Rapid Development of SARS-CoV-2 Monoclonal Antibodies

Offers potential for diagnostic, research, and therapeutic applications

This panel of SARS-CoV-2-specific monoclonal antibodies has the potential to advance significant diagnostic, research, and therapeutic applications against COVID-19. Working with the U.S. Centers for Disease Control and Prevention (CDC), innovators at Georgia Tech developed and functionally characterized 158 nanomolar-affinity mouse monoclonal antibodies specific to SARS-CoV-2, using an accelerated immunization and hybridoma screening process. The innovation has the potential to produce an unmatched set of reagents for research and development.

Researchers focused on the receptor binding domain (RBD) with approximately 300 amino acids within the S1 subunit of the spike protein because of its key interaction with the human angiotensin-converting-enzyme 2 (hACE2) receptor present on many cell types, especially lung epithelial cells. The research team identified three groups of neutralizing antibodies recognizing distinct epitopes on the RBD motif with high affinity, as inferred from sequence and competitive binding experiments. Additionally, differing functions—including binding of diverse protein epitopes, viral neutralization, impact on RBD-hACE2 binding, and immunohistochemical staining of infected lung tissue—were correlated with variable gene usage and sequence.

The researchers further determined that the antibody response to the SARS-CoV-2 RBD can be functionally diverse, which can have significant utility in a variety of applications. Data to support SARS-CoV-2-specific binding include enzyme-linked immunosorbent assay (ELISA) and label-free binding measurements using recombinant proteins, immunofluorescence in culture, immunofluorescence staining of tissue from infected patients, and virus neutralization assays.

Summary Bullets

- **Powerful**: Demonstrates potential to recognize intact SARS-CoV-2 virions with high affinity
- **Highly efficient**: Enables researchers to select pairs of high-affinity antibodies that bind to different receptor sites, maximizing the efficiencies of sandwich-style rapid testing methods
- **Enabling**: Furthers the development of neutralizing antibodies that can be used as therapeutic agents, delivered either directly or via mRNA for in situ expression

Solution Advantages

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Potential Commercial Applications

- Diagnostics
- Therapeutics
- Vaccines

Background and More Information

There is a need for high-affinity SARS-CoV-2-specific monoclonal antibodies for use against the COVID-19 pandemic, as such reagents can offer significant diagnostic, research, and therapeutic applications. Studies of earlier coronaviruses have informed current SARS-CoV-2 vaccine design, especially epitope motifs to target virus neutralization; however, a full assessment of different potential epitopes and the effects of their binding has not yet been described. This joint effort by Georgia Tech and CDC fully characterized a large panel of monoclonal antibodies that demonstrate a breadth of function against the SARS-CoV-2 virus.

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