- Sapovirus (GI, GII, GIV & GV)
- Shigella spp.
- Staphylococcus aureus
- Streptococcus agalactiae
- Vibrio (parahaemolyticus, vulnificus and cholerae)
- Vibrio parahaemolyticus
- Vibrio vulnificus
- Verocytotoxin-producing Escherichia coli
- Yersinia enterocolitica

Microbes that can be detected with the Sexually Transmitted Infections Panel include:

- Herpes simplex virus 1
- Herpes simplex virus 2
- Trichomonas vaginalis
- Mycoplasma genitalium
- Mycoplasma hominis
- Ureaplasma urealyticum
- Gardnerella vaginalis
- Neisseria gonorrhoeae
- Chlamydia trachomatis
- Lactobacillus crispatus
- Prevotella bivia
- Treponema pallidum

Pathogen Detection with ddPCR

Droplet Digital PCR (ddPCR) technology is a digital PCR method utilizing a water-oil emulsion droplet system. Droplets are formed in a water-oil emulsion to form the partitions that separate the template DNA molecules. The droplets serve essentially the same function as individual test tubes or wells in a plate in which the PCR reaction takes place, albeit in a much smaller format.

The ddPCR System partitions nucleic acid samples into 20,000 nanoliter-sized droplets, and PCR amplification is carried out within each droplet, compared to qPCR and traditional PCR, a single sample offers only a single measurement. This technique has a smaller sample requirement than other commercially available digital PCR systems, reducing cost and preserving precious samples.

Using the ddPCR system we can accurately quantify the absolute number of copies from microbes, genes, copy numbers, and rare mutants. We have validated ddPCR assays for common Vaginal microbes that quantify levels.

Microbes that can be detected include:

Gardnerella vaginalis, Prevotella bivia, BVAB2, Neisseria gonorrhoeae, Lactobacillus crispatus, Lactobacillus jensenii, Lactobacillus iners, Lactobacillus gasseri, Megasphaera 1, Atopobium vaginae, Mycoplasma genitalium, Mycoplasma hominis, Ureaplasma urealyticum, Trichomonas vaginalis, HSV2, Human papillomavirus type 16, Human herpesvirus 1, Hepatitis C virus, Hepatitis B virus, Human immunodeficiency virus 1, Candida glabrata, Candida krusei and Candida parapsilosis.

16S Microbiome

We provide 16S microbiome sequencing of the variable V3 and V4 regions of the 16S ribosomal RNA gene, offered on Illumina and IonS5. The illumina 16S Amplicon PCR to amplify the variable V3 and V4 regions of the16S ribosomal RNA gene. The illumina service includes library preparation, sequencing and post run data handling and quality control. The Ion 16S Metagenomics Kit is designed for rapid, comprehensive and broad-range analyses of mixed microbial populations using the Ion Torrent semiconducter sequencing workflow. The kit permits PCR amplification of hypervariable regions of the 16S rDNA gene from bacteria. Sequences generated can be directly analyzed using the Ion Reporter software enabling a rapid and semi-quantitative assessment of complex microbial samples.

Human Genomics

Human Leukocyte Antigen (HLA) Typing

Using either blood, PBMCs or extracted DNA, the typing process does class 1- A, B and C can be done within 7 days. KRISP offers an ultra-high-resolution HLA typing service.

HLA typing by next-generation sequencing (NGS) generates unambiguous, phase-resolved HLA typing results using a single assay, system, and analysis program to assist in the matching process.

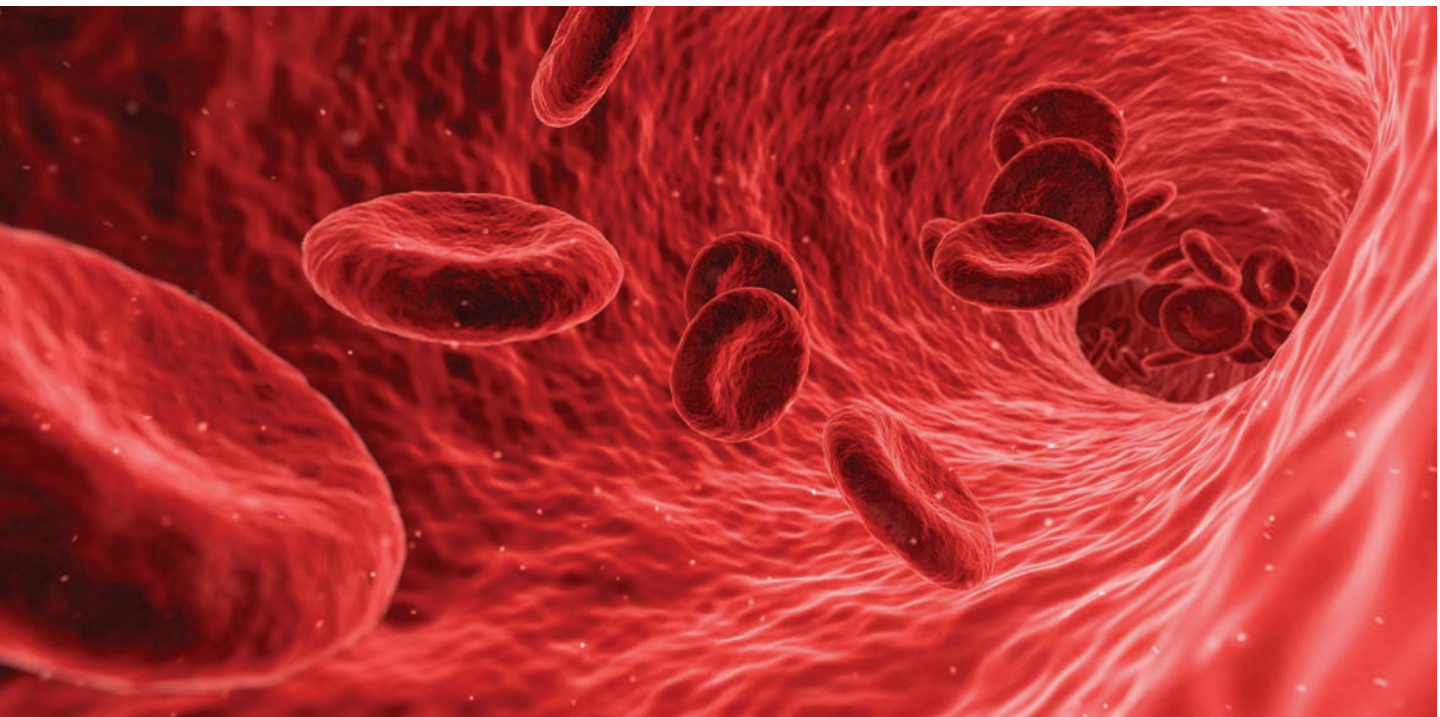
The TruSight HLA Sequencing Panel v2 produces high-resolution typing of 11 HLA loci. Our comprehensive sample-to-report solution for HLA typing includes reagents and software optimized for HLA analysis.

