According to World Health Organization, ***cancer*** is the second leading cause of death globally, accounting for an estimated 9.6 million deaths each year. Cancer can start in almost any organ or tissue of the body and spread to distant locations. This, called as a ***metastasis*** *process*, is one of the biggest concerns of people health nowadays. ***Breast, prostate and lung cancers*** are the ones that commonly metastasize to ***bone.*** Bone has unique characteristics, its undergoes constant remodeling, which attracts cancer cells to survive and develop a secondary tumor. In general, cancer cells enter the bone trough the ***blood vessels,*** which feed the ***bone marrow.*** Moreover, tumor cells release signaling proteins, which stimulate the displacement of osteoblast lining of the bone surface and allows cancer cells to enter the bone tissue. However, our understanding of the pathophysiological mechanism of cancer progression is incomplete and the translation of bone metastasis research into the clinic has been slow mainly due to the lack of good *ex vivo* and *in vivo* models to study the disease.

Some research works towards bone metastasis understanding have already been undertaken via implementation of cell cultures and laboratory animal-based models. Those, consisting of simple 3D tissue models of bone, blood vessel and cancer are available. However, for the investigation of more complex and pathophysiological relevant research questions towards the understanding of cancer evolution and metastasis, accurate *ex vivo* model systems which represent key functional properties of the participating tissue (here bone) are urgently needed.

The overall aim of this project is to develop a novel functional three-dimensional *ex vivo* Bone Metastasis Model, that will allow to investigate the mechanism of cancer (breast, prostate, lung) progression towards bone. By this, the project will focus on engineering of bone organoid consisting of vessel, bone marrow and bone. Therefore, it is proposed that the model recapitulating the structure and biological features of native vascularized bone tissue will be developed using an innovative method of bio fabrication – 3D bioprinting with the use of cell-instructive bio-inks. Multi-biomaterial and multi cell-type 3D printing will be employed to fabricate biomimetic and functional tissues. One important aspects of such engineered tissues for the study of cancer metastasis, is a functional, through vessel-mimicking channel, perfusion establishment. This, comparable to the *in vivo* situation will serve the nourishing of the tissue, but also will act as a medium for the shipment of circulating tumor cells. Additionally, the blood mononuclear cells, to mimic the blood environment will be incorporated into perfused engineered bone organoid, and as a result, their effect on cancer cells extravasation will be evaluated.

Ultimately, the knowledge gained in the field of biomaterials, biofabrication and cell (cancer) biology will provide a stepping stone to establishment of personalized urgently needed platform (here bone metastasis model) for specific drug evaluation.