Dutch Dx Alliance Plans Early-Stage Cancer Tests on Photonics-Based Chip Platform

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NEW YORK (360Dx) – Qurin Diagnostics, a Dutch molecular diagnostics company, is moving ahead with plans to develop and launch photonics-based biochips for early-stage detection of cancer.

Last month, the Enschede-based firm together with Lionix International, a manufacturer of photonic integrated circuit modules, acquired a majority stake in Surfix, a provider of custom-made nanocoatings. Lionix and Surfix are also based in the Netherlands.

The partners believe their technology could have advantages over others used in early-stage cancer detection, such as next-generation sequencing. They also see potential applications of the technology beyond cancer diagnostics.

By combining its diagnostics expertise with Lionix's photonics technology and Surfix's surface chemistry, lead partner Qurin is assembling a platform on which it can deploy its tests, according to CTO Henk Viëtor.

"The idea is that Lionix will provide the detection technology and we'll provide the molecules for specific gene signatures," Viëtor said. "What has been missing is the coating, the chemistry to allow the application of the biomarkers," he said. "That technology is now provided by Surfix. They provide the chemistry that is needed for it to be functional as a biosensor."

Viëtor has an extensive pedigree in the European molecular diagnostics space. He previously served as CEO of SkylineDx, a Rotterdam-based company that offers microarray-based tests for hematological cancers. Viëtor joined Qurin two years ago just as the four-year-old firm's activities began to intensify, bolstered by a €12 million ($13 million) investment at the end of 2017.

"I've been working to identify technologies that we can use to develop a completely new diagnostic platform based on photonics while, on the other hand, trying to identify signatures that can be applied on the diagnostic system," said Viëtor of his role in the firm.

Qurin also maintains a business office in Amsterdam and employs eight full-time staffers at the moment, he said. The company's' goal is to deliver cost-effective biosensors for early cancer detection in urine, with an initial focus on urogenital cancers, such as bladder, prostate, and cervical cancer.

Lionix is a main technology partner for Qurin. Established in 2001, the Enschede-based company has focused on manufacturing photonic integrated circuits using silicon-nitride-based wave guides. Wave guides are similar to optical fibers that transport light. The company's technology mimics an optical fiber on the chip and can be used in various sensing applications.

The technology has found application not only in the life sciences but also in communications and metrology, where it is used in both laser interferometry and spectrometry. In life science applications, its laser lights form a component of various optical sensing platforms.

According to Viëtor, the Lionix sensor works on the principle of sending light over an active sensor to detect the binding of analytes to specific probes. "If the light passes and there is binding, then the light is slowed and you can pick that up as a signal readout for a diagnostic device," he said.

If successful, the companies involved believe the approach could rival NGS-based tests in terms of complexity and price.

"Everybody talks about NGS, but this is still a technology that, while becoming cheaper, is expensive to implement for routine use," said Henk Leeuwis, vice president of strategy and innovation at Lionix. "What our technology provides is the ability to get the information you want with a simple measurement."

He said that Lionix's approach has advantages over other technologies as well, claiming that it is "extremely sensitive" when compared to other photonic biosensors and, unlike conventional microarrays, does not require fluorescence to detect binding. Leeuwis also credited Surfix's surface chemistry with the ability to concentrate receptors on a specific location on the sensor's surface, therefore reducing binding to other parts of the surface.

"If you only functionalize a small part of the wave guide, it's far more effective than having a spot wholly covered with DNA strands that deplete your analyte," noted Leeuwis. "With this technology, it's possible to [detect the analyte] only on the most sensitive part of the chip," he said. The result is a sensitive, integrated module that only needs electrical interfaces to operate.

The chips consist of a laser and photodiode integrated together.

"Then you have a complete electrical model, you can guide it with currents and get the signal electrically," said Leeuwis.

Achieving high levels of sensitivity and specificity is essential to applying the technology in early-stage detection of cancer in urine, an application that Leeuwis noted is "very ambitious."

According to Viëtor, the next milestone for the diagnostics alliance is to have a signature that is ready to be applied on the platform. The first indication will be for bladder cancer, he said, though the launch of any test could be years away. Viëtor said it is likely the firm may require additional funding to see its test through launch, but that it is "secured for the coming years."

He added that in the meantime Qurin will continue to develop signatures for its diagnostics pipeline. "It's important to have as many applications for the detection of cancer at an early stage as possible," Viëtor said. The company will achieve this by both licensing in new signatures and by identifying new signatures in collaboration with scientific research institutes, he said.

The company has a close collaboration with the University of Twente in Enschede, he noted.

Aquaculture

While Qurin's initial focus has been on cancer testing, it has seen interest in applying its approach in agricultural biotechnology and aquaculture in particular.

This month, a project commenced that involves Qurin and Lionix, as well as TunaTech GmbH, a Düsseldorf, Germany-based company that offers tests and services for fisheries, with a focus on tuna and salmon. Nytor, a Nijmegen, the Netherlands-based firm that develops molecular assays, with a focus on multiplex quantitative PCR, is also taking part.

The aim is to develop a tool called SensiChip for detecting infectious diseases in aquatic systems. The project received €275,000 through a German-Dutch program called Regional Collaboration on Key Enabling Technologies, or ROCKET. A kick-off meeting is scheduled for next month.

The new project will build on earlier work to develop a chip capable of detecting bacterial and viral contaminants of vaccines in fish. In an abstract outlining the work, participants said that economic feasibility of the test will depend on production costs, but they noted that the indications are promising.

"Production costs of these sensors are strongly related to chip surface area and cartridge integration," the developers wrote in the abstract. "Integration of a light source and detector on chip, integration of microfluidics and plastic disposable cartridge development have a strong impact on the final product price."

Viëtor said that Qurin sees applications of its technology in aquaculture as a potential revenue source going forward.

"The beauty is that the application of biomarkers — still to be discovered to a large extent — requires extremely sensitive chips," said Viëtor. He noted that bacterial markers are present in fish at much higher concentrations compared to cancer biomarkers, levels that are already measurable by the partners' technology, making the market more immediately accessible to the company.

He also said that seed testing, for instance, could be another potential application of the technology going forward, as well as testing for B-type natriuretic peptide, a marker associated with heart failure, in patients' urine and blood.