

Title: Graphene biosensors: Procalcitonin detection with chitosan functionalized field-effect transistors

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Authors:

Last name	First name	Email	First name initials	Affiliation	City	Country
Villarreal	Renan	renan.villarreal@uclouvain.be	R	UCLouvain	LLN	Belgium
Jaramillo Calderon	Diego Fernando	diego.jaramillo@uclouvain.be	DF	UCLouvain	LLN	Belgium
Melinte	Sorin	sorin.melinte@uclouvain.be	S	UCLouvain	LLN	Belgium
Nyabi	Omar	omar.nyabi@uclouvain.be	O	UCLouvain	Brussels	Belgium
Vandenberghe	Pierre	p.vandenberghe@uclouvain.be	P.	UCLouvain	Brussels	Belgium
Gala	Jean-Luc	jean-luc.gala@uclouvain.be	J.-L.	UCLouvain	Brussels	Belgium

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Discriminating bacterial from viral infections in children is a common challenge for clinicians in pediatric medicine. It is important to differentiate the cases that require prompt antibiotic treatment. For example, pediatric sepsis affects approximately 25 million children annually and results in mortality rates ranging from 4% to 50% depending on the clinical severity, risk factors, and geographic variability. Several biomarkers have been identified for this purpose; in particular, procalcitonin (PCT) can be a high sensitivity indicator of bacterial infection. However, the improvement of current qualitative and quantitative methods of PCT detection is hampered by long analysis times, high costs, and the need for trained personnel and sophisticated instruments.

Among the various biosensing platforms, graphene-based field-effect transistors (GFETs) offer fast, sensitive, specific, and low-cost detection capabilities. Here, we report on progress with chitosan-functionalized commercial GFETs for the specific recognition of PCT; chitosan is electrostatically adsorbed on the surface of GFETs and used to immobilize anti-PCT nanobodies. Moreover, we combine GFET detection with loop-mediated isothermal amplification (LAMP) primers designed to target the PCT protein. The operational protocol addresses Dirac point shifts with a differential scheme using compact electronic boards, suited for point-of-care testing from clinical nasopharyngeal samples. The final purpose behind the combination of these technologies is to develop a fast diagnostic system allowing us to identify respiratory infections in pediatric medicine.