BRCA Gene Sequencing

This precision medicine service offering, in partnership with Thermo Fisher Scientific, provides an Oncomine BRCA testing service in South Africa for both academic and commercial purposes. These cancer assays are used for the detection of somatic and germline mutations from Formalin-Fixed Paraffin Embedded (FFPE) tissue and whole blood, as well as the rapid, accurate sequencing of genetic variation and include large indels, exons, whole gene deletion and duplication events. The sequencing data is then analysed using the Ion Reporter Software – a tailored bioinformatics solution, for easy implementation and interpretation of results.

RNA-Seq

RNA-Seq (RNA sequencing) uses NGS to reveal the presence and quantity of RNA in a biological sample at a given moment. RNA-Seq is used to analyze the continuously changing cellular transcriptome. Specifically, RNA-Seq facilitates the ability to look at alternative gene spliced transcripts, post-transcriptional modifications, gene fusion, mutations/SNPs and changes in gene expression over time, or differences in gene expression in different groups or treatments. In addition to mRNA transcripts, RNA-Seq can look at different populations of RNA to include total RNA, small RNA, such as miRNA, tRNA, and ribosomal profiling. We run RNA-seq projects using Illumina platform Hi-Seq.



Whole Exome Sequencing (WES)

Exome sequencing is a targeted sequencing approach that is restricted to the protein-coding regions of genomes. The exome is estimated to encompass approximately 1% of the genome, yet contains approximately 85% of disease-causing mutations. It identifies the genes implicated in over 6,800 rare diseases, exome sequencing enables rapid, cost-effective identification of common single nucleotide variants (SNVs), copy number variations (CNVs), and small insertions or deletions (indels), as well as rare de novo mutations that may explain the heritability of Mendelian and complex disorders. KRISP leverages the ultrahigh-multiplex PCR approach of Ion AmpliSeq technology and the superior accuracy of the new Ion S5 Sequencing Solution allows for rapid, accurate sequencing of key exonic regions of the genome, going from DNA to variants in just a few days.

Preimplantation Genetic Screening (PGS)

The Ion ReproSeq PGS kits for the Ion S5 System enable a simple and scalable next-generation sequencing (NGS) workflow for reliable and rapid aneuploidy detection across all 24 chromosomes (22 autosomes plus X/Y chromosomes) when studying biopsy samples from preimplantation embryos. These kits take advantage of automated template preparation using the Ion Chef System and can be used to analyze 16-96 samples. The Ion ReproSeq PGS kits enable detection of whole-chromosome and down to 17 Mbp copy number events from just 6 pg of DNA from a single or multiple cells.

Custom Gene Panel Sequencing

KRISP offers commercial and customized gene panels for your specific gene targeting needs. This allows for deep sequencing and the identification of low frequency genetic variants. Our team of experts can help you design the ideal targeted gene panel sequencing approach for your project, helping you to save both time and money.

As mentioned in the Animal and Plant section, KRISP has access to the following DNA sequencing Platforms:

Sanger Sequencing

KRISP is excited to announce the purchasing of two new Sanger sequencers, including the Applied Biosystems 3730xl Genetic Analyzer, which is the highest throughput capillary electrophoresis instrument in the world. The instrument has 96 capillaries and is able to produce over 2 500 sequences per day!

The availability of this Sanger sequencer now puts us in the position to provide high-throughput and affordable DNA sequencing services to customers. The 3500xl Genetic Analyzer is a 24-capillary electrophoresis instruments for the medium throughput laboratories. The system offers industry-leading performance, plus sophisticated automation capabilities allowing researchers to save time, reduce costs and increase productivity. We offer Sanger sequencing services for bacterial and viral DNA.

