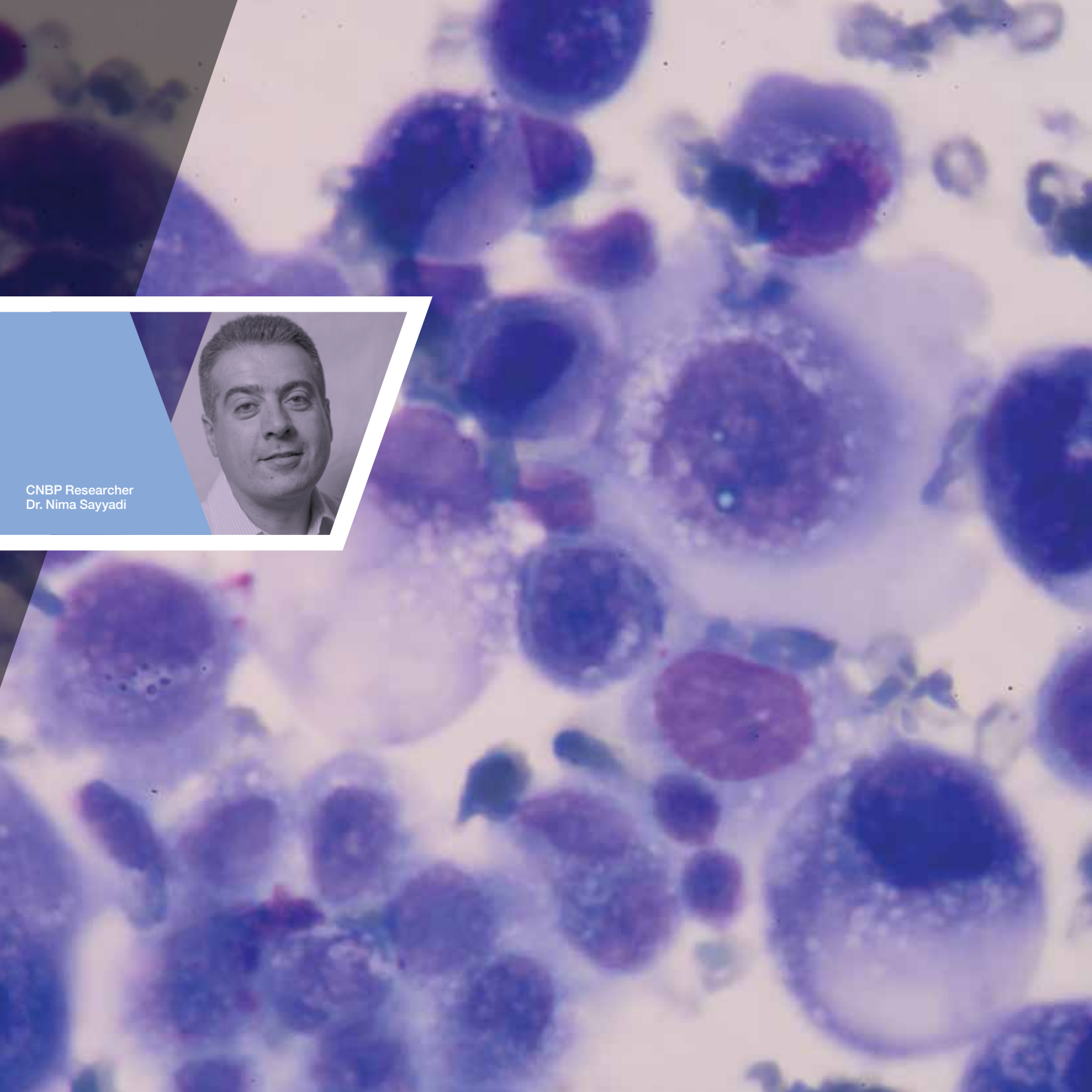

CNBP Researcher
Dr. Nima Sayyadi

Case Study

Detection of Prostate Cancer Cells

SENSITIVE IMMUNODETECTION OF PROSTATE CANCER CELLS

Dr. Nima Sayyadi

Rapid, sensitive, and non-invasive diagnostic tests for prostate cancer have the potential to lead to better treatment outcomes and lower healthcare costs. However, less than ten cancer cells need to be detected in large volumes of urine for useful diagnosis. Current urine cytology approaches lack required sensitivity at this level.

Detection of prostrate cancer cells (PCCs) in urine would be far more preferable than the current approach of invasive needle biopsy. More than 50% of the biopsies are negative for prostate cancer partially because the prostate specific antigen (PSA) biomarker in serum can be elevated for reasons other than prostate cancer. The low sensitivity (33%) widely used PSA have been increasingly recognized.

A highly specific IgG antibody (MIL38) was developed to specifically recognise PCCs by our collaborator Minomic International Ltd. However, at present, immunofluorescence urine cytology detection of PCCs is not sensitive enough as a diagnostic approach.

The fundamental problem in the detection of these low abundance PCCs in urine is the weak signal-to-noise ratio (SNR) obtained when using common fluorescence probes, such as fluorescein isothiocyanate (FITC), because of the overlapping of the fluorescent signal with the commonly encountered auto-fluorescent molecules within the cells and urine matrices; these factors combine to greatly reduce detection efficacy.

The capacity to quantify single prostate cancer cells has the potential to revolutionise the diagnostics industry.

We have developed time-gated immuno-luminescence detection of PCCs with up to two orders of magnitude greater sensitivity than the commercially available fluorescence probes.

Using long-lifetime lanthanide probes in conjunction with time-gated imaging, the cellular autofluorescence background is totally suppressed, allowing the capture of vivid, high contrast images of immunestained PCCs.

We are developing the application of orthogonal scanning automated microscopy (OSAM) techniques for fast scanning of the luminuscently stained PCCs on a microscope slide (in ~3 min) with high precision and high signal-to-noise ratios.

We are also currently working on a systematic analysis of the urine sample of pre-biopsy patients for the detection of PCCs using our technology in collaboration with Minomic International and Prof. Gillatt from Macquarie University Hospital.

The final goal is performing analysis of the urine of pre-biopsy patients in parallel with existing diagnosis methods, including PSA and MiCheck tests. The capacity to quantify single prostate cancer cells has the potential to revolutionise the diagnostics industry.