Increased sensitivity for better detection

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A group of European scientists from Imperial College London in the United Kingdom and the University of Vigo in Spain has made a technological breakthrough with its development of an ultra-sensitive test with the capacity to detect signs of a disease in its earliest stages. This study is presented in the journal *Nature Materials*.

The scientists, including one Marie Curie Action beneficiary, have developed a new diagnostic blood test to detect a biomarker called prostate specific antigen (PSA) that is associated with prostate cancer. Monitoring the levels of PSA at ultra-low concentrations is crucially important for early diagnosis, particularly for those patients with prostate cancer reoccurrence, It should be noted that current detection approaches are not sufficiently sensitive to carry out this analysis with a high degree of accuracy.

"It is vital to detect diseases at an early stage if we want people to have the best possible outcomes - diseases are usually easier to treat at this stage, and early diagnosis can give us the chance to halt a disease before symptoms worsen," said senior author Professor Molly Stevens from the Departments of Materials and Bioengineering at Imperial College London. "However, for many diseases, using current technology to look for early signs of disease can be like finding the proverbial needle in a haystack. Our new test can actually find that needle. We only looked at the biomarker for one disease in this study, but we're confident that the test can be adapted to identify many other diseases at an early stage."

The researchers detected PSA in whole serum at concentrations of nine

orders of magnitude lower than tests currently in use. They achieved such ultra-sensitivity with an enzyme called glucose oxidase (GOx), which controls the rate of crystallization of silver to favour either the nucleation or growth of nanocrystals on plasmonic nanosensors (gold nanostars) which register the signal. By taking advantage of a so-called "inverse sensitivity phenomenon," the scientists coupled the enzyme to antibodies specific for PSA and used it in immunoassays to detect PSA in the range of 10-18 g/ml.

The team plans to carry out further clinical testing to assess the efficacy of the biosensor in detecting a range of different biomarkers associated with various diseases, such as AIDS. They will also explore ways of commercialising their product.

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