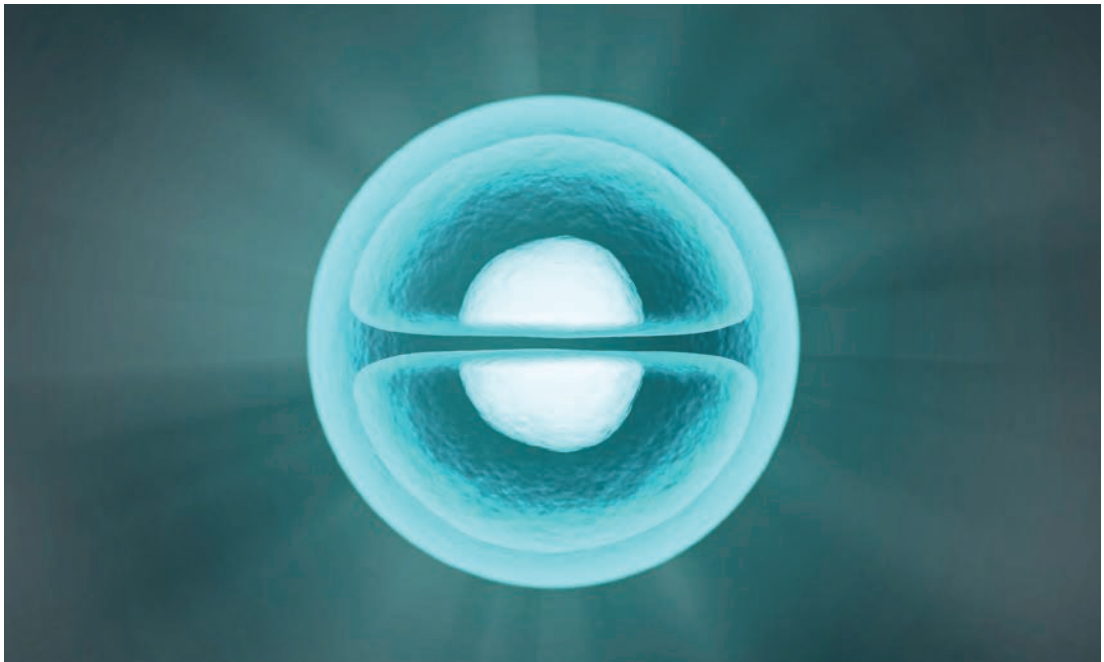
Service Options

1. Full Sequencing Service – non-purified product & primers are provided by the customer and KRISP will perform the PCR purification and quantification of the template, followed by the sequencing
2. Basic Sequencing Service – purified product & primers provided
3. Simple Sequencing Service – sequencing reaction is provided (capillary electrophoresis only)

We are currently running a promotion on Sanger sequencing (for more information please see page X).

Oxford Nanopore Technologies

As one of the only laboratories in South Africa to offer it, KRISP has invested in a portable real-time DNA and RNA sequencing device called the MinION. This system generates up to 30 gigabases (Gb) of sequence data (equivalent to 7-12 million reads for RNA analysis. The portable sequencer produces ultra-long reads (tens to hundreds of kilobases (Kb) which enables the assembly and accurate characterisation of complete genomes, pathogen detection/microbiome analysis. This sequencing power therefore has the potential to deliver new insights into many scientific research areas including plant biology, animal health and environmental research.



PacBio's Single Molecule, Real-Time (SMRT) Sequencing

In collaboration with our DIPLOMICS partners we give customers access to another affordable long read sequencing technology, the PacBio Sequel System, which is currently available at the National Institute for Communicable Diseases (NICD). The system is based on Single Molecule, Real-Time (SMRT) sequencing technology which produces long reads with high accuracy. The PacBio Sequel System provides a comprehensive view of the genetic composition of microbes, plants and animals. It further produces the accuracy required to identify and resolve complex populations in viral and bacterial communities.

Our short-read technologies are also available to customers. We offer sequencing on the Thermo-Fisher Ion Chef and Ion S5 Sequencing Systems and Illumina MiSeq, NextSeq and HiSeq platforms.

Thermo-Fisher Ion S5 Sequencing System

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Illumina MiSeq, NextSeq and HiSeq Platforms

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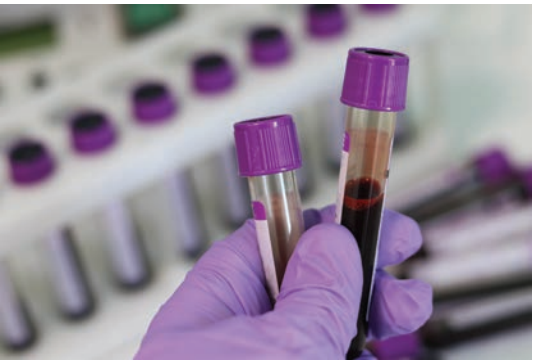

Sample collection and shipment service

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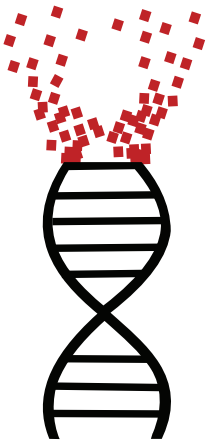


04. Bioinformatics Services

Bioinformatics is an interdisciplinary field of science, combining biology, computer and data science, mathematics and statistics to organise, analyse and interpret biological data and maximise the value and future application of that data.

In short, the aim of the KRISP Bioinformatics Unit is to convert biological questions into answers.

Our team of experts specialise in the analysis of complex biological systems and datasets within the context of a particular research question or project from a variety of biological fields. We provide tailored support to each client with data analysis, computational tools and systems development that is specific to their needs.

CHPC Lengau Cluster

The Centre for High Performance Computing (CHPC) of the Council for Scientific and Industrial Research (CSIR) unveiled a new machine in June 2016 called Lengau, which is seTswana for Cheetah. The peta-scale system consists of Dell servers, powered by Intel processors, using FDR InfiniBand by Mellanox and is managed by the Bright Cluster Manager. Lengau is available to the scientific community of South Africa and CHPC has installed 100s of software applications.

Offering big data analysis, GWAS, Microbial Genomes, Phylogenetics and SNPs

SAMRC & KRISP Tools and Databases

KRISP has access to cutting-edge servers, including High Processing Clusters (HPCs) computers at CHPC and SAMRC and has dedicated Linux servers and multiple top of the range MacPro Desktops. KRISP has also installed 100s of bioinformatics software applications and pipelines with allows us to provide world class bioinformatics support and services to the academic and commercial community. For example, KRISP has a long-term partnership with the South African Medical Research Council (SAMRC). The SAMRC cluster allows interrupted access (24/7) to our online tools and databases, including the Rega Subtyping tools (de Oliveira et al. Bioinformatics 2005) and the South African mirror of the Stanford HIV Database (de Oliveira et al. Nature 2010).

Offering access to the Stanford HIV database, Rega Typing Tools, Genome Detective and other tools.

KRISP also has two medium enterprise HP Linux servers at UKZN, which provides very fast access (Fiber Cat6 access) and large disk space to assemble whole genomes of viruses and bacteria's produced in our laboratories. In additions, these servers for processing big data before using one of the high-processing computer clusters available to us.

