Making better biosensors with electron density waves

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An emerging field with the tongue-twisting name of "optofluidic plasmonics" promises a new way to detect and analyze biological molecules for drug discovery, medical diagnostics, and the detection of biochemical weapons. Investigators at the University of California, San Diego led by Yeshaiahu Fainman have succeeded in merging a microfluidics system with plasmonics -- sometimes called "light on a wire" -- onto a single platform. Plasmonics is based on electron waves on a metal surface excited by incoming light waves.

According to Fainman, tapping the potential of plasmonics for biomolecule detection systems has been a challenge, because localized optical field scales are usually much larger than the molecules in question. In order to make a useful optical biosensor, he says, "We need to increase the interaction cross-section by finding ways to localize optical interrogation fields ideally to the scales comparable to those of biomolecules." Since that is not currently possible, he and his team used an approach of integrating microfluidics and plasmonics on single chips, allowing fluid to ferry the molecules into the cross-section of the optical field.

Fainman expects the system to be particularly useful in studying large arrays of protein-protein interactions for identifying potential drugs that bind to specific target molecules, which may lead to earlier cancer diagnoses and faster discovery of new drugs. Unlike most current methods, optical detection does not require labeling of molecules with fluorescent or radioactive entities -- labels often hinder interaction by

covering up or blocking binding surfaces.

The new platform also carries the advantage of being high throughput and multiplexed, offering researchers an opportunity to examine thousands of arrayed compounds simultaneously, which, he says, "biologists and physicians get very excited about."

Fainman will present these results at Frontiers in Optics (FiO) 2010/Laser Science XXVI -- the 94th annual meeting of the Optical Society (OSA).

More information: The presentation, "Optofluidic Nano-Plasmonics for Biochemical Sensing" is at 4 p.m. on Tuesday, Oct. 26.

Provided by Optical Society of America

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