

Improving quality and throughput of assays for genomic and proteomic research in South Africa

The Centre for Proteomic and Genomic Research (CPGR) has several Tecan instruments for automated processing of multiple batches of microarrays simultaneously, including an HS 4800™ Pro Hybridization Station with the new QuadChamber™ and a HydroFlex™ system.

The CPGR in Cape Town, South Africa, is a world-class technology center funded by the Cape Biotech Trust and PlantBio. The center was founded in 2006 as a not-for-profit organization that, among other projects, focuses on diagnostics research for diseases that are prevalent in South Africa, such as tuberculosis (TB), HIV/AIDS, malaria and cancers. Increasingly, the CPGR is also involved in plant biotechnology research and in food safety.

“Our main goals at the CPGR are to increase the South African research output and knowledge base, while becoming sustainable through providing services and collaborative projects to scientists in academia and industry,” explained Dr Reinhard Hiller, Managing Director of the CPGR. “To achieve these goals we need to use automated systems to minimize our manual procedures and assay costs as far as possible, while increasing the quality of our results at the

same time. So far, we have established a high throughput biological research platform with a number of systems from Tecan and other companies, such as Applied Biosystems and Affymetrix. We are now fully equipped for processing almost all existing slide-based microarray formats, including genomic DNA, microRNA (miRNA) and protein microarrays. We also have facilities for RT-PCR based gene expression profiling, genotyping, as well as state-of-the-art mass spectrometry-based proteomics.”

“I chose the Tecan HS 4800™ Pro Hybridization Station for automated microarray processing because I have previously had fantastic experience with this system, it is really versatile,” Reinhard continued. The HS 4800 Pro performs all steps of the hybridization process, from pre-hybridization through to drying, of single, dual and even quadruplex microarrays. These capabilities are vital to the scientists at the CPGR: “We have also adapted a number of different microarray-based assays for automation with the HS 4800 Pro,” said Reinhard. “For example, we are using lots of miRNA microarrays from Exiqon (Denmark), who has pre-developed protocols for Tecan’s hybridization stations so we can deliver excellent results with the system, straight away.”

“We also use the HS 4800 Pro for processing a number of custom protein and peptide microarray assays, for example, for allergy diagnosis or infectious disease research,” Reinhard continued. “One example is a collaborative project using high density TB peptide

assays to screen for potential diagnostic antibodies for TB. New, reliable, simple and quick tests are urgently needed for TB diagnosis, which is particularly difficult to diagnose in children with HIV. Automation has hugely improved the quality of our results and we are now testing hundreds of samples with these microarrays in a follow-up study.”

“We are also using protein microarrays developed by VBC-GENOMICS (Vienna, Austria) for the diagnosis of allergic diseases. These diagnostic arrays contain hundreds of allergen molecules immobilized in four identical microarrays on a single microscopy slide. While originally designed for manual processing, we are now adapting these miniaturized antibody-capturing assays to a four-plex and 16-plex format on the HS 4800 Pro and the Tecan HydroFlex™, respectively. Thereby, we are going to increase assay throughput and quality while dramatically reducing the costs per data-point.”

The CPGR has recently purchased a HydroFlex platform from Tecan for automated incubation and washing of microplate-based immunoassay formats. “Tecan has customized the HydroFlex for us so that we can process 16-plex protein microarray slides, such as the cytokine arrays from GenTel BioSciences. These arrays are used for cytokine profiling, which is important for research in many disease areas,” added Reinhard. “To name just one example, highly automated cytokine profiling assays are very important in the context of monitoring clinical trials, where the



The LS Reloaded laser scanner



Dr Reinhard Hiller

Rachel van Dyk inserting slides into the HS 4800 Pro

consistency of results is a key prerequisite. However, using these cytokine arrays is only the first step towards implementing more multiplex antibody capturing and sandwich antibody assays that come in eight- or 16-plex formats.”

The CPGR also plans to use Tecan’s recently developed QuadChamber™ for automating 4-pack Microarrays from Agilent. The QuadChamber is designed for simultaneous processing of four individual, whole-genome microarrays printed on a single glass slide, using the HS 4800 Pro. This is the first fully automated system that can independently handle four arrays on one slide with no cross-contamination between the arrays. Reinhard said. “I am confident that the QuadChamber will work, the results I have seen previously on pilot projects from Tecan look very promising. Currently, we are using malaria expression arrays printed by Operon in a dual format with excellent results and we are going to run the first protein arrays in a four-plex format shortly. We have recently decided to implement an LS Reloaded™ laser scanner from Tecan in order to increase the throughput and

versatility of the microarray scanning process at the CPGR. In addition to offering high resolution scanning of existing slide-based microarray formats at outstanding consistency, the LS Reloaded is also capable of analyzing microarrays printed in 96-well formats. This opportunity allows the rapid validation of results generated on our discovery platforms (eg. mass spectrometry), the screening of biomedical extracts for specific antibody binding or the development of low density diagnostic microarray formats. Also, the LS Scanner works neatly in line with the HS 4800 Pro when transferring slides processed on the latter directly into the scanner with minimal manual manipulations.”

“We are now talking to Tecan about adding a Freedom EVO® liquid handling workstation to our collection. Among other applications, the Freedom EVO would be ideal for automated DNA and RNA extraction, for the preparation of serum samples for multiplex immunoassays on our Luminex platform, for the parallel depletion of samples subjected to mass spectrometry analysis, and for all the liquid handling needed to prepare 384-well plates for our Applied Biosystems 7900 RT-PCR platform,” Reinhard added. “This would be another step towards turning our laboratory into a high throughput microarray and biomarker analysis platform.”

The HS 4800 Pro Hybridization Station



The applications described here are not available in the US outside of the research market.



The HydroFlex system