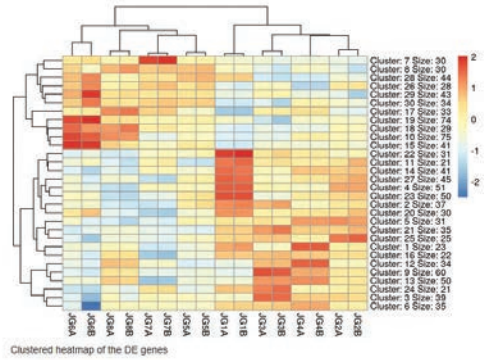
Offering Big Data analysis, GWAS, Microbial Genomes, Phylogenetics and SNPs.

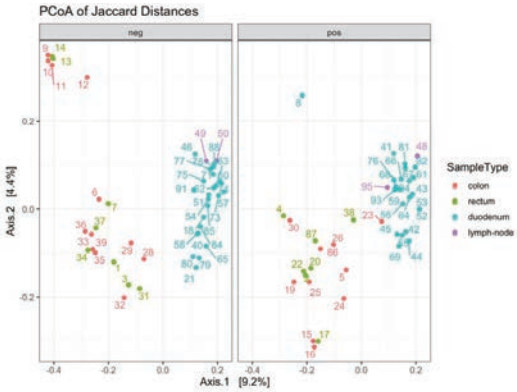
KRISP MacPros

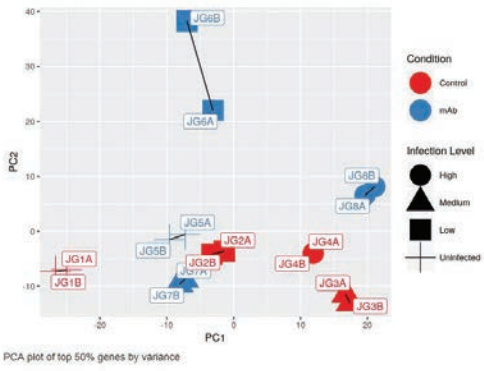
We have 6 top of the range MacPros (32 processors, 64Gb memory) that allow our researchers and post-docs to perform computer intensive analysis without the need to move data across Linux servers and HPCs.

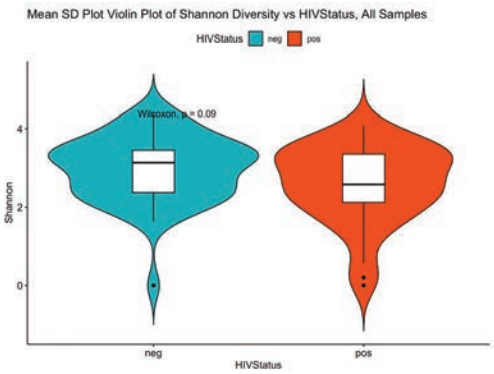
Offering Big Data analysis, GWAS, Microbial Genomes, Phylogenetics and SNPs.

Bioinformatic Data Representations









Contact us to discuss your bioinformatic needs –

For general enquiries:

Mr Sibusiso Khanyase – KhanyaseS@ukzn.co.za or +27 31 260 4049

For technical enquiries:

Prof. Tulio de Oliveira – tuliodna@gmail.com or +27 31 260 4898

05. Training and Capacity Building

KRISP has trained more than 1,500 people since its launch in 2017 in over 30 training workshops. Some of the workshops we offer include:

Hands-On laboratory training:

Sample to PCR Training Workshop, KRISP and Thermo Fisher Scientific Workshop:

Science Technology Engineering and Maths (STEM) training on PCR Polymerase chain reaction (PCR) is a technique used in molecular biology to amplify a segment of DNA across several orders of magnitude, generating thousands to millions of copies of a particular DNA sequence. In this course, students will learn the basics of PCR. They will also extract DNA and create 1000s of copies of genes using Thermo Scientific™ Direct PCR kits, which are designed to deliver ultimate convenience by allowing PCR directly from crude samples.

Quantitative PCR (qPCR), KRISP and Thermo Fisher Scientific Workshop:

Science Technology Engineering & Maths (STEM) training on qPCR.

Training provides an overview of real-time PCR instrument choices and learn how real-time PCR differs from endpoint PCR. Learn to use real-time PCR in your laboratory. Students will also learn on what you should consider when planning your gene expression assays and what is the impact of multitranscript assays and assay specificity. Training will be done in the state-of-art Q7 Studio.

This training is a perfect follow-up course from the basic PCR course and for researchers and technicians with previous experience of PCR and qPCR.

Capillary Electrophoresis (i.e. Sanger Sequencing), KRISP and Thermo Fisher Scientific Workshop:

This hands-on course is a 2-day intensive overview of DNA sequencing. Course topics include application workflow setup and optimization; an overview of instrument hardware, operation and maintenance; use of data collection software; preparation and running of samples and standards; analysis software tutorials and troubleshooting discussions. Students will run, analyze and troubleshoot sequencing samples. Applied Biosystems 3500 instruments will be used for lab practicals.

DNA Sequencing Fragment Analysis (i.e Microsatellite) Workshop, KRISP and Thermo Fisher Scientific Workshop:

This hands-on course is a 2-day intensive overview of Fragment Analysis (i.e. Microsatellite). Course topics include application workflow setup and optimization; an overview of instrument hardware, operation and maintenance; use of data collection software; preparation and running of samples and standards; analysis software tutorials and troubleshooting discussions. Students will run, analyze and troubleshoot fragment analysis samples. Applied Biosystems 3500 instruments will be used for lab practicals

NGS Sequencing Workshop

This training provides an overview of next generation sequencing (NGS) data assembly, phylogenetic analysis, and dynamic visualization. The workshop will be focused on the use of Genome Detective and Nextstrain. Genome Detective is an automated bioinformatics system for virus identification from high-throughput next generation sequencing data. Nextstrain is an open-source project to facilitate phylodynamic analysis, data integration, and visualization of large data sets of viral and bacterial pathogens. The analysis results can be visualized on your own computer or shared on the web. The Nextstrain team maintains a collection of continually-updated analyses of publicly available data for a number of pathogens at nextstrain.org

Bioinformatics training:

16S Microbiome Analysis

This hands-on two days workshop teaches microbiome investigations utilize amplicon surveys (16S rRNA, ITS, or 18S rRNA gene sequence) or metagenomic approaches to assess microbial ecology and gene expression studies take advantage of RNA-seq technology to identify differential gene regulation. Analysis of data resulting from any of these techniques requires proficiency in computational (UNIX, R) and statistical (exploratory data analysis, hypothesis testing, uni- and multivariant analysis) techniques.

