

Amplification-free CRISPR-Cas12a based biosensor for cell-free DNA detection with metal-enhanced fluorescence

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Abnormal concentration of cell-free DNA (cfDNA) in body can cause cell death and defects. However, cfDNA is not yet widely applied to diagnostic fields, due to the nucleic acid amplification step which leads to some considerable disadvantage such as false-positive signals. In this research, nucleic acid amplification-free CRISPR-Cas12a based cfDNA biosensor with a metal-enhanced fluorescence (MEF) by DNA modified gold nanoparticle (GNP) was developed for the first time. In case of target cfDNA (BRCA-1) was presented, CRISPR-Cas12 cleaved ambient single-stranded DNA (ssDNA) between FITC and GNP, thereby inducing MEF that was proportional to target cfDNA concentration. As a result, proposed biosensor can detect BRCA-1 with high sensitivity (0.34 fM of detection limit, ranging from 1 fM to 100 pM). Developed biosensor can be adapted to quantify other nucleic acids as a promising diagnostic and prognostic strategy in a field-deployable platform. **Acknowledgments:** This research was supported by the National Research Foundation of Korea (NRF) grant funded by the Korea government (MSIT) (No.2019R1A2C3002300), the Ministry of Education (No.2016R1A6A1A03012845) and the SOL Bio Corporation.