

TITLE OF RESEARCH TOPIC: Development of spatially restricted induction of cancer immunotherapy

Summary: In 2020 almost 10 million deaths in the world were attributed to cancer, establishing cancer as the leading cause of death. A revolution in cancer treatment in the past decades modernized cancer treatment with an emphasis on targeting the immune system for efficient and long-lasting anticancer intervention, however, some types of solid tumors are due to their immunosuppressive tumor microenvironment (TME) refractory to immune checkpoint inhibitor or CAR T-cell therapy. The major aim of the proposed Ph.D. topic is to develop tools that enable spatially restricted induction of immunostimulatory processes that will break the immunosuppressive TME. The Ph.D. student will develop irradiation-induced genetic platforms that will be specifically induced locally within solid tumors to trigger strong whole-organism anti-tumor immune defenses. The Ph.D. student will perform experimental work in the cutting-edge synthetic immunology laboratory and do a rotation with the industrial partner, Cosylab, which develops medical-grade software solutions for spatially restricted radiotherapy.

Research techniques used: The work will include: selection and design of immunostimulatory molecules and control elements, preparation of constructs (classical cloning, Gibson assembly, etc.), validation of constructs in cell culture, including tumor cell lines (reporter systems, secretome analyses -ELISA and mass spectrometry, viability assays); validation of the best-performing constructs in mouse cold tumor animal models (laboratory animal work will be performed by experienced personnel): tumor growth upon mono and combination therapy, analysis of immune cell infiltration by multicolor flow cytometry, immunohistochemistry etc.

The reason why the topic is innovative: The topic presents an innovative combination of basic mechanistic knowledge with applied top-notch technology to create the radiation-controlled spatially-restricted expression of novel immunostimulatory molecules including designer cytokines within solid tumors for boosting antitumor responses.

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INDUSTRIAL PARTNER: Cosylab