Basic Phylogenetic Analysis

This 2-days workshop provides both theoretical and practical training in phylogenetic inference as applied in virology and molecular epidemiology. The workshop will provide scientists with intensive training in the mathematical principles and computer applications used in the study of virus evolution and for conducting detailed molecular epidemiological investigations.

Advanced Phylogenetic Analysis

This 2-days workshop provides both theoretical and practical training in understanding the processes that generate genetic diversity assists in the struggle against viral infections and enhances our understanding of past evolutionary and epidemiological events. The training provide the tools for the identification of the origins of new epidemics, in monitoring the effectiveness of therapeutic strategies, and eventually in predicting the behavior of viral epidemics.

RNA-seq workshop

This 2-day workshop will provide the understanding in Next-Generation Sequencing (NGS) with a special focus on bioinformatics issues. Students will be trained on understanding NGS data formats and handling potential problems/errors therein. In the course we will use a real-life RNA-seq dataset from illumina sequencing.

HIV and TB drug resistance analysis and clinical interpretation

The workshop program follows and expands on the successful format of previous SATuRN and CAPRISA workshops and will include presentations of anti-retroviral (ARV) and anti-TB treatment programs and clinical case management of HIV and TB patients. Emphasis will be put on how to manage HIV & drug resistance as well as advert effects of treatment.

The workshop is targeted at clinicians, clinical virologists and nurses working in the public sector who are currently involved in the treatment of patients with HIV and TB in KwaZulu-Natal, South Africa.

Translational Science Workshops:

Workshop in Translational Research, Health Innovation & Commercialization

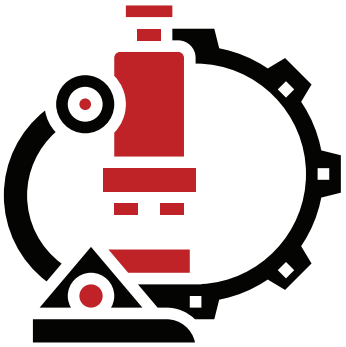
The workshop is targeted at early stage researchers and aims to introduce participants to the concepts and tools available to plan the translational pathway of their research towards healthcare delivery and social impact, including discussion around the issues of intellectual property and downstream commercialization and adoption.

Organized in three sessions:

> ***Session 1*** will start with an overall perspective on Health Innovation in South Africa with talks covering policy making, funding opportunities and intellectual property legislation;
>
> ***Session 2*** will focus on the specifics of doing translational research, technology transfer and innovation;
>
> and ***Session 3*** will be case studies based with some teams presenting their innovation journeys in all its diversity.

Applications from Sub-saharan Africa, particularly South Africa, are welcomed. Approximately 40 places available.

To see a full list of the training workshops on offer or book place on an upcoming workshop please visit us at: ***www.krisp.org.za/training***



06. KRISP Toys


NA 1.25

We have a range of industry-leading equipment available for collaborative research, diagnostics, sequencing and training services. These include:

Sequencers

Oxford Nanopore MinION

MinION is the only portable real-time device for DNA and RNA sequencing. Each consumable flow cell can now generate 10–20 Gb of DNA sequence data. Ultra-long read lengths are possible (hundreds of kb, e.g. 100,000bp) as you can choose your fragment length. The MinION streams data in real time so that analysis can be performed during the experiment and workflows are fully versatile.

Offering NGS Services of Amplicon, Microbial Whole Genomes, Human Genetics, Cancer & Environmental samples

ABI Sanger 3500xl Genetic Analyzer

The 3500xl Genetic Analyzer is a 24-capillary electrophoresis instruments for the medium throughput laboratories. The system offers industry-leading performance, plus sophisticated automation capabilities allowing researchers to save time, reduce costs and increase productivity.

Offering Sanger Sequencing: Amplicon, Drug Resistance and HLA typing

Ion S5 NGS

The Ion S5 next-generation sequencing system enables scalability and flexibility to support a broad range of high throughput sequencing applications, from microbial genomes and gene panels to exomes and transcriptomes. The Ion S5 System leverages the speed of semiconductor sequencing with impressive on-board computing power, to enable the production of high-quality sequencing data.

Offering NGS of Amplicons, Microbial Whole Genomes, Exomes, Transcriptomics, 16S RNA and Microbiome.

Ion Chef

The Ion Torrent Ion Chef System simplifies the workflow for Ion S5, Ion PGM, and Ion Proton systems, providing an automated, walk-away workflow solution for Ion AmpliSeq library preparation and reproducible template preparation and chip loading. It allows data to be produced from sample in 48h and from library preparation into 3 hours.

Offering NGS library preparation, microbial genomes, exomes and transcriptomics.

Illumina Miseq, NextSeq and HiSeq

This allows focused applications such as targeted resequencing, metagen

omics, small genome sequencing, targeted gene expression profiling, and more. KRISP has access to MiSeq (x2), NextSeq 500 (x2) and HighSeq (x1) as part of DIPLOMICS SARIR, which aims to generate sequencing data at similar price, quality and speed as the international leading genomics centres.

Offering NGS of Amplicons, Microbial Whole Genomes, Exomes, Transcriptomics, 16S RNA, Microbiome and RNA-Seq.

