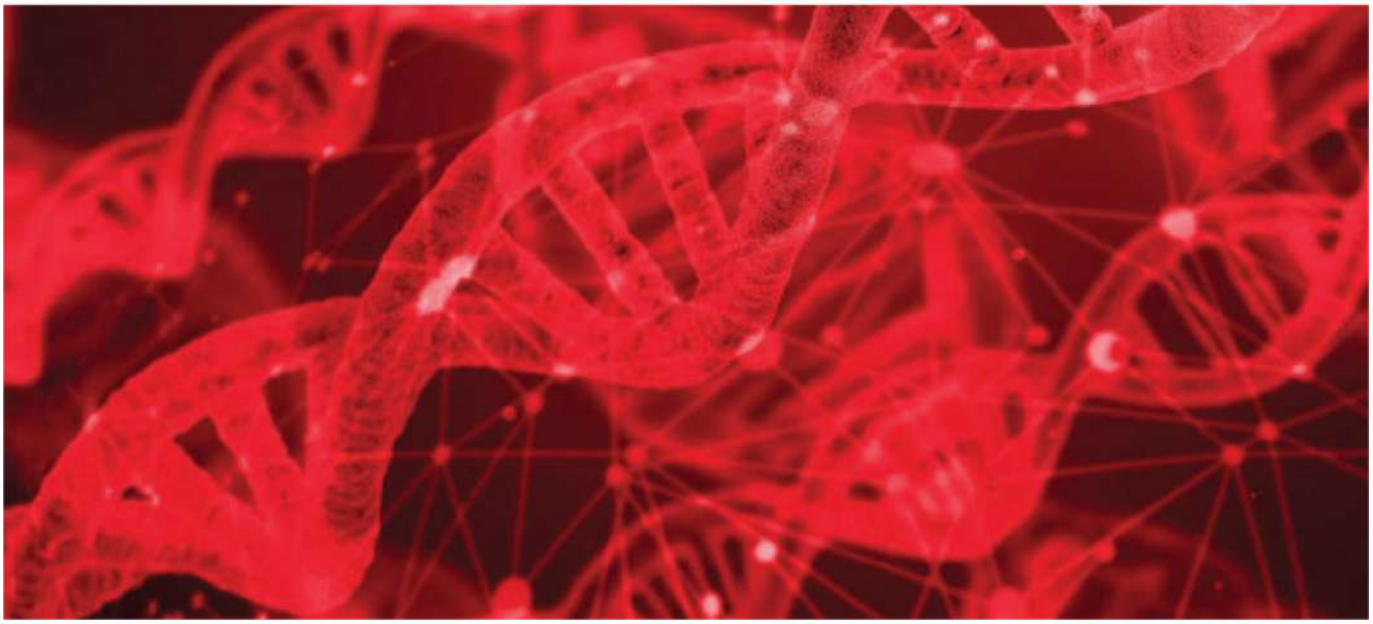
Vol 3, Num 8
Sept 2019

# KRISP Newsletter:

## KwaZulu-Natal Research Innovation and Sequencing Platform



## Introduction:

Our July issue of 2019, **we focus on the launch of KRISP Sale Brochure 2019-2020 and the launch of KRISP Business Development Unit.** These two initiatives aim to provide access to high-quality, output-driven, customer-centric and cost-effective genomics services in Africa.

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.

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## Highlights:

KRISP Services: **Sales Brochure 2019-2020 introduce dozens of new genomics & bioinformatics services**

DNA sequencing: **Illumina, PACBIO, Sanger, S5 Ion and Nanopore sequencing at KRISP and Genomics Africa**

Pathogen Detection: **qPCR panels for 100s of pathogens at KRISP**

Pathogen Quantification: **digital droplet PCR (ddPCR) for pathogens and microbes at KRISP**

Human Genomics: **HLA typing, BRCA sequencing, RNA-seq and Whole Homan Exomes (WES) and Whole Human Genomes (WGS) at KRISP and Genomics Africa**

Conference: **3rd African Diaspora Global Mental Health Conference, 18-19 Sept 2019**

