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## Advancing In Vitro Natural Rubber Synthesis via Cell-Free Systems

**Abstract:** Natural rubber (NR), vital for over 40,000 products, is projected to reach $68.5 billion in demand by 2026. Traditionally sourced from Hevea brasiliensis latex, NR production is hindered by low productivity, slow growth, environmental limits, and pathogen susceptibility. Recent advances in in vitro NR synthesis using recombinant proteins in bacterial, yeast, plant, and cell-free systems have provided significant insights, yet fully replicating NR production remains challenging. A major achievement includes synthesizing large cis-polyisoprene chains by reconstituting the HRT1-HRBP-REF complex on washed rubber particles (WRPs). However, substituting WRPs with nanodiscs has only produced small chains, indicating further research is needed. A promising approach involves isolating the rubber transferase (RTase) complex using natural membrane lipids, or “natural nanodiscs,” and reconstituting it on liposomes. These refined techniques offer potential solutions to current challenges in understanding and replicating the RTase complex's role in NR synthesis. This research is relevant to the “International Conference on Cell Science and Regenerative Medicine” as it demonstrates the innovative use of cell science to create functional biological materials outside traditional cellular systems, aligning with regenerative medicine’s goals.

**Keywords:** Cell-Free Protein Synthesis, Cis-prenyltransferase, Membrane Proteins, Rubber Transferase

**Biography:** Dr. Abdul Wakeel Umar is a biotechnology and molecular biology expert with a Ph.D. from Zhejiang University, China, and an MPhil from Quaid-I-Azam University, Pakistan. He is currently an Associate Distinguished Research Fellow at Beijing Normal University. Dr. Umar has served as a Brain Pool Invited Scientist at Korea Research Institute of Bioscience and Biotechnology and an Outstanding Postdoctoral Fellow at Henan University. His expertise includes hormonal crosstalk, secondary metabolite biosynthesis, and plant tissue culture. He has received prestigious grants and published extensively in peer-reviewed journals, showcasing his dedication to scientific research.


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