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Special Issue Reprint

# Detection of SARS-CoV-2 Neutralizing Antibodies and Vaccine Development

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The development and deployment of safe, effective, affordable, and accessible vaccines are essential for reducing transmission and disease severity. A central component of vaccine evaluation and immune protection against SARS-CoV-2 is the measurement of neutralizing antibodies, which serve as key indicators of antiviral immune activity. Accordingly, there is an urgent need for standardized, reliable, and reproducible in vitro potency assays to assess antiviral products throughout preclinical and clinical development. Neutralizing antibody assays are critical not only for evaluating vaccine efficacy but also for characterizing immune responses in COVID-19 patients, asymptomatic individuals, and vaccinated populations. However, current SARS-CoV-2 neutralization assays—including live virus, recombinant virus, pseudotyped virus, and competition-based assays—exhibit substantial methodological diversity. Differences in protocols, reagents, and result interpretation across laboratories have led to significant variability, limiting comparability between studies and vaccines and hindering the establishment of robust correlates of protection. This reprint provides a systematic and up-to-date overview of advances in SARS-CoV-2 neutralization assay development and vaccine evaluation. By summarizing methodological progress and remaining challenges, it aims to serve as a reference for researchers, clinicians, regulatory scientists, and public health professionals involved in COVID-19 research and response.

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