RNA/DNA/Protein Extraction

KingFisher Flex Extraction System

The Thermo Scientific KingFisher Flex Purification Systems processes DNA/RNA, protein or cell from a variety of materials (e.g. blood, plasma, cells, urine, faeces, saliva, breast milk, dried blood spots, etc). It offers highly versatile, automated magnetic-particle purification and extraction. Using revolutionary magnetic particle separation technology, this system provides excellent reproduciblity and quality.

Offering RNA/DNA, protein, cell, purification & extraction.

QIAGEN QIAcube

RNA, DNA automated extraction with QUIAGEN spin collum kits. There are over 80 products available to extract RNA and DNA.

Offering RNA and DNA purification and extraction.

Chemagic 360 PerkinElmer

This is a Nucleic Acid Extractor for Medium to High Throughput. Based on our patented chemagen magnetic bead technology the chemagic™ 360 instrument represents the ideal solution for nucleic acid isolation in a huge variety of research market segments including but not limited to Biobanking/Human Genetics, HLA Typing, Virus and Bacteria Detection.

Experience the revolutionary compact benchtop design of our newly developed chemagic 360 Nucleic Acid Extractor. Based on the well-established chemagen Technology, the system offers a flexible solution for different sample processing and throughput needs. Configurable with three kinds of chemagic Rod Heads (see table below) the system can process sample volumes from 10 µl – 10 ml.

Key features:

- Sample volumes from 10 µl – 10 ml
- High throughput
- Huge kit portfolio – whole blood, saliva, serum/plasma etc.
- No cross contamination

To support our automation needs, the system is equipped with the chemagic Software and the chemagic Dispenser 360. These allow LIMS-compatible bar code reading/sample tracking and automated buffer filing for all volume applications.

Offering RNA and DNA purification and extraction.

PCR

Applied Biosystems Thermal Cycler 2720

This personal-sized 96-well thermal cycler is ideal for both basic PCR and cycle-sequencing applications using 0.2 mL reaction tubes or 96-well reaction plates.

Offering PCR, DNA and RNA amplification.

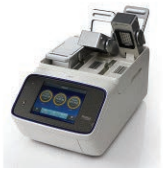
Applied Biosystems Veriti Thermal Cycler

The Applied Biosystems Veriti Thermal Cycler delivers the proven reliability you expect from Applied Biosystems PCR instruments. The VeriFlex temperature control technology inside makes it possible to run up to six different temperatures in the same protocol step, providing precise control over your PCR optimization. The Veriti Thermal Cycler now has a 3x faster processor, making the easy-to-use colour touch screen, more responsive and a quicker boot-up time.
Offering PCR, DNA and RNA amplification.

QuantStudio 7 Flex Real-Time PCR System

The Applied Biosystems QuantStudio 7 Flex Real-Time PCR System delivers the proven reliability, sensitivity, and accuracy of the Applied Biosystem ViiA 7 System in a new, industrial design. The system has been optimized to enable the broadest range of quantitative PCR applications, with additional dyes, formats, and automation options. The analysis of hundreds of 384-well plates can be achieved in just minutes.

Offering PCR quantification, Gene expression and High-Resolution Melting (HRM)



ProFlex 3x32-Well PCR System

The ProFlex in the new generation of PCR Thermo Cyclers. It has a 3x32-Well PCR System allows three experiments run at once with the 3x32-well, 0.2-mL block. Optimize your PCR quickly and efficiently with better-than-gradient VeriFlex blocks.

Offering PCR and gene amplification.

BioRad QX200 Droplet Digital PCR System

The QX200 Droplet Digital PCR (ddPCR) System provides absolute quantification of target DNA or RNA molecules. It is the most precise and sensitive digital PCR solution for a wide variety of applications. It uses Flexible digital PCR chemistry optimized for TaqMan Hydrolysis Probe and EvaGreen Assays. Droplet partitioning by the QX200 Droplet Digital technology reduces bias from amplification efficiency and PCR inhibitors

Offering ddPCR, absolute quantification, DNA, RNA and alleles.

Roche LightCycler 480

The LightCycler 480 System is a high-performance, medium- to high-throughput PCR platform (96- or 384-well plates) that provides various methods for gene detection, gene expression analysis, genetic variation analysis, and array data validation.

Offering qualitative & quantitative detection, mutation scanning, as well as SNP analysis.

Applied Biosystems 7500 RT-PCR

Applications include gene expression analysis, pathogen quantitation, SNP genotyping, isothermal and + or - assays utilizing internal positive controls. To facilitate many of these applications, Applied Biosystems provides preformulated, ready-to-use, quality-tested, TaqMan assays for use with the 7500 system.

Offering gene expression analysis, pathogen quantitation, SNP genotyping and TaqMan assays.

Imaging

FLoid Cell Imaging Station

The FLoid Cell Imaging Station is the ideal instrument for the wide array of fluorescence imaging experiments that researchers are performing every single day. From checking GFP expression in a tissue culture facility or screening fluorescent samples prior to analysis on a high-end confocal microscope or flow cytometer, to teaching students the wonders of cell biology in an instructional lab, the FLoid Cell Imaging Station makes the capture of two- and three-color fluorescence images as easy as taking pictures on a smartphone.

Offering fluorescence imaging, GFP expression and screening fluorescent samples.

BioRad Chemidoc Touch

This is a compact and automated gel imaging instrument designed to yield publication-quality images and analysed results.

Offering gel and Western Blot imaging and analysis.

Bioquantification & Bioanalyzer

Agilent 2100 Bioanalyzer

Using automated electrophoresis, the Agilent 2100 Bioanalyzer system provides sizing, quantitation, and purity assessments for DNA, RNA, and protein samples.

Offering DNA, RNA and protein quantification.

PerkinElmer LabChip GX Touch

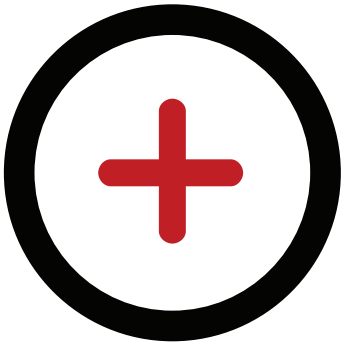
The PerkinElmer LabChip GX Touch uses microfluidics technology that performs reproducible, high-resolution, electrophoretic separations. A variety of assay kits are available to automate DNA and RNA sizing and quantitation of both fragments and smears to address multiple input concentration ranges.

