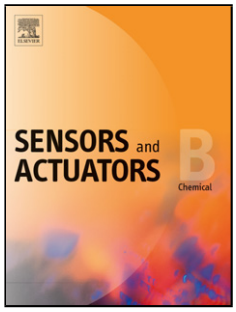

Title: CRISPR/dCas9-mediated biosensor for detection of tick-borne diseases

Authors: Bonhan Koo, Da-eun Kim, Jiyeon Kweon, Choong Eun Jin, Sung-Han Kim, Yongsub Kim, Yong Shin

PII: S0925-4005(18)31174-2
DOI: https://doi.org/10.1016/j.snb.2018.06.069
Reference: SNB 24906

To appear in: *Sensors and Actuators B*

Received date: 16-1-2018
Revised date: 23-5-2018
Accepted date: 14-6-2018

Please cite this article as: Koo B, Kim D-eun, Kweon J, Jin CE, Kim S-Han, Kim Y, Shin Y, CRISPR/dCas9-mediated biosensor for detection of tick-borne diseases, *Sensors and Actuators: B. Chemical* (2018), https://doi.org/10.1016/j.snb.2018.06.069

CRISPR/dCas9-mediated biosensor for detection of tick-borne diseases

Bonhan Koo[a,b,1], Da-eun Kim[c,d,1], Jiyeon Kweon[e], Choong Eun Jin[a,b], Sung-Han Kim[f], Yongsub Kim[e,*], Yong Shin[a,b,*]

[a]Department of Convergence Medicine, Asan Medical Center, University of Ulsan College of Medicine, 88 lympicro-43gil, Songpa-gu, Seoul, Republic of Korea
[b]Biomedical Engineering Research Center, Asan Institute for Life Sciences, Asan Medical Center, 88 lympicro-43gil, Songpa-gu, Seoul, Republic of Korea
[c]Department of Chemistry, Seoul National University, Gwanak-ro, Gwanak-gu, Seoul, Republic of Korea
[d]Center for Genome Engineering, Institute for Basic Science (IBS), Gwanak-ro, Gwanak-gu, Seoul, Republic of Korea
[e]Department of Biomedical Sciences, University of Ulsan College of Medicine, Asan Medical Center, 88 lympicro-43gil, Songpa-gu, Seoul, Republic of Korea
[f]Department of Infectious Diseases, Asan Medical Center, University of Ulsan College of Medicine, 88 lympicro-43gil, Songpa-gu, Seoul, Republic of Korea
[*]Correspondence should be addressed to Y. Shin (shinyongno1@gmail.com) & Y. Kim (yongsub1.kim@gmail.com)
[1]These authors contributed equally to this work.

Highlights

- An improved molecular diagnostics tool that utilizes CRISPR/dCas9-mediated biosensor
- It couples a nuclease inactivated Cas9 (dCas9) and single microring resonator biosensor for detection of pathogenic DNA and RNA
- Achieved single molecule sensitivity for the detection of ST (0.54 aM) and SFTS (0.63 aM)
- CRISPR/dCas9-mediated biosensor was able to clearly distinguish between scrub typhus (ST) and severe fever with thrombocytopenia syndrome (SFTS) in serum samples within 20 min.

Abstract

Rapid and highly sensitive detection of biomolecules is greatly needed for pathogen diagnosis in clinical samples, but the method needs to be significantly improved in terms of sensitivity and specificity for actual use in clinical settings. Here, we report the development of an improved molecular diagnostics tool that utilizes CRISPR/dCas9-mediated biosensor that couples a nuclease inactivated Cas9 (dCas9) and single microring resonator biosensor, enables label-free and real-time detection of pathogenic DNA and RNA. We addressed the clinical utility of this CRISPR/dCas9-mediated biosensor in tick-borne illnesses including scrub typhus (ST) and severe fever with thrombocytopenia syndrome (SFTS), whose clinical presentations are too similar to be easily differentiated. By using CRISPR/dCas9-mediated biosensor, we achieved single molecule sensitivity for the detection of ST (0.54 aM) and SFTS (0.63 aM); this detection