Innovation: **Student Entrepreneurship Week: UKZN Medical School, 3 Sept 2019**

## Events: SPARK Breakfast & Talks at KRISP

**Innovation:** **Student Entrepreneurship Week: UKZN Medical School**
**Speaker:** **Prof. Tulio de Oliveira, KRISP, UKZN**
**Date:** Tuesday, 03 September 2019
**Time:** 2:30pm – 4:30pm
**Venue:** Nelson R Mandela School of Medicine, UKZN

**Conference:** **3rd African Diaspora Global Mental Health Conference**
**Speaker:** **Prof. Bonga Chiliza, Phychiastry Department, Nelson R Mandela School of Medicine**
**Date:** 18 to 19th September 2019
**Time: 8:00am – 4:00pm**
**Venue:** Century City Conference Centre, Cape Town

## KRISP has released its first sales brochure (2019-2020)

**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.

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.

**Genomics Africa:** 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. As part of this initiative, we can offer services in the six largest Genomics laboratory in the country.

## 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

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. Such as the microbial environment of the human gut.

## 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, 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. KRISP is involved in some critical research projects with the HIV-1 Virus, TB and other Bacterial and Viral Whole Genomes.

## 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. To arrange a timely sample pick-up that suits your needs please contact us.

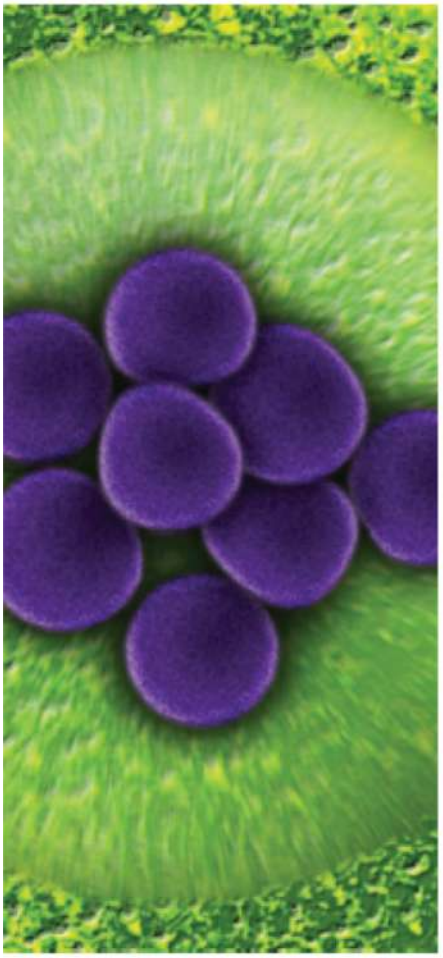
## Pathogen Detection with qPCR

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.

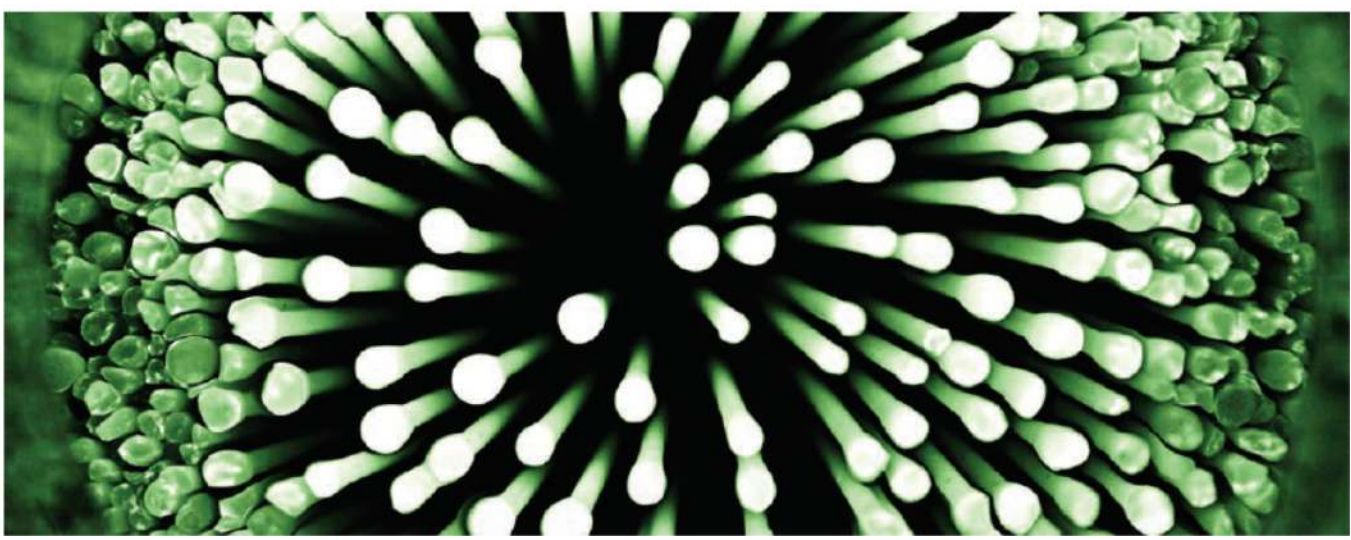
Using the ddPCR system we can accurately quantify the absolute number of copies from microbes, genes, copy numbers, and rare mutants. We have validated ddPCR assays for common Vaginal microbes that quantify levels.