Offering DNA and RNA sizing, quantitation, input concentration and purity quantification.

Thermo-Fisher Qubit 2.0 Fluorometer

A fluorometer for DNA, RNA and protein quantitation using the highly sensitive and accurate fluorescence-based specific probes.

Offering DNA, RNA and protein quantification.



07. Additional KRISP Services

Grants Support Services

The aim of the KRISP Grants Management Unit is to raise funding for world-leading research in Africa and abroad.

We strive to provide ongoing useful support for funding applications and award management. The support of the unit is one of critical aspects to ensure preparation of competitive grant applications. Our record of success with grant applications speaks volumes about our capacity: in 2018, we submitted forty-one (41) and got close to 50% of the grants funded! The unit is run by a professional grants' management team that brings together complimentary skills & knowledge in science, finance and administration hence able to satisfy a wide range of activities relating to grants management.

Pre-award services - includes the preparation of the funding application, submission, any subsequent negotiation of award terms and conditions, acceptance of the award.

Our team assists administrators, faculty and project teams in;

- Facilitation with organizational structures and addressing administrative requirements of the specific call for funding
- Budget preparation
- Approvals and submission of proposal

Post-award services - this covers a multitude of policy issues and processes both financial and nonfinancial after the award is made. Our team provides assistance for:

- Award Acceptance (managing and administering contracts)
- Ensuring compliance (consideration for all applicable statues, regulations and guidelines)
- Award Set-up (funding disbursements)
- Award budget, financial management and reporting
- Award closeout

Training and capacity development

- Our team also conducts training for grants personnel and investigators to build capacity for effective management of grant funds.

Tools and resources available:

List of selected funders, previous grant applications, templates and sample materials.

Contact us to discuss your support needs or collaborative grants applications - KRISP Senior Grants Managers: Mrs Gugulethu Mkhize and/or Mrs Suzette Grobler.

Links: *http://www.krisp.org.za/grants_support_unit.php*

Genomics Africa

Genomics Africa encapsulates our mission and vision to challenge the status quo and allow science to benefit our continent. It is a KRISP and DIPLOMICS initiative to bring genomic technologies to Africa to fight some of the great challenges facing the continent, such as famine, migration, disease and loss of biodiversity. The vision is to provide access to high-quality, output-driven, customer-centric and cost-effective genomics services in Africa.

The initiative is split into three main areas of research, namely:

- **Human Genomes,**
- **Animals and Plants**
- **Microbes and Pathogens**

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, 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 and now there is a race to identify genes that can be used to **develop better treatments, diagnostics and vaccines.**

In order 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.**

Some inspiring projects are already underway within these research areas.

Human Genomes

- Using WGS to Discover Host Genetic Influences on HIV Control and Disease
- Decoding the South African Indian Genome for Diabetes and Heart Disease
- The effect of whole genome methylation on the HIV disease

Animals and Plants

- Conservation Genomics: The Microbiome of Wild Animals in Africa

Africa's rich biodiversity is extremely valuable global resource which 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 scientific research and conservation efforts.

Microbes and Pathogens

Pathogen richness and prevalence vary dramatically among geographic regions in the world. Africa is the region that has the highest number of human, animal and plant pathogens and microbes. The reasons for this are unclear and are probably caused by a multitude of factors. For example, Africa has suffered and still suffer from low spending on disease control. Poverty and basic sanitation remain a problem. The disease prevalence of pathogens may also be elevated because of enhanced susceptibility owing to the high incidence of human immunodeficiency virus (HIV) or the presence of a greater number of more closely related primates. In spite of the high burden of disease, Africa still lacks genomic facilities that are commonly used around the world to characterise the spread of pathogens, identify better treatments and derive public health interventions.

For more information about a Genomics Africa initiative or to get involved contact us on:

Email: contact@genomics.africa

Tel: +27 31 260 4898

Twitter: @AfricaGenomics

Promotions

KRISP is currently running two promotions:

1. Sanger Sequencing Promotion

KRISP is running a Sanger Sequencing promotion to celebrate the launch of two new Sanger Sequencers (ABI 3730xl and 3500).

