Development of an Influenza A Virus Biosensor with Sialic-Acid Bound Gold Nanoparticles

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The influenza A virus causes acute respiratory disease in humans. Each year, seasonal influenza affects 3-5 million people, with approximately 500,000 deaths worldwide. Thus, the rapid diagnosis of influenza is vital to early anti-influenza treatment and containment. Unfortunately, current methods of influenza diagnosis are either costly or time-consuming. The aim of this study is to develop a colorimetric biosensor using sialic-acid bound gold nanoparticles for the rapid detection of the influenza virus. It was hypothesized that gold nanoparticles would aggregate around influenza viruses and reduce nanoparticle-to-nanoparticle distance, leading to observable color changes. Three biosensors were developed and compared. The first method used N-acetylneuraminic acid to reduce chloroauric acid and synthesize gold nanoparticles whereas the second method linked alpha(2,6)-linked sialylglycans to gold nanoparticles using a streptavidin-biotin bond. Thirdly, alpha(2,6)-linked sialylglycans were used to reduce chloroauric acid and synthesize gold nanoparticles. All three biosensors were able to colorimetrically detect influenza viruses in solution. Biosensors synthesized with the first method were shown to detect influenza viruses at approximately 6,000 infectious viral particles/mL and were highly cost effective, at about 3 cents per test. The efficacy of the second and third methods suggest that these nanoparticles can be used for the specific detection of only human influenza strains. All three biosensors were also effective at a volume of as little as 10 microliters. Thus, sialic acid-bound gold nanoparticles can be used as a quick, inexpensive, and sensitive biosensor for the detection of influenza viruses.

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