Biomimetic tumor engineering to enhance drug discovery (BioengineeredTumor)

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Development of novel anti-cancer therapies is still slow and cumbersome partially due to weaknesses of current preclinical studies based on simple monolayer cell cultures followed by animal testing. Consequently, there is a clear need for development of more reliable in vitro three dimensional (3D) tumor models, which will capture key features of the in vivo tumor cell microenvironment and provide drug testing results relevant for human patients. The proposed project aims to develop 2 novel, simple and robust 3D models for cultures of carcinoma and osteosarcoma cells by applying systematic and integrated methodology to comprehensively define the key model components in conjunction with developing/adapting analytical methods for reliable and reproducible characterization of cells within 3D scaffolds. In specific, different human and animal cancer cell lines will be immobilized in novel alginate-based scaffolds as artificial extracellular matrices imitating tumor environment and the obtained constructs will be cultivated in perfusion bioreactors providing enhanced mass transport at adequate hydrodynamic conditions. The models will be validated in short- and longer-term cell cultures with the application of standard anti-cancer drugs in clinically relevant regimens. By comprehensive analyses of the cells regarding morphology, viability, proliferation, apoptosis, immunological and gene expression profiles, and response to anti-cancer drugs the developed models will be critically evaluated regarding the attained level of resemblance of physiological cancer features. Thus, the strategic goal of the project is to establish a sufficiently simple, but relevant, adaptable and scalable platform suited to the use by scientists without technical expertise for in vitro studies of cancer cells for applications in: (i) anti-cancer drug discovery and validation, (ii) development of personalized medical treatments, and (iii) cancer research