*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.

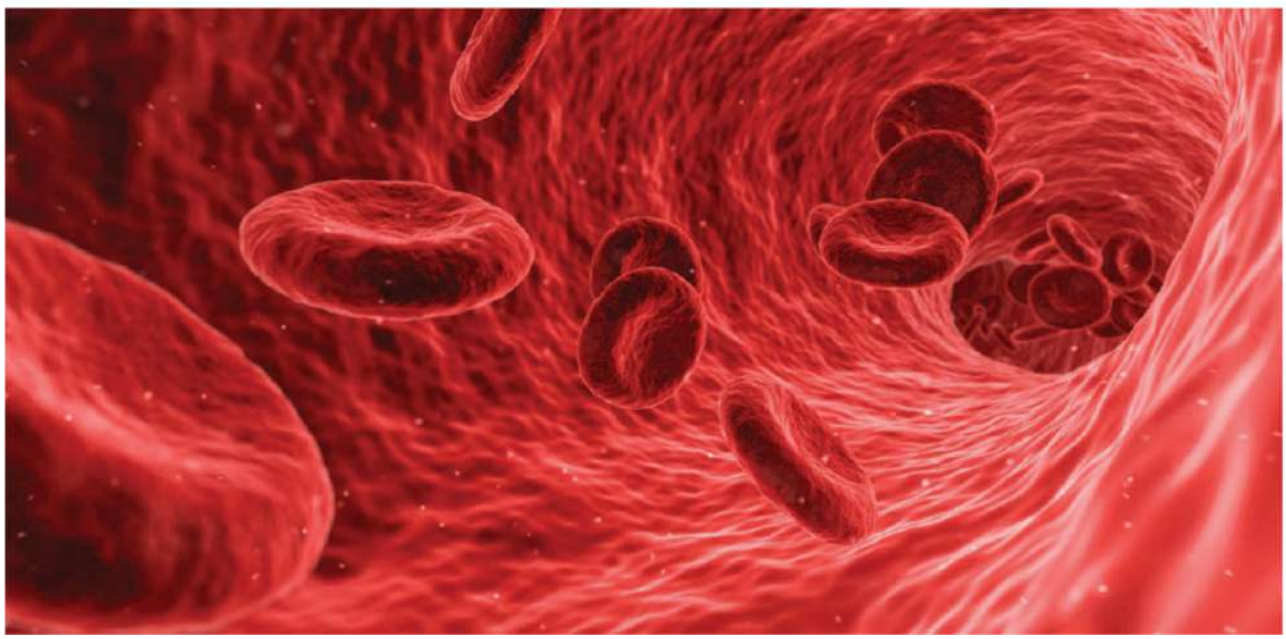
The TruSight HLA Sequencing Panel v2 produces high-resolution typing of 11 HLA loci. Our comprehensive sample-to-report solution for HLA typing includes reagents and software optimized for HLA analysis.

### 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.



**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

## For further information please visit our website at www.krisp.org.za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