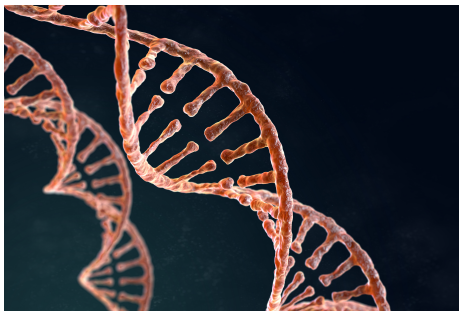
A method for detecting RNA and DNA using surface-enhanced Raman scattering (SERS)

Unmet Need

The development of practical and sensitive techniques for screening nucleic acid biomarkers related to medical diseases and cancers is critical for early diagnosis, prevention, and effective interventions. Recent advances in molecular profiling technology have made significant progress in the discovery of various biomarkers. It has been implicated that biomarkers such as single?nucleotide polymorphisms (SNPs) variations in DNA and microRNAs (miRNAs) could serve as important predictors of cancer risk and progression. SNPs are the most common genetic variations and could contribute to disease risk by creating genetic instability. miRNAs, a class of small noncoding endogenous RNA molecules, are emerging as promising biomarkers for many diseases including cancer diagnostics and classification. Fast and precise measurement of SNPs and miRNAs will help identify molecular signatures critical for the evaluation of cancer risk and early detection of diseases. Currently, there is a strong need to develop these technologies for use at the point of care or global health applications.

Technology

Duke inventors have developed a novel approach for detecting RNA and DNA using surface?enhanced Raman scattering (SERS). This invention can be applied to the development of nucleic acid diagnostic tools for biomedical diagnostics and biosensing applications using SERS detection. The label-free technology uses plasmonic coupling interference (PCI) nanoprobes designed to assemble in a nanonetwork of silver nanoparticles through Raman?labeled oligonucleotide duplexes. The formation of nanonetworks induces a



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Meet the Inventors

Vo-Dinh, Tuan
Wang, Hsin-Neng

Department

Biomedical Engineering (BME)

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External Link(s)

• From the lab of Dr. Tuan Vo-Dinh

strong plasmonic coupling effect leading to intense SERS signals from the Raman labels located between nanoparticles. In the presence of targets of interest, the formation of nanonetworks is interfered and inhibited by the target sequences. Consequently, the plasmonic coupling effect is significantly diminished, resulting in reduced SERS signals. The potential of the PCI technique for biomedical applications has been illustrated by detecting single?nucleotide polymorphism (SNP) and miRNA sequences involved in breast cancers.

Advantages

- A label-free approach for detecting nucleic acids
- Has been demonstrated to detect SNPs and miRNAs
- Could be used in a variety of applications in disease diagnosis and environment sensing
- Can use portable and/or handheld Raman reader
- Possibility of using smartphones for rapid screening