

# Diagnostic Pathology: Open Access

## Nanotechnology in the Development of COVID-19 Vaccine

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### Editorial Note

Nanotechnology is an evolving science that is expected to advance popular and widespread in the future. It enhances current production methods, materials and implementations by scaling them down in order to eventually completely leverage the unique quantum and surface dynamics that matter exhibits at the nanoscale.

Nanomedicine draws on the natural scale of biological phenomena to develop specific approaches for the prevention, diagnosis and treatment of diseases. It plays a major role in vaccine development as it is suitable for delivering antigens, acting as adjuvant platforms, and emulating viral structures. For the first time, emerging innovations and techniques are expected to have a therapeutic influence from a vaccine technology growth point of view. Next-generation vaccines that have been facilitated by developments in nanotechnology are classified into the following.

#### Peptide-based Vaccines

Peptide-based vaccines can be formulated by an effective nanocarrier encoded by nucleic acid vaccine formulations as peptides plus adjuvant mixtures. These are the simplest type of easily developed, validated, and efficiently produced vaccines i.e., 10 million doses of influenza vaccine within one month to demonstrate the speed and scalability.

Viruses like particles are an interesting nanotechnology category for peptide vaccines due to their ability to mimic the molecular patterns associated with pathogens that serve not only as the delivery platform but also as adjuvant. Various B- and T-cell epitopes of the SARS-CoV-2 S protein have been identified using a combination of informatics and immunological analysis of antibodies and patient plasma.

#### Nucleic-acid based Vaccines

These are developed to deliver the genetic code for the in situ development of viral proteins as a promising alternative to traditional vaccine methods. This category includes both DNA and mRNA vaccines and is being investigated in the perspective of the COVID-19 pandemic. A variety of COVID-19 vaccines are being produced using DNA or RNA. Though DNA vaccines are more stable than mRNA vaccines, the mRNA is not incorporated and therefore does not pose a risk of insertional mutagenesis.

### Subunit Vaccines

Subunit vaccines use only limited pathogenic virus structural elements such as virus proteins or assembled Virus Like Particles