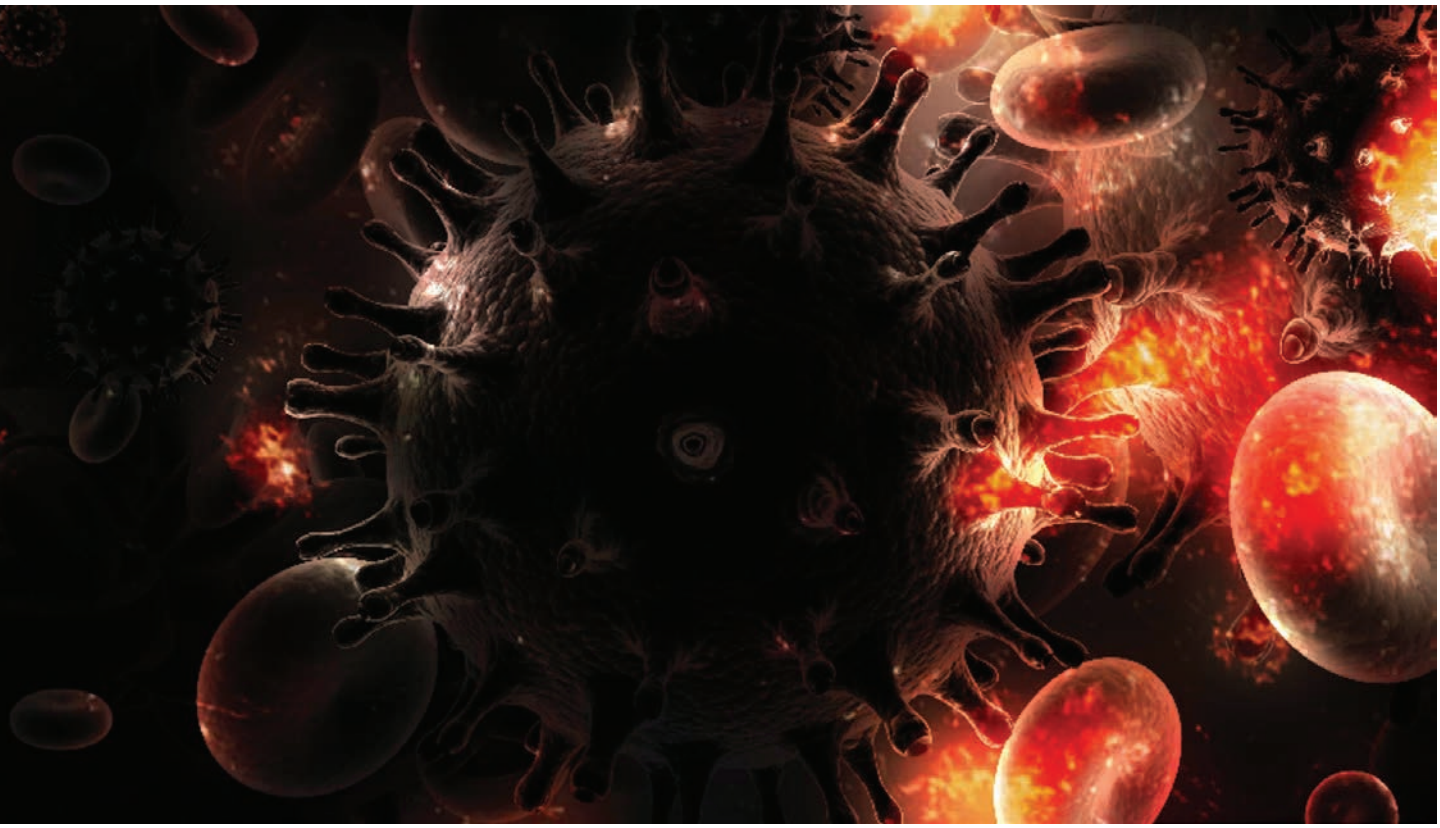
We are offering unbelievable prices until December 2019.

Capillary electrophoresis only – R 25 (per sample well). Sequencing of PCR purified amplicons – R 45 (per primer). Sequencing of PCR unpurified amplicons – R 75 (per primer).

2. HIV-1 Genotyping Service

Promotion offered until December 2019.

ZAR800 (US$ 55) per genotyping test, using plasma or DBS samples, with a turnaround time of seven days.



BioDurban

Just imagine Africa's very own bioinnovation hub… A place to cultivate and celebrate scientific excellence and entrepreneurship while harnessing the untapped potential of the continent; and transforming it into indigenous, world-changing innovations, new technologies and products that can compete in the world market.

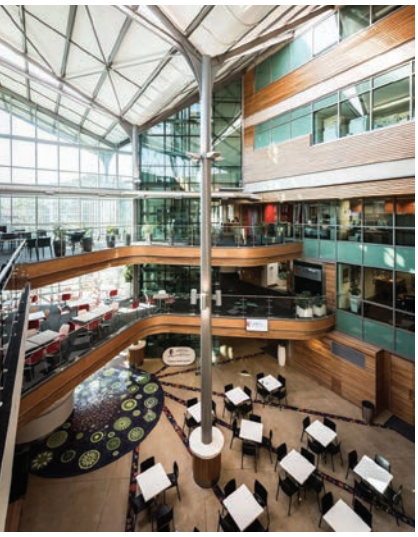
BioDurban is that dream becoming a reality. It is an exciting initiative launched by KRISP UKZN, in partnership with the Technology Innovation Agency (TIA), the Departments of Science and Technology (DST) and Trade and industry (DTI) and the eThekwini Municipality, to transform Durban into the biotechnology capital of Africa.

With the city's world class infrastructure and amazing weather and coastline, it boasts a standard of living that is second to none and provides the perfect environment to establish it as the epicentre for bioinnovation in Africa.

The team has spent the last few years learning from some of the best international biotech-incubation models in Europe, USA and South America in order to develop a business plan that will succeed in the South African context and attract a range of public and private funding.

The Mission:

To create a cutting-edge, Bio-Innovation Science Park and Incubator in Durban that links academic, government and private entities around the continent in order to perform early stage research, innovation projects and incubate start-up companies in the health, agricultural and industrial biotechnology sectors.



BioDurban's services will focus on six main business areas:

BA1 – Indigenous Knowledge Innovation Area (IMBEWU), which means 'seed' in isiZulu. This will provide mentoring, business support, information, communication and physical infrastructure to translate indigenous knowledge systems into intellectual capital for production of commercial products.

BA2 – Scientific and technological enabler, which will focus on providing services to academic, grassroot innovators (IKS-holders and practitioners) and commercial clients to incubate start-up companies.

BA3 – Consultancy services, including legal advice, which will provide necessary support for small, medium and micro-sized Enterprises (SMMEs) that aim to accelerate their business models.

BA4 – Physical space for start-ups to allow them to move from the development to manufacturing phase. The objective here is to provide strong support for start-ups to help them succeed.

BA5 – A Masters in Business Administration, with a clear focus in Science & Technology, will be developed in collaboration with the UKZN Business School. The Scientific & Technological MBA (ST- MBA) will provide fundamental scientific and technological tools for the future generation of corporative leaders.

BA6 – Training, capacity building and a public engagement programme, which focus on providing workshops and events to scientists, IK-holders and practitioners as grassroot innovators and entrepreneurs. We will also have a public engagement activities at high schools and higher education institutes (HEIs) in order to increase the number of Science, Technology, Engineering and Mathematics (STEM) graduates.

To find out more please visit our website – ***www.biodurban.org***

or contact Tel: +27 31 260 4898 / Email: contact@biodurban.org

08. Contact Us

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