

Professor Gurudutta Gangenahalli

PhD, FICS, FNABs, FICI (Ire), FRSC (UK), FRSB (UK), FRSM (UK).



Biography

Dr. Gurudutta Gangenahalli, currently serving as a Professor of Biotechnology at Netaji Subhas University of Technology in Dwarka, New Delhi, was formerly a Senior Scientist 'G'/Additional Director & Founding Head of the Division of Stem Cell & Gene Therapy Research at the Institute of Nuclear Medicine and Allied Sciences (INMAS), DRDO, Delhi, India. He obtained his PhD from the University of Delhi and completed his post-doctoral fellowship in Stem-Cell research from the University of Pennsylvania, Philadelphia (USA), and the Brookhaven National Laboratory, New York, USA, as a NASA / NSBRI Post-doctoral research fellow with Professor Alan Gewirtz, a physician scientist & distinguished Professor of Stem Cell & Haematology. He also worked as a FAPESP fellow at the University of Sao Paulo, Brazil.

Dr. Gangenahalli has been a driving force behind several original and novel discoveries in the stem cell field within DRDO. His research focuses on understanding the therapeutic potential of human stem cell fate response signaling, including critical processes such as Apoptosis, Adherence, Osteogenesis, Differentiation, and Homing. He employs genetic engineering techniques to manipulate human stem cell genes (including CD34, BCL-2, CXCR4, PU.1, SCF/c-Kit, APC, OSx, Wnt, etc.) and utilizes high-throughput gene-expression analysis. Additionally, he has contributed to the development of human stem cell targeting, shielding formulations, and NMR stem cell tracking methods. These foundational efforts pave the way for fate modification strategies and the development of effective molecules that enhance stem cell regenerative potentials, particularly for injury treatment of Defense interest.

In this context, Dr. Gurudutta Gangenahalli's ground-breaking discovery involves two critical aspects. Firstly, he identified the unique potential of Fluronic-127/Pol-407 to sequester platelet nanovesicles in the blood of stem cell-infused recipients. Secondly, this same compound plays a crucial role in robustly delivering stem cells to the bone marrow, achieving a world record by surpassing previous delivery efficiency. Remarkably, this regimen ensures 100% survivability for recipient-models exposed to toxic radiation doses before stem cell infusion. These achievements significantly contribute to the National Biological Radiation Protection mission, particularly for the Defense and Armed Forces as a life-saving regimen.

Dr. Gurudutta Gangenahalli has made significant strides in stem cell molecular biology, particularly in clinically relevant human stem-cell response research (huSC-RR) in India, with a specific focus on DRDO. Notably, his discovery of the active site of the hBCL-2 molecule stands as a milestone in BCL-2-Apoptosis biology, garnering recognition in the scientific community. This breakthrough facilitated the generation of an hBCL-2 variant with an increased shelf-life and enhanced cell survival, making it a valuable candidate for designing anti-cancer molecules.

Dr. Gangenahalli's oversight extends to elucidating negative control mechanisms on the human Stem Cell Factor receptor (human c-Kit tyrosine-kinase) by SHP1 (a phosphatase). Simultaneously, he

unravelling downstream signal clusters activated by human c-Kit tyrosine-kinase, leading to the development of a molecule—high-affinity modified NSC-87877 (Pubchem-CID-16654632)—that induces proliferation in human Stem Cells (huSC). His substantial contributions also encompass drug-repurposed molecules, including Mecasermin, Raloxifene, and Metformin, known for their stem cell proliferation-inducing properties.

Notably, Dr. Gangenahalli's structural mapping of the huSC transcription factor (known as PU.1) binding to GATA-1 (Erythroid-factor) revealed negative regulation. This finding paved the way for developing a molecule—PU.1 transcription-factor (TF) Y244D—that promotes huSC differentiation toward the myeloid lineage. Furthermore, his extensive work includes elucidating the signalling domain in the hCD34 antigen (a huSC marker) and the huCXCR4 molecule, enhancing stem cell endothelial adhesion and transmigration. Additionally, Dr. Gangenahalli is responsible for developing high-affinity peptide (VHPKQHR) targeting of VCAM-1, constitutively present on bone marrow endothelial cells, along with the Quercetin-Ploxomaer407 conjugate for efficient high-cell dose transmigration..

Further, his efforts to decipher Osterix, APC, and Lithium/Wnt mechanisms in osteogenic differentiation highlight the usefulness of Lithium in clinical osteogenic therapy. He synthesized several novel hydrogels and multi-layer scaffolds, both with and without LiCl embedded, along with bioactive glasses. These materials induce rapid stem cell-mediated osteogenic responses. One notable formulation is the Sol-Gel, created using Ploxomer407+FBS+LiCl for wound healing. Remarkably, it remains functional at high altitudes, existing as a gel/liquid at -100°C and solidifying upon contact with wounds. Additionally, it promotes hair growth—an innovative application. Notably, LiCl incorporation induces the expression of the Hair-Fiber promoting gene KRTAP-10-2 (patented) and effectively arrests internal bleeding (laceration)..

Dr. Gangenahalli's ground-breaking discovery of RRAD as a downstream effector transcription-factor (TF) molecule critical for osteogenic mechanisms in human Mesenchymal stem cells (huMSCs) represents yet another milestone. Furthermore, identifying hypo-immune response gene clusters in these huMSCs opens avenues for manipulating their clinical potential as hypo-immunogenic stem cells. These insights may have future applications in treating Covid-19 by modulating cytokine storms.

The development of T2 relaxometric Ultra small super-paramagnetic iron oxide (USPIO) agents containing 'Fe' and in-vivo stem cell tracking by 7-9Tesla NMR (Nuclear Magnetic Resonance Imaging) was a novel task. Another significant achievement was the creation of a probe using receptor-specific Human-Low Density Lipoprotein (huLDL), which holds potential for clinical inflammation and atherosclerotic lesion imaging. Dr. Gurudutta Gangenahalli's established parameter for human Mesenchymal stem cells (huMSCs) cultivation has become a global standard method, widely cited in research. His work has

led to the identification of numerous new genes responsible for stem cell activities, including migration, radiation resistance, differentiation (to myeloid and osteogenic lineages), and proliferation. These insights were gained through Micro-array gene-expression analysis and i-Track protein analysis.

With over ninety high-impact research publications and twelve patents filed/awarded, Dr. Gangenahalli's contributions are substantial. He has supervised several PhD scholars and graduate/postgraduate students. His accolades include being named the Defence/DRDO Scientist of the Year in 2017. Additionally, he is an elected Fellow of both International and National scientific academies and societies.

Research Interest

Stem Cell Response, Tissue Engineering, Gene-Engineering, Synthetic Biology, Regenerative Medicine