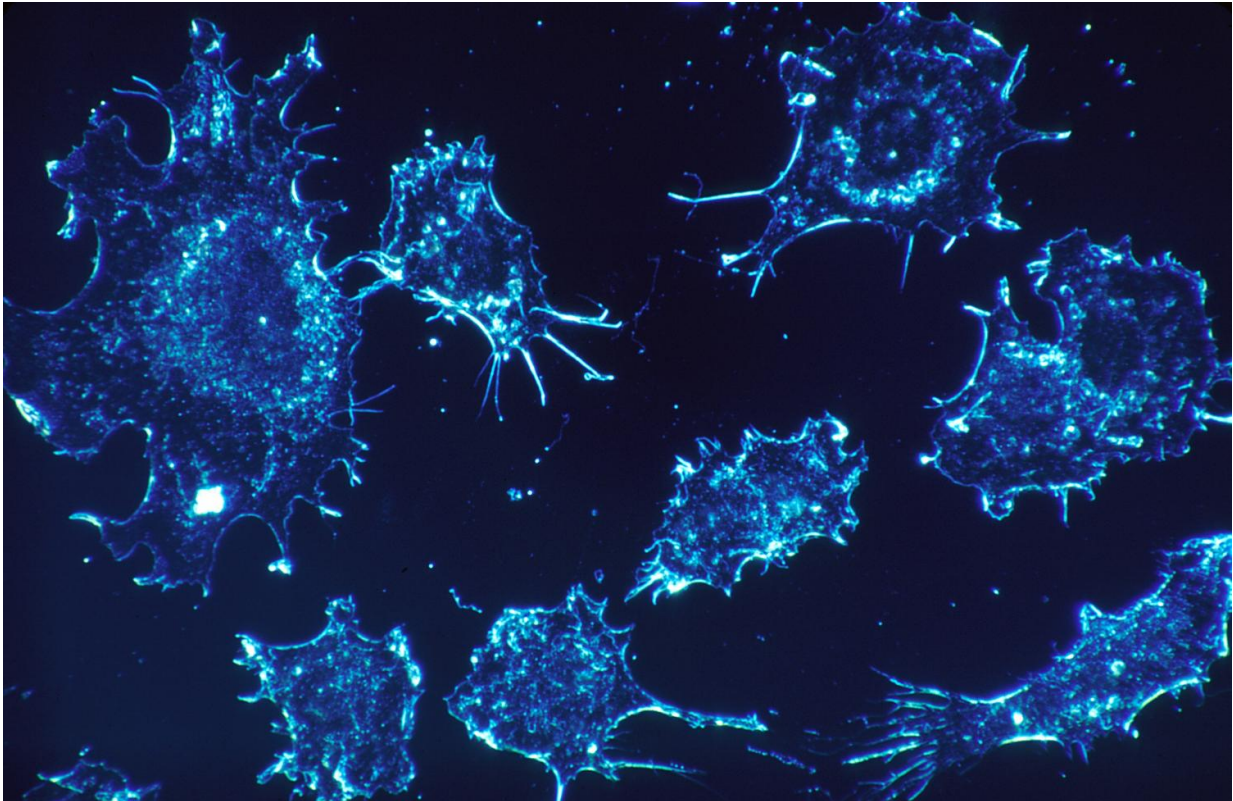


Detecting cancer in urine

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Credit: CC0 Public Domain

Feeling anxious around needles is common. The NHS estimates that around one in 10 people experience trypanophobia, a fear of medical procedures that involve needles or injections.

Unfortunately, in medicine, the use of needles is often necessary to

check on a person's health. But looking in the blood may not be the only way to find clues left behind by disease. Other bodily fluids, like [urine](#), also have the potential to reveal what's going on in our bodies.

"Urine gives a great insight into what's going on inside our bodies," says Mr Richard Bryan from the University of Birmingham, a Cancer Research UK-funded [bladder](#) cancer surgeon who's working on a [test](#) to detect the disease in its early stages.

"The beauty of urine is that it is abundant, and nobody really wants it other than people like me. It's very helpful when patients give permission for us to use their urine for research."

Bladder cancer is perhaps the most obvious cancer to find in urine, but evidence suggests that remnants of other cancers—like kidney, [prostate](#) and [cervical cancer](#) – can also get into pee.

How do cancer clues get into urine?

There are two main ways for cancer to end up urine—through the kidneys or from the bladder and ureters (the tubes that connect the kidneys to the bladder).

