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Commentary

Nano-Enabled Biosensor for Detection of *N. gonorrhoeae*

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DESCRIPTION

The increasing prevalence of sexually transmitted diseases calls for the urgent development of multiplexed, quick diagnostic methods. Here, we present a new nanoplasmonic biosensor for the simultaneous detection of *Neisseria gonorrhoeae*, the most widespread bacterial illness. Our plasmonic microarray contains gold nanohole sensor arrays that have Extraordinary Optical Transmission (EOT), enabling label-free and highly sensitive examination. The real-time identification and quantification of the bacteria is made possible by the integration in a microfluidic system and the exact immobilisation of certain antibodies on the individual sensor arrays. Our direct immunoassay of urine samples produced exceptional sensitivity, with a limit of detection of 300 Colony Forming Units (CFU)/mL for C. trachomatis has 1500CFU/mL. *N. gonorrhoeae*. The multiplexing capability of our biosensor was demonstrated by analysing different urine samples spiked with either *C. trachomatis* or *N. gonorrhoeae*, and also containing both bacteria. Without the need of DNA extraction or amplification methods, we were able to successfully detect, identify, and quantify the amounts of the two bacteria using a one-step experiment. This discovery offers up new avenues for the application of point-of-care biosensors that allow for quick, easy, and effective diagnosis of STDs.

Neisseria gonorrhoeae, a human pathogen that has adapted to its host, is the cause of the sexually transmitted illness *gonorrhoeae*. Over 90% of the world's 87 million new cases, according to the World Health Organization (WHO), occur in undeveloped areas. *Gonorrhoeae* is a serious public health issue due to an increasing global morbidity. The urogenital tract, pharynx, conjunctivae, and rectum are only a few exposed anatomic areas where *N. gonorrhoeae* can easily infect the mucosa and cause significant disease if not promptly and appropriately treated. Infection in females causes tubal factor infertility, ectopic pregnancy, chronic pelvic pain, and pelvic inflammatory disease. Additionally, infections during pregnancy have been linked to preterm birth, low birth weight, spontaneous abortion, and early membrane rupture. Hyper-acute conjunctivitis, corneal perforation, and blindness can all result from maternal transfer to newborns during birth. Prostatitis and epididymo-orchitis can result from a gonococcus infection in guys. Infection and transmission of the Human Immunodeficiency Virus (HIV) are also linked to *gonorrhoeae*. Therefore, the creation of a diagnostic test for *N. gonorrhoeae* is essential for quick treatment and the abatement of further transmission.

A measurement device for analyte detection that combines a biological component with a physicochemical detector is known as a biosensor. The biosensor's design and intended use affect how an analyte is detected. With the addition of simple attachments, several everyday items, like cell phones, can be used as biosensors. For example, they created a non-invasive smartphone-based urea biosensor that uses saliva as a sample. This enables quick and inexpensive preliminary detection. Biosensors typically identify substances linked to disease, such as nucleic acids, proteins, and cells. Their three main parts the physiologically sensitive element, the detecting element, and the reader device allow for this. The biomolecules are identified using enzymes, bacteria, organelles, antibodies, and nucleic acids. Additionally, researchers need to determine what is needed to build a gadget that is functional for the intended purpose. Therefore, multidisciplinary research is essential to choosing the right material, transducing technology and biological component before putting the biosensor together. Biosensors are used in the medical field to find biomolecules linked to disease. These devices have created a non-invasive glucose testing method based on a disposable saliva nano-biosensor to increase patient compliance, lower complications, and lower costs associated with managing diabetes.

These devices can monitor the biochemical markers of a disease in body fluids such as saliva, blood, or urine. In comparison to the UV spectrophotometer, they achieved exceptional results in the clinical trials for Sensors 2020, 20, 6926 3 of 26 accuracy. The disposable gadget can therefore be offered as an option for tracking salivary glucose in real time. Other clinical diagnostic uses for biosensors include the measurement of cholesterol, cardiovascular disease markers, cancer or tumour biomarkers, allergic reactions, and infections with pathogenic bacteria, viruses, and fungi. In addition, biosensors can be used to find

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bacteria and viruses in water and food, which are potential disease-causing agents. For the quick in-situ detection of *E. coli*, a low-cost, portable microfluidic chemiresistive biosensor based on monolayer graphene, AuNPs, and streptavidin-antibody system was created. In this instance, the biosensor's surface is used to catch the bacteria, and electric readouts are used to detect them. By using a self-assembled monolayer, the creation of a Glutathione-S-Transferase tag for White spot Binding Protein (GST-WBP) fixed onto a gold electrode. Due to the interaction between the immobilized GST-WBP and the White Spot Syndrome Virus (WSSV), this biosensor is able to detect WSSV in shrimp pond water.