

Abstract Schürmann/Schär (Ref. A2012-02)

Interfering with cell proliferation (growth control) is an established and successful concept of both, conventional and targeted cancer therapy, but often the therapeutic choice is a double edged sword. Treatments interfering with cell proliferation are potentially harmful because they are severely toxic and often cause undesirable short and long side-effects on different tissues, adversely affecting the patient's well-being. In this respect, the observation that low intensity pulsed electromagnetic fields (PEMFs) interfere with the proliferation of cancer cells may reflect a promising strategy for future cancer therapeutics. Importantly, non-cancerous tissue cells do not seem to be affected and stem cells respond by increased proliferation and and/or differentiation.

Molecular targets and mechanisms underlying this potential therapeutic effect of PEMFs are poorly understood to date, but there are indications pointing to an involvement of signalling cascades, mitotic failure and induced apoptosis. The investigation and characterization of these mechanisms at the cellular and molecular level is the focus of the proposed project. It involves cell culture-based experimental approaches using advanced microscopy and molecular biological means to explore the PEMF-induced network of anti-proliferative signals and response of cancer cells from different origin in comparison to differentiated and undifferentiated cells. Key readouts will be parameters of cell proliferation (i.e. cell viability, proliferation and apoptosis), mitotic and cell phase progression and growth-, stress- and checkpoint signalling activities.

The proposed experiments aim to reveal whether PEMF-mediated reduction of cell proliferation is a common phenomenon of cancer cells or rather restricted to a spectrum of responsive cancers. Designed to identify the responsive targets, pathways and structures, they will extend the current understanding about how cells react instantly to PEMF exposure and how these responses are then transduced to produce the cellular consequences observed. The proposed work will thus provide insight into how PEMFs and possibly other types of electromagnetic signals interact with cellular processes to disturb cell proliferation and, thereby, a mechanistic framework for a rational design of therapeutic applications.