Molecules released by [cancer cells](#) can travel to the kidneys via the blood. But to pass through the kidney's delicate filtering system and enter the bladder, these molecules need to be small. They're usually molecular building blocks that make up cancer cells, like proteins.

And a useful clue doesn't have to come from the cancer directly. There are [promising studies](#) that show that the [human papillomavirus \(HPV\)](#), a virus responsible for the majority of [cervical cancer](#) cases, can be detected in the urine.

Larger clues—like entire cancer cells or their DNA—are too big to pass through the kidneys and will have to come from the bladder or ureters. Pee contains normal bladder cells that have dropped off from the lining of the urinary tract as part of the normal cell lifecycle. "If you have disease, diseased cells will be there too," says Bryan, whose research is looking for the [DNA of bladder cancer cells in urine](#).

Looking for bladder cancer in pee

We've discussed before that a successful cancer test needs to tick certain boxes.

Bryan says there's already an effective way to pick up bladder cancer in people who have symptoms, called cystoscopy, where a flexible camera is inserted into the urethra.

"Whether that is acceptable to use as a screening a test, is open to debate," says Bryan adding that even though the unpleasant procedure is reliable it's also expensive, labour-intensive and sometimes requires patients to be put to sleep to receive it.

At the moment the biggest 'reg flag' that a person might have bladder cancer is blood in their urine. It's a symptom that usually puts a person in line for cystoscopy.

"But only around a fifth of people with blood in their urine will actually have bladder cancer, so we're hoping to develop a urine test that will help narrow this down." Then those given the cystoscopy would be the ones most likely to need it.

To make this test, Bryan and his team are trying to [pin down the DNA fragments](#) from bladder cancer cells that appear in the urine, which would flag up those who need further tests.

"The aim then would be to take those with a positive urine test into the operating theatre to have a cystoscopy and treat them for the cancer right there and then, as soon as we see it."

The team have [tested](#) 800 urine samples for these DNA fragments. "We have a very promising experimental test that identifies the most common genetic changes seen in bladder cancer."

Now they're starting to look at whether they've managed to pick up cancer using these clues. And if they do find the test can detect cancer, it will then need to be validated in large clinical trials.

Bryan also says the test is not intended to screen the entire population as at the moment it wouldn't be cost-effective to give the test to everyone. But as well as those who are worried about blood in their urine, the test is likely to be useful to those who are at higher risk of bladder cancer. "This could be people who have smoked for a long time or who have worked with certain industrial chemicals for prolonged periods," he says.

A urine test to detect signs of bladder cancer could mean a swift and less invasive tool to decide if someone needs more tests. But where urine tests really have the power to transform the future for patients is pancreatic cancer.

Testing pee for pancreatic cancer

At the moment there's no easy way to diagnose pancreatic cancer at an early stage. A diagnosis usually involves a series of scans and invasive biopsies that are normally done once a person has developed symptoms. But by the time they show signs of illness, the disease is usually too advanced to be treated successfully.

A group of our scientists in London want to change this.

"We started like everybody else," says Professor Tatjana Crnogorac-Jurcevic from Queen Mary, University of London, "and began looking in the blood for pancreatic cancer." Her team soon realised blood was teeming with molecules released from all kinds of other cells.

Urine is a lot less crowded. Crnogorac-Jurcevic says around 40 percent of material found in urine is from outside the kidneys and urinary tract. "The blood plasma is filtered through the kidneys, so you can detect lots of things in it."

After 15 years of hard work, Crnogorac-Jurcevic and her team have found three key proteins linked to pancreatic cancer that successfully flag up its presence in pee.

She says that people often use the analogy for early detection as 'looking for a needle in a haystack'. "We've already gone through the haystack and found our needles, so now it's really a matter of evaluating our test on large samples of patients."

Excitingly, the clinical trial testing this [pancreatic cancer](#)-detecting tool is about to start recruiting patients.

"We're hoping that by the time we have the results of our clinical study we'll be ready to offer this test to patients," says Crnogorac-Jurcevic. Pancreatic cancer also isn't very common, so once a test is ready to go it will mostly likely be used on those who are known to have a higher risk of developing the disease, like people with certain genes.

It might be a few years until needles are a thing of the past when detecting the early stages of certain cancer types, but there's no doubt of the impact a urine test could have on a patient's wellbeing and how well they do.

Crnogorac-Jurcevic says it was extremely difficult for researchers looking at urine to get projects going at first because, "no one really thought you could find [cancer](#) markers in urine." But the perseverance is paying off, "I'm constantly looking ahead and I'm very pleased with where we are at the moment."

Provided by Cancer Research UK

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