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My primary academic interest focuses on the areas of Tissue Engineering, Regenerative Medicine and Cancer Biology. This encompasses many aspects of cell and molecular biology with emphasis on the study of mesenchymal stem cells (MSCs) and their role and potential within the above areas, both with regards to their *in vivo* and *in vitro* properties. My long-term research plan is to understand the *in vivo* functionality of MSCs in order to fully exploit their therapeutic and regenerative potential. This includes their unanticipated role in malignancy in bone metastasis. My ultimate goal is to bridge the gap in knowledge between *in vivo* and *in vitro* properties of MSCs which will influence the way these cells are used in Tissue Engineering and Regenerative Medicine approaches.

Since I joined Dr. Caplan’s group 10 years ago, we have been working on novel approaches for cartilage repair and regeneration using MSCs. The current focus is to develop novel advances which can be used to modulate the final chondrogenic fate of human MSCs into an articular-like cartilage. Articular cartilage can easily be compromised due to injury or physiological conditions resulting in significant reduction of quality of life. This major clinical challenge often leads to osteoarthritis and eventually total joint replacement surgery. In this context, our current research efforts seek to develop novel approaches to modulate the final chondrogenic fate of MSCs into an articular-like cartilage.

Another area of interest is to study the mechanisms of bone invasion during metastasis. Skeletal metastases (SM) are lethal, and no targeted therapy exists, thus, contributing to low survival rates. Bone is the predominant metastatic target for many cancers such as melanoma, breast and prostate cancers, nevertheless, the molecular mechanisms of SMs are still poorly understood, largely due to a lack of an *in vivo*experimental system. In my studies, we identified key hematopoietic niche molecules that are expressed by both cancer cells and perivascular pMSCs that are required for bone metastasis. These include key components of the vascular basement membrane and bone marrow niche components. These studies led to the development of a novel extraskeletal humanized niche-mimicking platform where human MSCs form live trabecular bone and become pMSCs. This platform clearly demonstrates that pMSCs/pericytes are required for successful bone metastasis. These results establish for the first time that SM requires the coordinated interaction and communication between at least two cell types in the niche via specific molecules.