**Statement of research achievements, if any, on which any award has already been received by the applicant. Please also upload brief citation(s) on the research work(s) for which the applicant has already received the award(s) (not to exceed 2000 words)**

Awards Received: National Bioscience Award for Career Development (2014)

Shanti Swarup Bhatnagar Prize in Biological Sciences (2017)

In response to stress, error-prone DNA polymerases (dPols) are upregulated in bacteria and serve to relieve selection pressure imposed by the maladapted environment. Stress-induced-mutagenesis by these dPols is implicated in the onset of drug resistance in pathogenic bacteria. Using DNA polymerase IV (PolIV) from *Escherichia coli* and its Mycobacterial homolog (MsDpo4) as model enzymes, Dr. Nair has discovered the unique attributes in these enzymes that allow them to participate in stress-induced mutagenesis [*Nuc. Acids Res. (2013) PMID:23525461*; *Acta Cryst. D (2012) PMID:22868761; J. Nucleic Acids (2012) PMID:22523658*]. He has shown that presence of a polar residue in the active site of PolIV located towards the minor groove of nascent DNA allows controlled mutagenesis to ensure adaptive capability without compromising genetic viability. Also, he has elucidated the mechanism utilized by PolIV to accurately rescue replication stalled at the nitrofurazone (NFZ) derived minor groove DNA adducts and thus neutralize the antimicrobial activity of the NFZ antibiotic [*Structure (2014) PMID*:*25497730; J. Org Chem (2016) PMID:26650891*]. These studies show that PolIV can synthesize DNA accurately past damaged nucleotides and in an error-prone manner on undamaged DNA.

His laboratory also studies multi-enzyme complexes associated with the replication of the genome of the Japanese Encephalitis Virus and DNA mismatch repair (MMR). He has shown that GTP binding ensures that RNA and nucleotides bind in the right order to guarantee accurate initiation of replication of the flaviviral genome [*Nuc. Acids Res. (2014) PMID:24293643*]. His laboratory has shed light on the correct assembly of an important enzyme in MMR to ensure calibrated and not adventitious endonuclease activity [*PLoS One (2010) PMID:21060849*]. He has also shown that minor changes in target DNA sequence of transcription factors have no impact on affinity but lead to drastic changes in the shape of the nucleoprotein complex [*Nuc. Acids Res. (2013) PMID:23109551; J. Biol. Chem (2016) PMID:26511320*]. Also, he contributed to the development of a new protocol for structure determination using anomalous signal from sulphur atoms [*Nat. Methods (2014) PMID:25506719*].

Recently, he has unearthed the structural mechanism utilized by PolIV to incorporate oxidized nucleotides in the genome. Based on this mechanism, he has designed and conducted elegant *in vivo* experiments that ultimately showed that reactive oxygen species do contribute substantially to the antimicrobial activity of bactericidal antibiotics and thus resolved a raging controversy [*Angewandte Chemie* (2015) *PMID:26757158*]. Overall, Dr. Nair has utilized structural and biochemical tools coupled with functional *in vivo* assays to shed new light on bacterial and viral replication. Together, his studies on PolIV show that, to ensure survival of bacteria, this enzyme links increase in stress-induced DNA damage with enhancement in the mutation rate. Additionally, in the presence of ROS, PolIV upregulation results in cell lethality and this caps the contribution of PolIV towards survival of bacteria. Dr. Nair's contributions allow for development of novel antimicrobials that perturb and accentuate the contributions of PolIV and related orthologs towards survival and lethality, respectively and thus add to the worldwide effort to combat the escalating global problem of antimicrobial resistance.