1) Role of redox signalling and metabolism in angiogenesis.

Supervisor: Prof. Mariano Beltramini, e-mail: mariano.beltramini@unipd.it

The research line is focused on studying how redox signaling, metabolism, and hemodynamic forces regulates endothelial homeostasis in development as well as during cancer progression. To accomplish this goal advantage in taken from innovative genetic and imaging technologies as well as new molecular and biochemical approaches in cells and vertebrate models, such as zebrafish and mouse. The goal is to expand the current vision of endothelial biology by identifying unforeseen metabolic and signaling mechanisms and used them to develop novel anti-angiogenesis therapies to treat cancer progression and pathological conditions.

2) Modulation of the expression of MHC molecules in tumours: a mechanism of escaping from the immune system.

Supervisor: Prof. Marina De Bernard, e-mail: marina.debernard@unipd.it

One of the mechanisms adopted by tumours to escape from the immune surveillance consists in silencing the molecules involved in the tumour antigen presentation to effector T cells, by both tumour cells and macrophages infiltrating the tumours. These molecules are coded by genes clustered in a locus called *major histocompatibility complex (MHC)*. Recently, we found that the engagement of an immune receptor called CD300E on the surface of macrophages, leads to the down-regulation of MHC expression. Moreover, we demonstrated that the expression of CD300E on macrophages may be modulated. The PhD project aims at: 1) Assessing whether macrophages that infiltrate tumours have an increased expression of CD300E, with respect to peritumoral macrophages and whether an inverse correlation exists between the expression of the immune receptor and that of the MHC molecules in tumour macrophages; 2) identifying the inducer of the expression of CD300E on macrophages; 3) identifying the ligand of CD300E and the signalling cascade responsible for the MHC silencing.

3) Yamanaka's factors in development of the tunicate *Botryllus schlosseri.*

Supervisor: Prof. Lucia Manni, e-mail: lucia.manni@unipd.it

The colonial tunicate *Botryllus schlosseri* weekly exhibits cyclical, zooid budding rhythm and constitutive whole body generation, with regular reactivation of early development molecular programs, differentiation of pluripotent stem cells, and putative transdifferentiation of adult somatic cells. This project aims to shed light on the role in *B. schlosseri* of the four Yamanaka's factors (Sox2, Klf4, Oct3/4, cMyc), with top reprogramming activity in vertebrates, focusing on the mechanisms controlling the stability of cell fate and stem cell renewal. The work plan will embrace gene expression and morpho-functional analyses.

4) Decoding molecular dialogues in a plant root endosymbiosis.

Supervisor: Prof. Lorella Navazio, e-mail: lorella@bio.unipd.it, lorella.navazio@unipd.it

Arbuscular mycorrhizal (AM) symbiosis is one of the most important and widespread beneficial plant-microbe interactions, improving plant mineral nutrition and decreasing the environmental impact of agriculture through a drastic reduction of the need for chemical fertilizers. The project aims to investigate the calcium-based signalling mechanisms activated by plant symbiotic signals in AM fungi. To this aim, novel genetically encoded fluorescent calcium reporters (GCaMP) fused to the cell-penetrating peptide TAT will be engineered and evaluated as new tools to monitor cytosolic and nuclear calcium dynamics in the fungal partner during the early stages of AM symbiosis.