

Abstract

# Detection of C-Reactive Protein by Liquid-Gated Carbon Nanotube Field Effect Transistors (LG-CNTFET): A Promising Tool Against Antibiotic Resistance †

Luis Antonio Panes-Ruiz <sup>1,\*</sup>, Tom Stückemann <sup>2</sup>, Leif Riemenschneider <sup>1</sup>, Markus Loeffler <sup>3</sup>, Viktor Bezugly <sup>1,2,4,\*</sup> and Gianarelio Cuniberti <sup>1,4</sup>

<sup>1</sup> Institute for Materials Science and Max Bergmann Center for Biomaterials, TU Dresden, 01062 Dresden, Germany

<sup>2</sup> Life Science Inkubator Sachsen GmbH & Co. KG, Tatzberg 47, 01307 Dresden, Germany

<sup>3</sup> Dresden Center for Nanoanalysis (DCN), Center for Advancing Electronics Dresden (CFAED), TU Dresden, 01062 Dresden, Germany

<sup>4</sup> Center for Advancing Electronics Dresden (CFAED), TU Dresden, 01062 Dresden, Germany

\* Correspondence: [antonio.panes@gmail.com](mailto:antonio.panes@gmail.com) (L.A.P.-R.); [v.bezugly@life-science-inkubator.de](mailto:v.bezugly@life-science-inkubator.de) (V.B.)

† Presented at the 8th International Symposium on Sensor Science, 17–26 May 2021; Available online: <https://i3s2021dresden.sciforum.net/>.

Published: date

**Abstract:** Respiratory tract infections have the highest rates of antibiotic prescriptions where symptoms like fever, cough and rigors are regularly misinterpreted and bacterial infections cannot be distinguished from viral ones. Nevertheless, it has been recently suggested that C-reactive protein (CRP), a protein produced by the liver in response to infection, could serve as a potential biomarker for the precise differentiation of these two types of infections. Thus, its quick and accurate detection would potentially reduce the unnecessary antibiotic use. To this end, we present an easy and sensitive approach for the selective detection of C-reactive protein (CRP) by liquid-gated carbon nanotube field effect transistors (LG-CNTFET). Herein, CNT-networks were deposited between electrodes via controlled dielectrophoretic deposition and then functionalized with a novel specific antibody and a polyethylene glycol (PEG) layer in order to overcome the Debye screening. Successful fabrication and functionalization was confirmed by scanning electron microscopy and chemiluminescence immunoassays. The results showed a selective and reproducible detection down to picomolar concentrations in PBS buffer without complicated microfluidics. The simplicity and high sensitivity of this sensor platform make it a promising tool for the quick and precise differential diagnosis of viral and bacterial infections.

**Keywords:** CNTs; biosensor; CRP; antibiotic resistance; point-of-care