Nanotechnology sensor for detection of influenza viruses in swine

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Key points:

- Nanotechnology based Giant magnetoresistance (GMR) biosensor has been developed for detection of influenza A virus (IAV)
- Although this technology is still being tested, if successful, it has the potential for serving as an affordable, fast, and with multiplex capacities diagnostic test for influenza viruses in swine
- Further improvement of this method to integrate into portable, hand-held device can make this technology available for "point-of-care" testing/ application

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Our objective:

To develop simple, sensitive and specific method for detection of influenza viruses in swine with minimum sample handling and laboratory skill requirements so that it can be used in the farm

Our approach:

We applied nanotechnology to develop GMR biosensor for influenza virus detection. This technology uses antibodies and magnetic nanoparticles (MNPs) in combination with electrical detection. It is based on the fact that stray fields from MNPs bound on sensor surface will alter magnetization and alters GMR sensor resistance, which is measured using an electrical readout. Presence of influenza virus makes MNPs bind to the GMR sensor through antibodies (Fig. 1 A and B) resulting in change in resistance, which transforms into an electrical signal.

Findings:

GMR biosensor detected as low as 1.5×10^2 $TCID_{50}$/mL influenza virus H3N2v (Fig 1C)
Signal intensity increased with increasing concentration of virus up to 1.0×10^5 $TCID_{50}$/mL, thus having approximately 4 log dynamic range of detection.

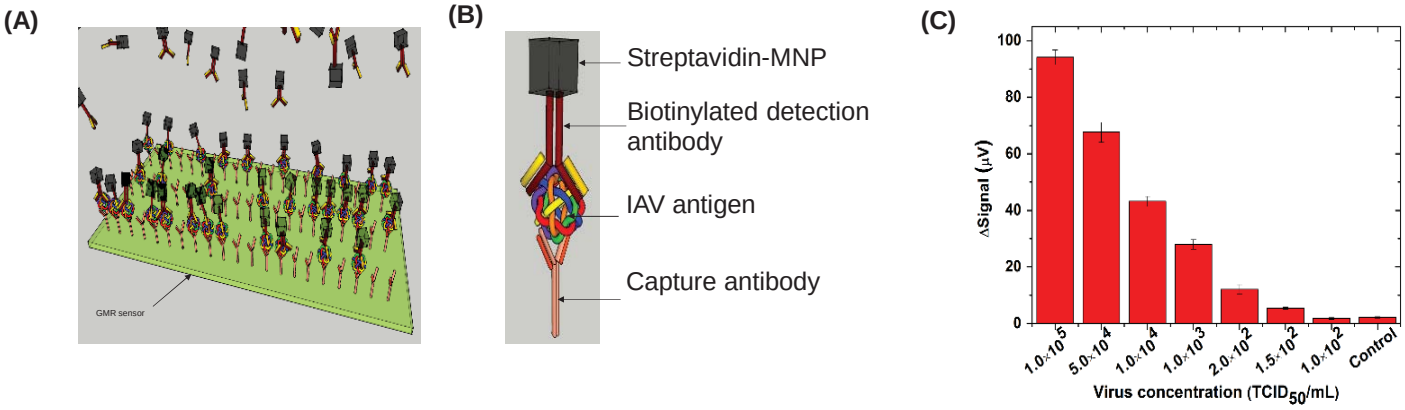

Figure 1: (A) Schematic illustration of GMR biosensor for influenza A virus detection. (B) Schematic drawing of a typical sandwich structure. (C) Electrical signals from different concentrations of influenza A virus H3N2v and control (mock) in GMR biosensor.

Reference: Krishna VD, Wu K, Perez AM and Wang J-P (2016) Giant Magnetoresistance-based Biosensor for Detection of Influenza A Virus. Frontiers in Microbiology. 7:400. doi: 10.3389/fmicb.2016.0040