'Stickiness' key to better diagnostics and pharmaceuticals

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"The stickiness, or viscosity, of liquids is incredibly important in biology," Professor Bowen said. Credit: The University of Queensland

The 'stickiness', or viscosity, of microscopic liquids can now be measured thousands of times faster than ever before, potentially leading

to better understanding of living cells, disease diagnostics and pharmaceutical testing.

University of Queensland's Professor Warwick Bowen and his colleagues at the Queensland Quantum Optics Lab developed the world-leading technology, technology that uses lasers to track microscale particles with world-record precision.

"The stickiness, or viscosity, of liquids is incredibly important in biology," Professor Bowen said.

"In living cells, viscosity fluctuations control shape and structure, modulate chemical reactions, and signal whether a cell is healthy or cancerous.

"However, current technologies to measure viscosity are too slow to monitor and track these important changes.

"Our innovative new technology overcomes this by achieving viscosity measurements a thousand times faster than ever before."

The technology may lead to a fundamental revision of scientists' understanding of cells.

"It's thought that fast viscosity fluctuations may occur in our cells—linked to their turbulent or chaotic activity—though they've never been observed," Professor Bowen said.

"Observing them would be re-calibrate our understanding of cells—it would force us to revise our basic models of cellular dynamics.

"These phenomena are predicted to occur on sub-millisecond timescales, far faster than can be measured with previous technology, but

completely measurable with ours.

"Cells are the building blocks of life—we could be on the precipice of reimagining how they function."

Dr. Lars Madsen said the discovery may spur advancements in pharmaceutical testing, allowing companies to quality control their drugs faster, and with greater accuracy.

"There are many moving parts when it comes to pharmaceutical manufacture—stirring, pumping, filling," Dr. Madsen said.

"These processes need to be incredibly exact, and usually have to be controlled by performing regular viscosity checks with a viscometer.

"We've invented an alternative technology, with accuracy and selectivity far beyond existing viscometer technology.

"Faster, more accurate testing can create products that are not only be safer, but could offer better storage stability, reduce costs significantly by improving yield, reduce raw material variability and increase delivery reliability.

"We've all seen the impacts of pharmaceutical hold-ups this year—speed-to-market is critical in this industry."

The research is published in *Nature Photonics*.

More information: Ultrafast viscosity measurement with ballistic optical tweezers, *Nature Photonics* (2021). DOI: 10.1038/s41566-021-00798-8

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