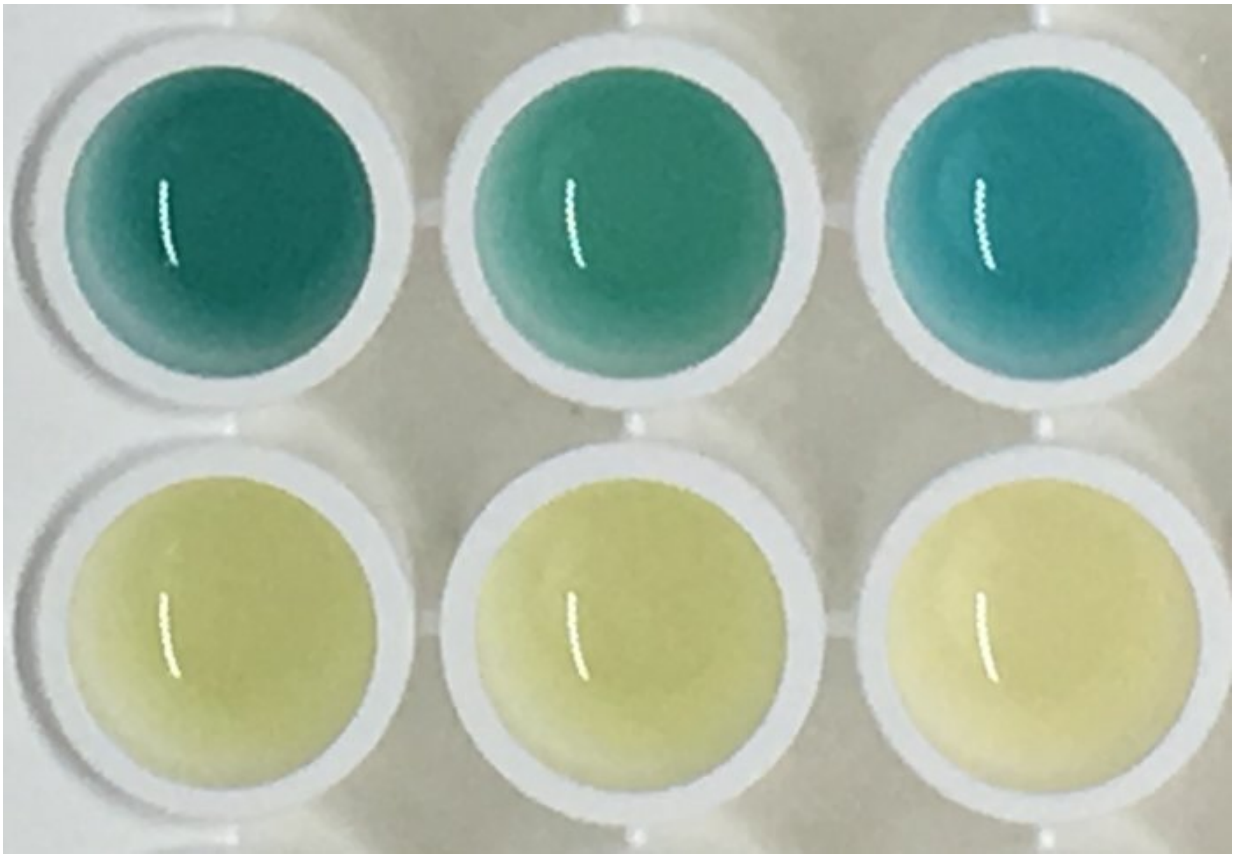
Color-change urine test for cancer shows potential in mouse study

September 3 2019, by Caroline Brogan



Mouse urine became blue in the presence of colon tumours. Credit: Imperial College London

A simple and sensitive urine test developed by Imperial and MIT engineers has produced a color change in urine to signal growing tumors

in mice.

Tools that detect cancer in its early stages can increase patient survival and quality of life. However, cancer screening approaches often call for expensive equipment and trips to the clinic, which may not be feasible in rural or developing areas with little medical infrastructure.

The emerging field of point-of-care diagnostics is therefore working on cheaper, faster, and easier-to-use tests. An international pair of engineering labs are championing this approach and have developed a tool that changes the color of mouse urine when colon cancer, also known as bowel cancer, is present.

The findings are published in *Nature Nanotechnology*.

