物理工学談話会

日時：2022年10月25日 (火)　16：15－17：15

場所：W棟　7階　701（ハイブリッドを予定）

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題目：“Magnetic nanoparticles and sensors for rapid diagnostic tests”

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Abstract

Lateral flow immunoassays for detecting biomarkers in body fluids are simple, quick, inexpensive point-of-care tests widely used in disease surveillance, such as during the coronavirus disease 2019 (COVID-19) pandemic. Improvements in sensitivity would increase their utility in healthcare, food safety, and environmental control. Recently, biofunctional magnetic nanoclusters have been used to selectively label target proteins, which allows their detection and quantification with a magneto-inductive sensor. This type of detector is easily integrated with the lateral flow immunoassay format. Pneumolysin is a cholesterol-dependent cytolysin and one of the most important protein virulence factors of pneumonia produced by Streptococcus pneumoniae. It is recognized as an important biomarker for diagnosis in urine samples. Pneumonia is the infectious disease that causes the most deaths globally, especially among children under five years and adults over 65 years, most of them in low- and middle-income countries. There especially, a rapid diagnostic urine test for pneumococcal pneumonia with high sensitivity and specificity would be helpful in primary care. In this work, a lateral flow immunoassay with magnetic nanoclusters conjugated to anti-pneumolysin antibodies was combined with two strategies to increase the technique's performance. First, magnetic concentration of the protein before the immunoassay was followed by quantification by means of a mobile telephone camera, and the inductive sensor resulted in detection limits as low as 0.57 ng (telephone camera) and 0.24 ng (inductive sensor) of pneumolysin per millilitre. Second, magnetic relocation of the particles within the test strip after the immunoassay was completed increased the detected signal by 20%. Such results obtained with portable devices are promising when compared to non-portable conventional pneumolysin detection techniques such as enzyme-linked immunosorbent assays. The combination and optimization of these approaches would have excellent application in point-of-care biodetection to reduce antibiotic misuse, hospitalizations, and deaths from community-acquired pneumonia.