

**Title:** Mechanotransduction of Hepatic Cancer Cells cultured in a 3D Collagen Scaffold

**Author:** Mgr. Adam Frtús

**Department:** Department of Optical and Biophysical Systems, Institute of Physics of the Czech Academy of Sciences

**Supervisor:** PharmDr. Šárka Kubinová, Ph.D., Department of Optical and Biophysical Systems, Institute of Physics of the Czech Academy of Sciences

**Abstract:** Cell culture models transformed over time from a simple monolayer culture in 2D Petri dish to advanced 3D platforms, that provide conditions and features for cellular growth in all directions, similarly to *in vivo*. Moreover, cells experience distinct microenvironmental features within the extracellular matrix in tissues, that 3D cell culture might replicate. In fact, majority of studies indicate that physical cues generated from extracellular microenvironment drive the cellular behavior and functions. In this dissertation thesis, we attempt to provide the mechanistic explanation behind the changes in cellular metabolism and molecular signaling pathways induced by physical cues of 3D cell culture. We have used the advanced biomaterial-based 3D cell culture, biochemical assays, genetic manipulation and photobiomodulation in order to reveal the molecular mechanisms of mechanotransduction in hepatic cancer cells under physical cues of 3D collagen scaffold culture. By conducting this research, we not only aim to gather fundamental knowledge about tumor cell plasticity and signaling pathways, but we also believe it may provide insights into more predictive and reliable cell culture systems that may possess practical interest, e.g., in liver organoid models for new drug validation.

**Keywords:** 3D cell culture; Mechanotransduction; Cancer; Mitochondria; Cytoskeleton; Extracellular Matrix; Cell Plasticity