Mechanobiology in Epithelial 3D Tissue Constructs

ME3T LECTURES

GRK 2415

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Artificial Tumors:
is it really possible..?

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at 9:00 am

Seminarraum B1.72
DWI – Leibniz-Institut für Interaktive Materialien
Forckenbeckstraße 50, 52074 Aachen

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Abstract: Cancer is a leading cause of death worldwide, accounting for nearly 10 million deaths per year. One of the biggest challenges to study this disease in vitro and to find new strategies to fight it, lies on the generation of new three-dimensional (3D) tumor-like models (i.e. artificial tumors). These matrices are able to resemble most of the biological and biophysical properties already described in neoplastic tissues, allowing us to analyze the pathological progression at laboratory scale.

In order to tackle this question, during the last years our team has been focused on designing and performing a new type 3D tumor-like scaffold, which could biomechanically stimulate confined cancer cells and submitting them to solid stress. These matrices, known as tumor-like microcapsules, correspond to microbeads (600 µm of diameter), and are made of partially degradable hydrogels, characterized by simultaneously allowing and hindering the growth of cancer cells found in confinement.

Interestingly, after comparing the activity of cancer cells cultured in our tumor-like microcapsules to those cultured as spheroids/organoids -and acknowledged as the “gold standard” in cancer research-, our results demonstrate that cells cultured in the tumor-like microbeads express, in a higher extent, multiple transcriptomic and proteomic hallmarks already described in vivo, promoting morpho-mechanical heterogeneity, resistance to anticancer drugs, as well as a comparatively enhanced migrative and proliferative capability. Furthermore, current in vivo experiments are supporting the experimental results obtained in vitro, showing that the biomechanical stimulation is in fact needed to enhance the metastatic capabilities of cancer cells.

Finally, since these results can be obtained within one week, we envisage the use of tumor-like microcapsules in the generation of new methods for diagnosis and prognosis, as well as in the development of novel translational methods for the clinics or the pharmaceutical industry, relying on a very simple, yet highly accurate and reproducible tumor-like model.