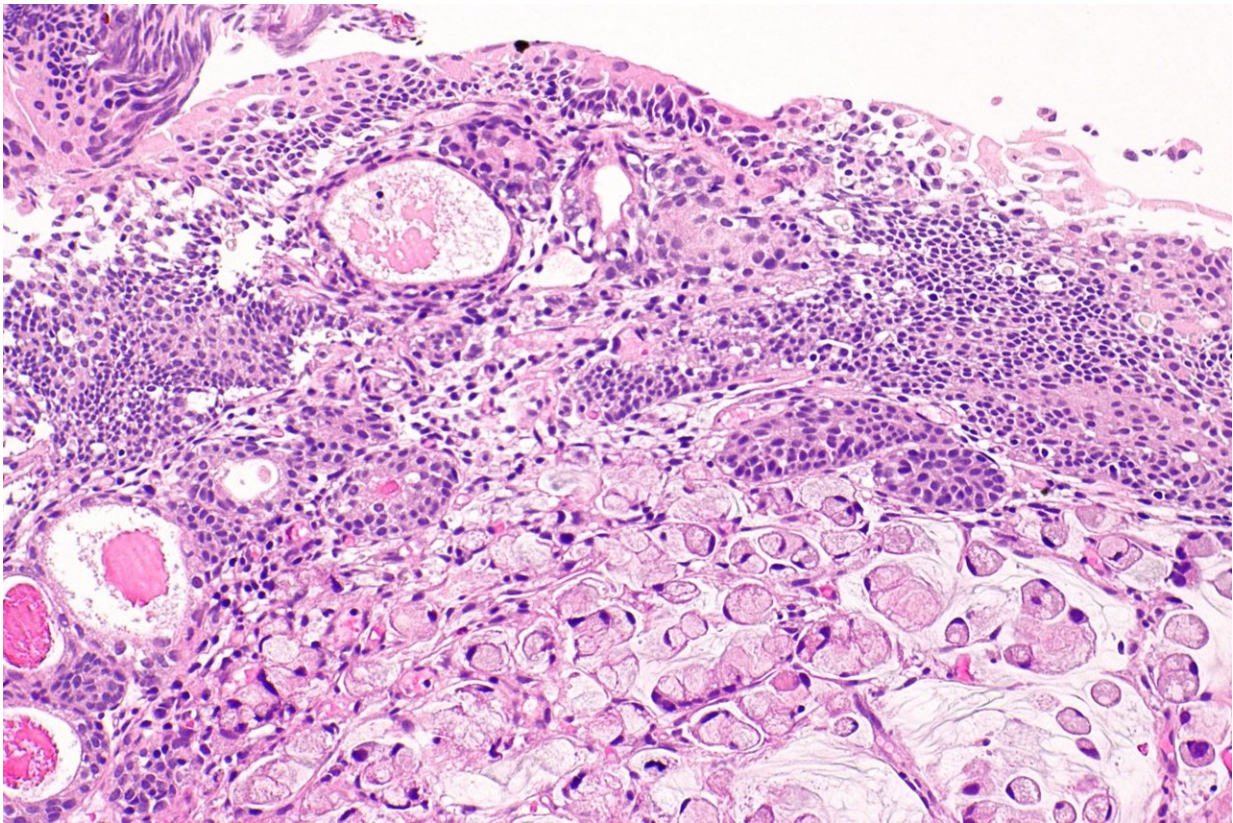


Family's grief sparks a quest for better bladder cancer cures

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Millions of lives are lost to cancer due to late detection so scientists are working on better ways of diagnosing the disease. Credit: Signet ring cell carcinoma of the urinary bladder by Nephron is licensed under CC BY-SA 3.0

"Invasive and uncomfortable' prodedures for detecting if someone has

bladder cancer could be replaced by urine tests that not only screen for the presence of the disease but also help doctors choose the right course of treatment for a particular patient.

"Our lives literally came to a stop when my mother was diagnosed with cancer," said Dr. Gitte Pedersen. "The first treatment didn't work, neither did the next one. Eventually we just ran out of time."

The heartbreak of losing her mother inspired Dr. Pedersen and her brother, Morten, to take action and start a Danish biotech company, Genomic Expression, in 2009. "It's very much a passion project – we want to help solve this problem."

