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

Proceedings, Abstract
Volume 5, Issue 1, 2023, 2
https://doi.org/10.33263/Proceedings51.002

Modeling Colorectal Cancer: From Flat Biology to Next Generation 3D Models †

Bianca Galateanu [1], Octav Ginghină [2,3], Marius Zamfir [2], Mara Mardare [2], Kelly Velonia [4], Ariana Hudiță [1,*]

[1] Department of Biochemistry and Molecular of Biology, University of Bucharest, Bucharest, Romania
[2] Institute of Oncology „Prof. Dr. Alexandru Trestioreanu", Bucharest, Romania
[3] Department II, Faculty of Dental Medicine, "Carol Davila" University of Medicine and Pharmacy Bucharest, Bucharest, Romania
[4] Department of Materials Science and Technology, University of Crete, Heraklion, Greece
* Correspondence: ariana.hudita@bio.unibuc.ro (A.H.);
† Presented at 2nd Edition of the OncoHub Conference – Connecting Scientists and Physicians for Next Generation Cancer Management, Poiana Brașov, Brașov, 21-23 September 2022

Received: 10.12.2022; Accepted: 20.12.2022; Published: 5.01.2023

Abstract: Despite numerous advances in drug development and nanotechnology, the process of developing new cancer drugs is still slow and extremely costly, mainly due to the significant discrepancies between preclinical and clinical data. For preclinical studies, the main tools used for *in vitro* and *in vivo* screening of new drugs or drug-delivery systems are based on cell cultures and animal models, but despite the promising results, most drugs fail in the first phase of clinical trials due to lack of efficacy or severe toxicity. To address these issues, alternative tools for preclinical testing have been implemented, aiming to capture the particularities of in vivo tumor architecture and interaction with other cell types. In this view, our study aimed to develop 3D study models of colorectal cancer based on human adenocarcinoma HT-29 tumor cells. We developed two 3D models: multicellular tumor spheroids and organ-on-a-chip systems, and optimized the cell culture protocols for the HT-29 cells. The 3D platforms were further used for screening 5-fluorouracil-loaded polymeric nanoparticle cytotoxicity. More, we developed an organ-on-a-chip model for both colorectal tumor cells and endothelial cells to assess the capacity of the original carriers to penetrate the endothelial barrier. Our results showed a significantly different response of HT-29 tumor cells cultured in 3D multicellular tumor spheroids as compared with organ-on-a-chip systems, as well a low cytotoxic effect of the nanoparticles on HT-29 cells when cultured in the presence of the endothelial barrier, proving that in the presence of a biological barrier, not all the administered treatment reaches the target cells. Moreover, the treatment administration in the organ-on-a-chip platforms mimics betterbetter mimics the in vivo landscape better, offering the possibility to surpass the static models available until now due to the pumps connected to the microfluidic channels. It is clear that the organ-on-a-chip platforms emulate the 3D hierarchical complexity of *in vivo* tumors and microenvironment setup and in the future, could outperform traditional models, making the understanding of human diseases and the development of drugs to treat them more rapid, efficient, and cost-effective, and in so doing replace, reduce and refine (the '3Rs') the use of laboratory animals.

Keywords: 3D cancer models; multicellular tumor spheroid; organ-on-a-chip.

Funding

This work was supported by a grant from the Ministry of Research, Innovation and Digitization, CNCS - UEFISCDI, project number PN-III-P1-1.1-TE-2021-1660, within PNCDI III.

Acknowledgments

This research has no acknowledgment.

Conflicts of Interest

The authors declare no conflict of interest.