Editorial

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RNA-Binding Proteins in Rheumatic Diseases: Emerging Roles in Pathogenesis and Therapy

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Introduction

Rheumatic diseases, including rheumatoid arthritis (RA), systemic lupus erythematosus (SLE), and spondyloarthritis, are complex autoimmune disorders characterized by chronic inflammation and tissue damage. Increasing evidence highlights the critical role of RNA-binding proteins (RBPs) in regulating immune responses, post-transcriptional gene expression, and inflammatory signaling, positioning them as potential biomarkers and therapeutic targets in rheumatology.

Functions of RNA-Binding Proteins

RBPs are a diverse group of proteins that interact with RNA molecules to regulate splicing, transport, stability, and translation. In immune cells, RBPs modulate the expression of cytokines, chemokines, and signaling molecules essential for immune homeostasis. Dysregulation of RBPs can disrupt these processes, leading to aberrant immune activation, autoantibody production, and sustained inflammation observed in rheumatic diseases.

RBPs in Pathogenesis

Studies have identified several RBPs, such as HuR, TTP, and Roquin, as key regulators of pro-inflammatory cytokines like TNF-α, IL-6, and IL-17. Overexpression or loss of function of these proteins contributes to excessive cytokine production, immune cell hyperactivation, and tissue damage in RA and SLE. Additionally, RBPs influence the stability of transcripts involved in autoimmunity, linking molecular dysregulation to disease severity and progression.

Clinical Implications and Therapeutic Potential

Targeting RBPs offers a novel approach to modulate immune responses with higher specificity compared to broad immunosuppressants. Small molecules, antisense oligonucleotides, and RNA interference technologies are being explored to restore RBP function or inhibit pathogenic interactions. Furthermore, RBP expression patterns may serve as biomarkers to predict disease activity, treatment response, and patient stratification.

Future Directions

Ongoing research focuses on mapping RBP networks in immune cells and synovial tissue, integrating transcriptomic and proteomic analyses to elucidate disease mechanisms. Advances in high-throughput screening and single-cell RNA sequencing will accelerate the identification of actionable RBP targets, paving the way for precision medicine in rheumatic diseases.

Conclusion

RNA-binding proteins play a pivotal role in the pathogenesis of rheumatic diseases by regulating post-transcriptional immune mechanisms. Understanding their function offers new insights into disease biology and opens avenues for targeted therapeutic interventions. Continued investigation into RBPs promises to enhance biomarker discovery and facilitate the development of precision strategies for managing autoimmune rheumatic disorders.