The deeper they looked at modern cancer care, the more convinced they became that a new approach was needed. Dr. Pedersen says that only about one in four treatments prolong life, and as many drugs don't work, tens of billions of euro are wasted globally every year. "My brother and I are both scientists and, understanding genetics, we concluded that there had to be a better way," she said.

Their goal has been to apply the latest findings from basic research in areas such as genomics to improve the lives of cancer [patients](#). At the heart of their approach are insights that allow patients to be treated according to the underlying cause of their disease.

Through Genomic Expression, the Pedersens believe they can improve cancer diagnosis and monitoring, help doctors find the right drugs for patients, and make it easier for drug developers to identify suitable patients for clinical trials of new medicines.

For Genomic Expression, [bladder cancer](#) is a key target because it is costly to treat due to expensive and invasive diagnostic procedures. It also has a very high recurrence rate of between 50% and 70%, which

means that patients undergo lifelong surveillance. Knowing the underlying genetic drivers in a patient's tumour presents an opportunity to pick the most effective treatment and reduce recurrence.

The company uses a patented technology that filters [urine](#), allowing bladder tumour cells to be selected and tested for a series of biomarkers – tell-tale molecular signs of cancer. Diagnostic and treatment choices can then be tailored to the genetic make-up of the tumour cells. Four studies are underway to test the system in people with breast, ovarian, colon and bladder cancer.

Barriers

One of the barriers to improving outcomes for bladder cancer patients is obtaining early and accurate diagnosis. "The only symptom is blood in the urine," said Dr. Pedersen, who leads the OneRNA4Bladder project focused on validating a urine-based diagnostic test. "But only one in 10 (people) who present to their doctor with blood in the urine actually have cancer. However, given the risk of serious illness, all are referred to specialist urologists for cystoscopy."

Cystoscopy is a highly invasive procedure wherein the bladder is inspected using a small camera inserted into the urinary tract. Patients who have survived cancer are required to have between four and eight cystoscopies per year.

"It's an invasive and uncomfortable procedure and causes urinary tract infections in 10% of patients," Dr. Pedersen said. "The test we are validating would potentially substitute for some or all of these."

The urine test would spare patients cystoscopies, save health professionals time, and reduce costs for health systems.

If all goes to plan, it could even be offered by general practitioners, reducing waiting times by avoiding referrals to hospital specialists.

"The patient experience will completely change over the next five years," Dr. Pedersen said. "For monitoring recurrence, the patients will be able to take the test in the comfort of their home and only get called into the doctor's office if the test is positive. That will support adherence, which is a problem for older patients who are immobile, as well as patients who simply refuse to undergo cystoscopy several times a year."

Another way of detecting the presence and nature of tumours is by analysing the small protein strands known as peptides. By identifying the combination of peptides in a urine sample and analysing this through mathematical models and data analytics, scientists can tell how aggressive a cancer is likely to be.

Mosaiques Diagnostics, a German biotech company, is using these predictive qualities of peptide analysis to develop a bladder cancer urine test. The work falls under several projects, which have been working on different aspects of the test.

The company uses an approach known as capillary electrophoresis coupled to mass spectrometry (CE-MS), to profile bladder cancer at the molecular level by analysing a urine sample.

"The system can detect up to 22,000 peptides which are initially separated depending on their electrical mobility (charge)," said Dr. Maria Frantzi, a postdoctoral researcher at Mosaiques Diagnostics working on a project called TheranOMICS.

Personalised

Scientists can test a single [urine sample](#) for several diseases at once. This information is then checked against a database including more than 50,000 patients to determine the molecular characteristics of the tumour in that particular person.

"By identifying the combination of peptides present in urine, we can go back to the patient with a score indicating the probability of disease being present," Dr. Frantzi said. "We could also calculate the risk of the disease recurring in patients who have been successfully treated for cancer." This can alert the urologist and guide personalised patient management.

This approach has the potential to improve bladder [cancer](#) detection, but ultimately, shifting to a new system may take time.

"Cystoscopy cannot see all tumours, particularly those high up in the [bladder](#), but this molecular approach is more precise," said Professor Harald Mischak, founder of Mosaiques Diagnostics.

"I hope clinical practice will change in the coming years, but this will require a willingness from clinics to implement new approaches, as well as regulatory approval and reimbursement. When it comes to changing patient care, science is not the only piece of the puzzle."

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