

GOVERNMENT OF INDIA
MINISTRY OF ELECTRONICS AND INFORMATION TECHNOLOGY
LOK SABHA
UNSTARRED QUESTION NO. 1431
TO BE ANSWERED ON 04.12.2024

DNA APTAMER TECHNOLOGY

1431. SMT. SMITA UDAY WAGH;
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Will the Minister of ELECTRONICS AND INFORMATION TECHNOLOGY be pleased to state:

- (a) the key features and potential applications of the indigenous healthcare technologies, such as the DNA Aptamer for prostate cancer detection and the Photonic Chip-based spectrometric biosensor, recently transferred to industry by IIT Delhi under the Nano electronics Network for Research Application (NNetRA) project;
- (b) whether the DNA Aptamer technology contribute to prostate cancer detection and if so, its advantages over existing methods;
- (c) the role of the Photonic Chip-based spectrometric biosensor in healthcare along with its broader potential applications; and
- (d) the manner in which the Government is facilitating the commercialization and adoption of these technologies and its likely impact on the healthcare industry?

ANSWER

MINISTER OF STATE FOR ELECTRONICS AND INFORMATION TECHNOLOGY
(SHRI JITIN PRASADA)

(a): Key features and potential applications of the indigenous healthcare technologies:

i. Deoxyribonucleic acid (DNA) Aptamer for prostate cancer detection:

Aptamers:

Aptamers are small molecules that can bind to specific targets such as proteins, carbohydrates and even live cells with high affinity.

Role of Aptamers in Cancer:

In cancer cells, some proteins, specific to the type of cancer, are at abnormally high level as compared to in the normal cells. These proteins can be used to identify the presence of the cancer cells, their localisation throughout the body and for cancer therapy. Since aptamers can bind to specific targets such as proteins, carbohydrates and even live cells with high affinity, therefore they may be used to target this specific protein on the surface of the cancer cells.

Contribution of IITD:

Researchers at IIT Delhi have fabricated DNA aptamers to target the proteins on the surface of prostate cancer cells. It can work as an excellent sensing element for biosensors due to its small size (2 nm), high affinity towards specific ligand/binder and stability.

Potential applications:

Along with the detection, fabricated DNA aptamers at IIT Delhi may provide the functionality to act for prostate cancer cells. For this, the fabricated aptamer has been conjugated/bound with a drug used to treat the prostate cancer. Due to small size, (approximately one fifth size of antibodies), aptamer has additional advantages as sensing layer for photonic biosensor devices; and can help as drug delivery agent.

Potential applications of this technology are in the development of point-of-care in vitro diagnostics especially in low-resource settings due to its robust nature.

ii. Photonic Chip-based spectrometric biosensor:

The photonic chip based spectrometric biosensor developed at IIT Delhi are portable, light weight, show quick response, highly sensitive for accurate detection of pathogens. The biosensor utilises Guided Mode Resonance (GMR) technology. The GMR technology entails etching of the special pattern and engrooves on the substrate which uses light waves and sensing layer to make a precise biosensor.

Advantages and Applications of Chips:

The fabricated chips are reusable and provide rapid detection of number of pathogens by using a very low sample volumes required to obtain the information on the presence of pathogens. This sensor may prove extremely useful for food and health industry.

(b): Contribution of the DNA Aptamer technology to prostate cancer detection and its advantages over existing methods

Contribution of the DNA Aptamer technology:

DNA aptamer technology has huge potential to contribute to prostate cancer detection as well as treatment.

Existing Methods:

Traditionally, “Prostate Specific Antigen (PSA)” is used as the biomarker for prostate cancer. However, PSA level in the body has been reported to be affected by several factors such as obesity or some medications. This has resulted in false positives in many cases.

Advantages of DNA Aptamers technology over existing methods:

DNA aptamer technology is advantageous over the PSA based technique as it overcomes the challenges due to its high affinity towards prostate cells.

In addition, this technology provides greater stability, minimal immunogenicity, and scalability.

(c): Role of the Photonic Chip-based spectrometric biosensor in healthcare and its potential applications

The biosensor is extremely sensitive to the presence of pathogens as well as other disease biomarkers that binds with high selectivity of antibody immobilized/bound on sensing layer hence can be used for wide range of healthcare applications.

This sensor may have potential applications in food industry as well.

Advantages over existing methods:

The advantages over the other existing detection schemes are its high selectivity, rapid detection and reusable nature.

(d): Government support in facilitating the commercialization and adoption of these technologies and the impact expected on the healthcare industry

The technologies developed have been transferred to interested private companies and start-ups through Foundation for Innovation and Technology Transfer (FITT) section of IIT Delhi. Incubation of a new startup for the same is also under process at IIT Delhi.

MeitY along-with other Govt agencies such as DBT, ICMR etc. have schemes to support for clinical trials, certification, prototyping etc for startups and industries to commercialise these technologies.

Through adoption of these new indigenous technologies for healthcare industry, early cancer detection, disease monitoring, food quality, and many more such applications may be feasible.
