Proceedings International
Platinum Open Access Journal (ISSN 2668-6384)

Proceedings, Abstract
Volume 4, Issue 1, 2022, 54
https://doi.org/10.33263/Proceedings41.054

Graphene-based Nanosubstrates for CD36-positive Circulating Tumor Cells Capture and Characterization †

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† Presented at 1st OncoHub Conference – Connecting Scientists for Next Generation Cancer Management (13-15 October 2021, virtual)

Received: 25.10.2021; Accepted: 5.02.2022; Published: 14.02.2022

Abstract: Circulating tumor cells (CTC) detection emerged as a diagnostic tool for early detection of cancer metastasis, but some drawbacks are still to be addressed, such as specificity of the captured cells and the sensitivity of the capture method. We aimed to design and test a novel graphene-based nano substrate to detect CD36-positive circulating breast tumor cells. Nanocrystalline and vertical graphene nanostructured surfaces of 300-500 nm thickness were produced and incubated for 1hr at room temperature with breast tumor cells (MCF-7) and normal human monocytes (CRL-9855). After several washes in PBS, the substrates were fixed in methanol: acetone (1:1 vol/vol) and nuclei of fixed cells stained with DAPI. CD36 expression of adhered cells was priory tested by immunofluorescence. MCF-7 breast tumor cells tested positive for two metastatic markers – EpCAM and CD36. If EpCAM is the classical biomarker for CTC isolation by immunoaffinity, CD36 has been misused so far in clinical settings and research to negatively enrich CTC population. This surface receptor is abundantly present on circulating monocytes, which were used in our study as a positive control. Incubation on various graphene substrates showed that attachment of both cell types depended on the nanostructure of the substrate, where vertical graphene bounded a significantly larger number of cells than nano-crystalline graphene. Characteristics of the nanostructure of graphene substrates may negatively impact the specificity of CTC capture, regardless of their subsequent functionalization.

Keywords: circulating tumor cells; graphene substrate; CD36; breast cancer.

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Funding

This work has been supported by a grant from the Ministry of Research, Innovation and Digitization, CNCS/CCCDI – UEFISCDI, project number PNIII.P2-2.1-PED-2019-3141, contract no 382/2020, within PNCDI III.

Acknowledgments

This research has no acknowledgment.

Conflicts of Interest

The authors declare no conflict of interest.