Dr. Boris POPOV

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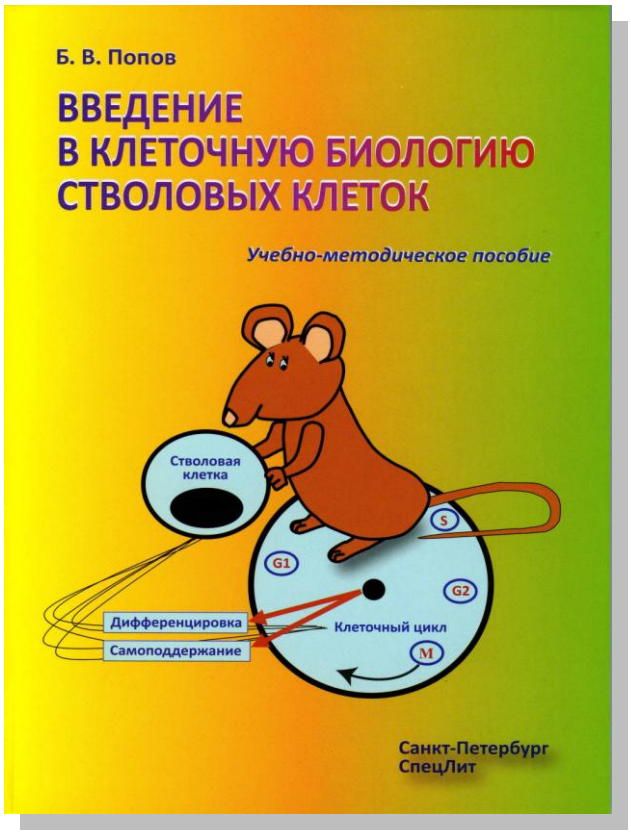
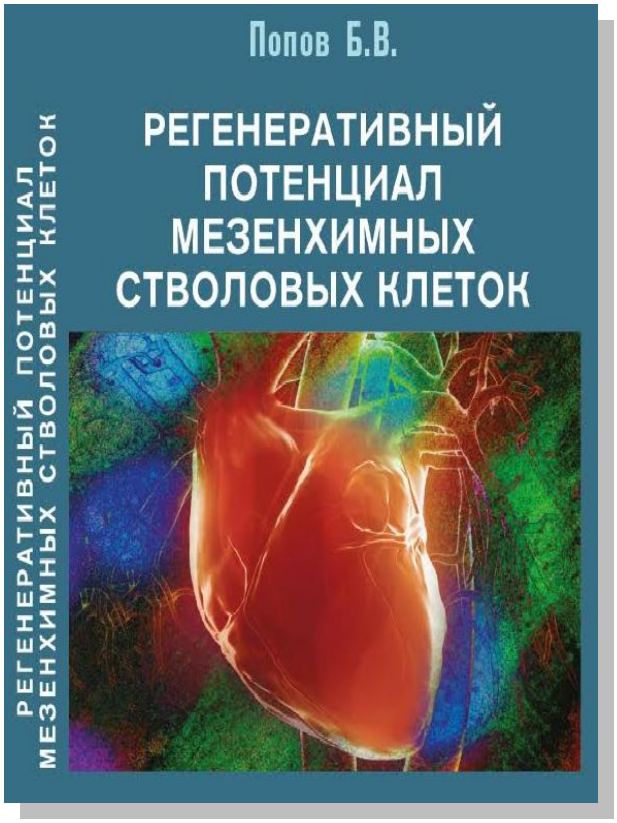
Our long-term research interests are related to study the molecular and cellular mechanisms of differentiation of somatic stem cells into mature cells of various tissue specificity. Mesenchymal stem cells (MSCs) represent a type of somatic stem cells originating from different tissues and possessing the wide differentiating potential to form under special conditions cells of any germ layer. Thus, there is a possibility of using MSCs to study the mechanisms of regeneration of various internal organs including heart, brain, pancreas, prostate, bladder, and others. Simplicity in preparation and in vitro culture of MSCs creates some additional benefits for the practical usage of these cells. Among first researchers in the world we have generated from the bone marrow of transgenic GFP mice the stable cell cultures of the MSC expressing green fluorescent protein (Gfp). Production of Gfp makes a unique opportunity to monitor the transdifferentiation of MSCs into cells of various tissues in culture or in vivo under conditions of the MSCs administration into the experimental animals. Regulation of MSCs differentiation occurs via interaction of regulatory proteins from various signaling pathways, the most important of which are the Wnt/β-catenin, TGFβ, Notch, Hedgehog and Polycomb. These interactions take place in certain parts of the cell cycle which are called restriction points. For example, many types of tissue specific differentiations are induced in quiescent cells at the restriction point R1 of the G1 cell cycle phase. Using this idea we concluded that an appropriate approach in decoding the mechanisms of tissue-specific differentiation is the study of interactions of some tissue specific regulatory molecules of different signal pathways with the cell cycle regulators, the retinoblastoma gene product family members – p130 and pRb.

We have hands on the somatic cell fusion technique and interested in its effective usage for preparation of monoclonal antibodies recognizing the markers of normal and cancer stem cells, accordingly, SC and CSC. It is known, that SC have self-renewal ability, other words SC are immortal. The immortality is common feature of SC and CSC that suggests that CSC originate from SC. The common features of different types of stem cells are based on function of identical or similar mechanisms generating by signal pathways and separate molecules transmitting the signals as ligands or receptors. Such molecules may represent the unique markers of stem cells. On the other hand, the monoclonal antibodies that recognize these markers may represent the effective instruments to study SC which are applicable, accordingly, as diagnostic means or therapeutic drugs. AMACR (acyl-methyl-coenzyme racemase) may serve as an example of the molecule which plays the role of a prostate cancer marker. AMACR is not expressed in prostate tissue under normal conditions but its production is highly elevated in prostates of patients with cancer. We have raised the monoclonal antibodies against AMACR and found that the antibodies epitopes are localized near the catalytic center of the AMACR molecule. Currently, we have been analyzing the anticatalytic activity of the antibodies against AMACR and their potential as anticancer drugs.





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