Docket #: S20-302

Intranasal, multivalent SARS-CoV-2 vaccine

The emergence of SARS-CoV-2 variants during the COVID-19 pandemic has demonstrated a need for broad immunization, such as provided by multivalent vaccines. In response, Stanford researchers have formulated a SARS-CoV-2 vaccine that allows delivery of all the SARS-CoV-2 surface antigens or multiple antigen variants, in order to provide broader protection than the monovalent vaccines currently in emergency use.

The researchers have leveraged their recently developed gold-polymer nanoparticles (see 'Publications') to carry eight SARS-CoV-2 mRNAs and proteins. The particles can be delivered to the respiratory mucosa via intranasal administration for specific immunization of the initial site of SARS-CoV-2 infection.

Stage of development

Proof-of-concept. The researchers have demonstrated nanoparticle delivery and generic mRNA expression in mouse lung via intranasal administration. They have formulated nanoparticles loaded with both mRNAs and proteins for all four SARS-CoV-2 surface antigens.

Applications

- Intranasal, multivalent SARS-CoV-2 vaccine for respiratory immunization
- Potential to treat other lung diseases with local mRNA and protein delivery

Advantages

- Delivers multiple antigens
- More practical than intramuscular route, especially for chronic vaccinations

- Targets lung mucosa to:
  - Reduce systemic side effects
  - Avoid circulating blood
  - Reduce hepatic/renal clearance
  - Increase lung-resident memory B and T cell responses

Publications

- Sukumar et al. Biomaterials (2019) "Intranasal delivery of targeted polyfunctional gold–iron oxide nanoparticles loaded with therapeutic microRNAs for combined theranostic multimodality imaging and presensitization of glioblastoma to temozolomide"

Patents

- Published Application: WO2022026917
- Published Application: 20230277646
- Issued: 12,678,496 (USA)

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