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Platform for High-Throughput Quantification of Neutralizing Antibodies

-In the past 10 years, there have been many new viral pathogens which have emerged as major public health threats, including Ebola virus, SARS-CoV, Zika virus and most recently SARS-CoV-2. Quantitative measurement of neutralizing antibodies (nAbs) is important for determining sterilizing immunity as well as evaluating effectiveness of vaccines and some therapeutics. Unfortunately, most nAb assays require high biosafety level (BSL) lab settings or lab-based equipment and professional training, which hinder large scale implementation. There is a need for low-cost, high-throughput platforms to measure nAbs against viral pathogens.

Researchers at Arizona State University have developed a novel metal nanoparticle-based rapid diagnostic platform that is sensitive, low-cost and epitope-specific for the detection of nAbs in a blood sample. Utilizing magnetic nanoparticles, and an innovative technique, neutralizing antibodies bind and cause nanoparticle aggregation and precipitation. This precipitation causes the solution to change color. This assay is compatible with portable electronic systems with mounted photodetectors as well as high throughput well-plate readers with electronic systems. Further, high BSL facilities and complicated laboratory equipment and training are unnecessary.

This low cost, simple operation platform provides rapid, high-throughput and epitope-specific quantification of nAbs which can be deployed in both laboratory and point-of-care settings.

Potential Applications

- Determining sterilizing immunity for:
  - General population, patients in long-term care facilities, immune-compromised individuals, etc.
- Evaluating vaccine effectiveness
- Determining potential best use of convalescent plasma and antibody treatments
- Epidemiological/Longitudinal studies

- Large-population serosurveillance in determining the level of herd immunity

Benefits and Advantages

- This platform is quantitative and accurate, with an expected dynamic range of 3 to 4 logs and a detection limit in the picomolar range
- Low cost, simple operation and automated
  - Accessible in both lab and point-of-care use
  - Could be useful in longitudinal studies of the immune response to infection, vaccination, and potential viral escape due to mutations
- Can be implemented in a rapid detection format without any washing steps, thus significantly simplifying its operation, reducing assay time to a few minutes, and making it feasible for masstesting
- Readout can be performed in a portable system or a high-throughput well plate format, making the system automated in both detection and data analysis
- Could help timely determine the potential best uses of convalescent plasma and antibody treatment with future emerging pathogens

For more information about the inventor(s) and their research, please see

Dr. Wang's departmental website