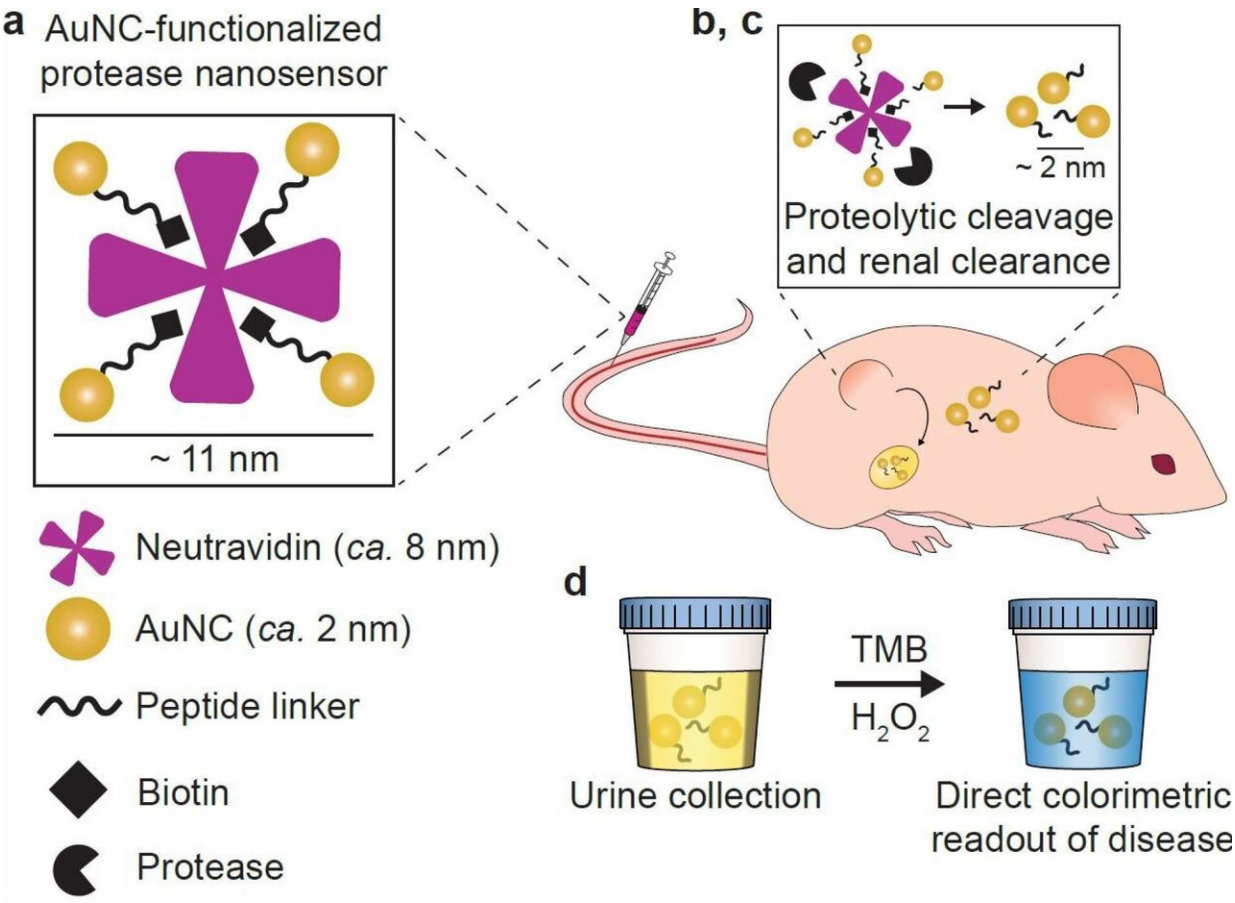
The early stage technology, developed by teams led by Imperial's Professor Molly Stevens and MIT's Professor Sangeeta Bhatia, works by injecting nanosensors into mice, which are cut up by enzymes released by tumors known as proteases.

When the nanosensors are broken up by proteases, they pass through the kidney, and can be seen with the naked eye after a urine test that produces a blue color change.

The researchers applied this technology to mice with colon cancer, and found that urine from tumor-bearing mice becomes bright blue, relative to test samples taken from healthy mice.

Professor Stevens, of Imperial's Departments of Materials and Bioengineering, said: "By taking advantage of this chemical reaction that produces a color change, this test can be administered without the need for expensive and hard-to-use lab instruments.

"The simple readout could potentially be captured by a smartphone picture and transmitted to remote caregivers to connect patients to treatment."



Creating the AuNC-protein complexes. Credit: Imperial College London

Sensing signals

When tumors grow and spread, they often produce biological signals known as biomarkers that clinicians use to both detect and track disease.

One family of tumor enzymes known as matrix metalloproteinases (MMPs) help promote the growth and spread of tumors by 'chewing up' the tissue scaffolds that normally keep cells in place.

Many cancer types, including colon tumors, produce high levels of several MMP enzymes, including one called MMP9.

In this study, the Imperial-MIT team developed nanosensors where ultra-small gold nanoclusters (AuNCs) were connected to a protein carrier called neutravidin, through linkers that are broken by MMP9s

To develop the color-changing urine test, the researchers used two AuNC properties—their very small (