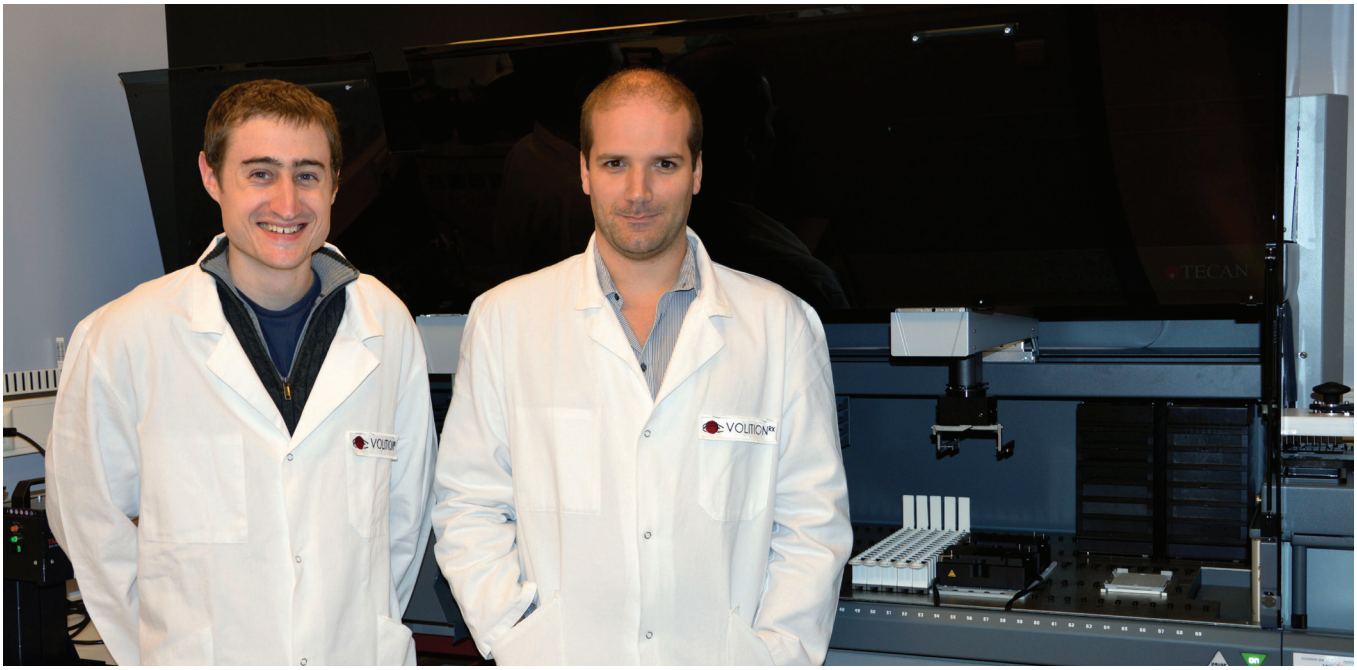
Liquid biopsies made easy

VolitionRx is using its proprietary Nucleosomics® technology platform to develop a range of diagnostic assays for cancer and other conditions, creating non-invasive tests that identify disease-specific nucleosome signatures circulating in the blood. High throughput biomarker validation is a crucial aspect of the company's workflow, which it has chosen to automate using four identical Freedom EVO® 200 workstations.

VolitionRx Ltd was established in 2010 to combine established immunoassay techniques with cutting-edge nucleosome detection and analysis, creating a revolutionary new approach to cancer diagnostics. Gaetan Michel, CEO of Belgian Volition SA – the parent company's operations organization in Namur, Belgium – explained: "Currently, the only blood test routinely used for cancer diagnostics is the PSA (prostate specific antigen) assay for prostate cancer. However, there are a number of other cancers which could benefit from blood-based diagnostics, and our Nucleosomics technology has the potential to detect early stage cancers and improve outcomes for many of these patients."

Nucleosomics relies on the identification of characteristic epigenetic features which are present on the nucleosomes in cancerous cells. These uniquely structured nucleosomes can be easily detected in blood samples using ELISA methods, reducing the cost of testing for laboratories and providing a virtually pain free method of diagnosing various cancers. Gaetan continued: "Nucleosomes are complexes composed of eight histone proteins plus 147 base pairs of double-stranded DNA, and their role is to package up the cell's DNA into chromosomes. Each of the histone proteins has a number of surface modifications – methylations, acetylations, etc. – depending on the condition of the cell, which have



Brieuc Cuvelier and Dorian Pamart with one of VolitionRx's four identical Freedom EVO platforms

an effect on transcription in the cell nucleus. These patterns of epigenetic modifications are disrupted in many cancers, leading to uncontrolled cell proliferation and subsequent cell death. Following cell death, the nucleosomes are released into the blood stream, allowing us to detect them with our panel of NuQ® immunoassays targeting specific structural features of the nucleosome."

"Identifying and validating the characteristic epigenetic nucleosome profile associated with each cancer is the main aim of our work here in Namur, collaborating with healthcare institutions across Europe and the USA to gather serum samples from clinically relevant patients. Once a candidate biomarker is selected, we begin by performing a proof-of-concept study with around 200 to 300 clinical samples. We then move into the confirmatory phase, testing between 1,000 and 5,000 samples and, finally, we perform a regulatory validation study on 5,000 to 15,000 samples from a different patient cohort for regulatory purposes. While the proof-of-concept experiments can easily be performed by hand, the confirmatory and validation studies, which are often performed on up to 30 candidate markers in parallel, would be virtually impossible to do manually. Inter-operator variability and the risk of handling errors would also make analysis of results very difficult, which is why we approached Tecan to help us automate the workflow."

Belgian Volition's first Freedom EVO 200 workstation was commissioned in September 2014 and, following transfer of the manual protocols onto the automated system, began routine operation in February 2015. Dorian Pamart, Research Associate and Manager of the Automated Platform, explained: "I already had some limited experience with Tecan liquid handling workstations from a previous role, but had not performed automated ELISA testing before. We outlined our workflow to the Tecan team, who then developed the instrument configuration to meet our needs. Once the system arrived, I worked closely with a Tecan application specialist to design and test the protocols. This was very easy, as the platform was already set up correctly for our workflow, but by carefully optimizing the various plate movements, pipetting actions and wash steps, we were able to dramatically ramp up throughput from 200 to 800 samples a day. Tecan also provided in-house training for several of the laboratory staff, allowing us to update or develop protocols as required."

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This set-up proved so successful that the company soon ordered three additional Freedom EVO 200 platforms with the same specifications. Gaetan continued: "We carefully planned the installation and commissioning of the new platforms, so we knew exactly when they would arrive on site. Because the systems were identical to our first platform, it was simply a case of copying the various protocols we had already developed onto the new instruments. This was done very quickly and efficiently, and all four systems were operational the following week, minimizing disruption."

"Without automation, our biomarker validation workflow would be almost impossible. There are two members of staff responsible for the day-to-day operation of the workstations, allowing us to process around 3,200 samples every day. This compares with just 120 samples per person manually, meaning we have increased our throughput more than 13-fold while improving reproducibility and process security," Gaetan concluded.

To find out more about Tecan's clinical solutions, visit www.tecan.com/clinicalsolutions

To learn more about VolitionRx, go to www.volitionrx.com