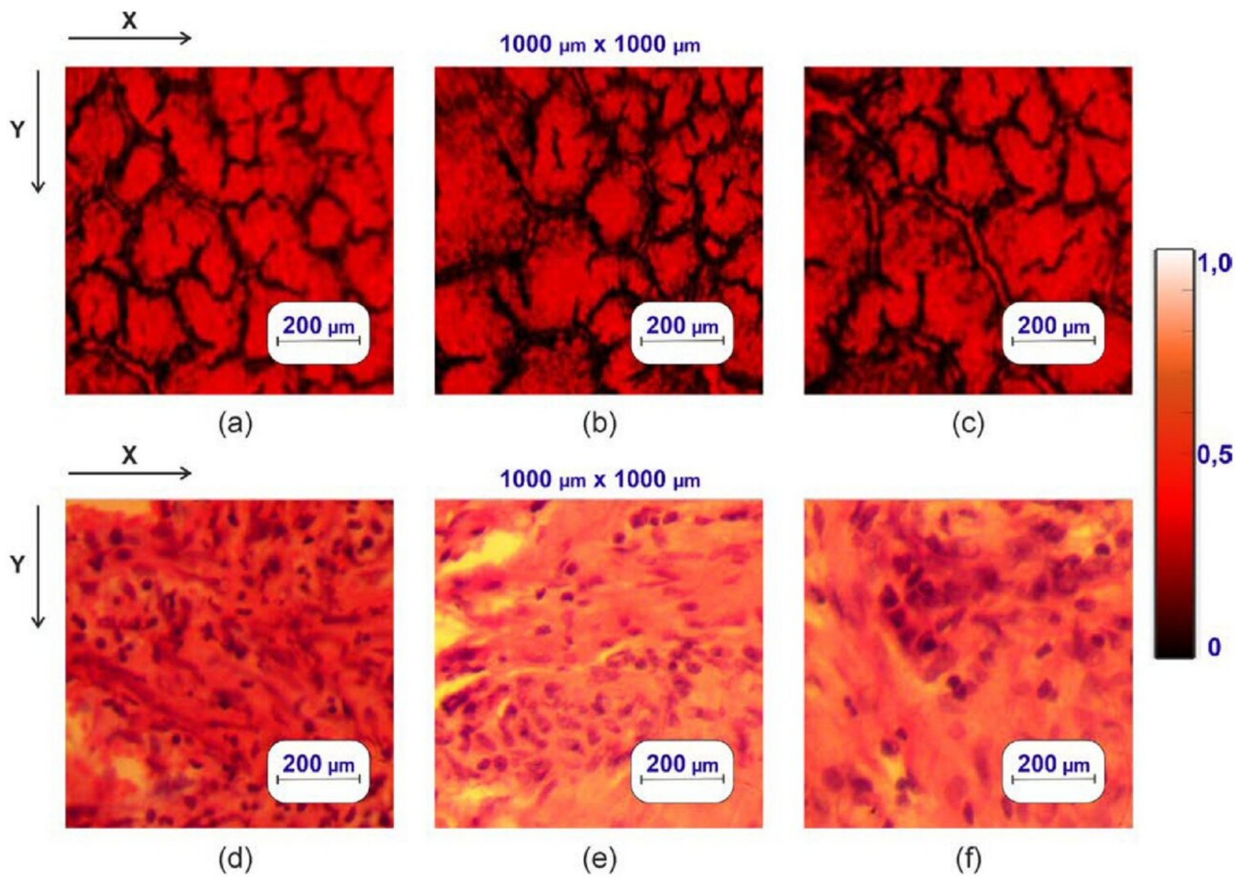
Novel light-based technique shows 90% accuracy in early prostate cancer detection

September 2 2024



Microscopic and histological images of blood smears and prostate tissue biopsies—thin (2–5 μm) films, respectively: (a) and (d) show blood smears and prostate tissue at normal conditions; (b) and (e) depict high-differentiation adenocarcinoma conditions; (c) and (f) illustrate low-differentiation adenocarcinoma. Credit: *Scientific Reports* (2024). DOI: 10.1038/s41598-024-63816-z

An Aston University researcher has used light to develop the first step towards a quicker, cheaper and less painful technique to detect cancer.

Professor Igor Meglinski from the University's Aston Institute of Photonic Technologies led the team that has developed a new method of analyzing the crystals in dehydrated blood. Their paper "Insights into polycrystalline microstructure of blood films with 3D Mueller matrix imaging approach" has been published in the journal *Scientific Reports*.

Professor Meglinski used a new polarization-based image reconstruction technique to analyze polycrystalline structures in dried blood samples. The proteins in blood change their shape and how they fit together during the early stages of diseases like cancer. Professor Meglinski and his team used changes in the proteins' tertiary structure or unique 3D shape together with its quaternary structure—which is how multiple proteins join together—to detect and classify cells.

This technique enabled the researchers to conduct a detailed layer-by-layer analysis of dry blood smears, which is crucial for identifying significant differences between healthy and cancerous samples.

The researchers analyzed 108 blood film samples from three equal size groups: healthy volunteers, those who had prostate cancer and a third group who had the illness and had cells that were more likely to aggressively spread.

Professor Meglinski said, "Our study introduces a pioneering technique to the liquid biopsy domain, aligning with the ongoing quest for non-invasive, reliable and efficient diagnostic methods. A key advancement in our study is the characterization of the mean, variance, skewness, and kurtosis of distributions with the cells which is crucial for identifying significant differences between healthy and cancerous samples.

"This breakthrough opens new avenues for cancer diagnosis and monitoring, representing a substantial leap forward in personalized medicine and oncology."

The study's findings had a 90% accuracy rate of both early diagnosis and classification of cancer which is much higher than existing screening methods. Also, as the technique relies on blood samples instead of tissue biopsies, it is less traumatic and risky for patients.

Professor Meglinski added, "This high level of precision, combined with the non-invasive nature of the technique, marks a significant advancement in liquid biopsy technology. It holds immense potential for revolutionizing cancer diagnosis, early detection, patient stratification and monitoring, thereby greatly enhancing patient care and treatment outcomes.

"This study also presents a testament to the resilience and support of our Ukrainian colleagues involved in the research, especially in light of the ongoing conflict in Ukraine."

More information: Alexander G. Ushenko et al, Insights into polycrystalline microstructure of blood films with 3D Mueller matrix imaging approach, *Scientific Reports* (2024). DOI: 10.1038/s41598-024-63816-z

Provided by Aston University