Brief Bio

My group worked on membrane dynamics in mammalian spermatozoa during their post- testicular development and its relevance in making the spermatozoa undergo membrane fusion events associated with fertilization. Our studies demonstrated the presence of organized lipid-protein clusters in biomembranes allowing restricted intracluster molecular motion, while enjoying the freedom for lateral motion. These microdomains are widely known as membrane rafts today. We studied sperm membrane structure in the context of male infertility and evolved protocols to modulate the physical state of sperm membrane in vitro to aid in gamete interaction and subsequent fusion. We conducted differential display proteomics analysis to identify the differences in the proteins, both within and outside membrane rafts, in spermatozoa from fertile and infertile human males. This study led to the identification of several proteins which were essential for making the sperm fertilize and activate the oocyte missing in several males with primary male factor infertility. We conducted extensive studies on a select set of the critical molecules involved in making the sperm functionally competent to fertilize and activate the oocyte. We have made an antibody array for screening the expression of 54 differentially displayed human sperm proteins associated with male factor infertility, which could be used for diagnosing male factor infertility in terms of molecular markers and for optimizing assisted reproductive technology interventions. My group was also successful in spermatogonial stem cell reprogramming to transdifferentiate them into somatic lineages. We studied spermatogenesis using a network biology approach integrating the changes in the global epigenetic, transcriptional, post- transcriptional and proteomic landscapes using the 1st wave of spermatogenesis model in mouse to address the molecular networks and pathways involved in germline stem cell maintenance, division and differentiation.
I have completed 26 extramural research grants and have successfully mentored 23 PhDs. I have trained 7 post-doctoral fellows and several Master-level students. I have published 121 research articles and am a reviewer of many international journals, all the Indian funding agencies and several international funding agencies.