# The Role of lncRNAs in Kidney Disease: A Breakthrough in Biomarker Discovery and Therapeutic Approaches

SHANNON, CLARE, IRELAND, March 10, 2025 /EINPresswire.com/ -- A new review published in Genes & Diseases on long non-coding RNAs (lncRNAs) highlights their critical role in the development, diagnosis, and potential treatment of acute kidney injury (AKI) and chronic kidney disease (CKD). The findings emphasize the importance of exosomal lncRNAs, which function as molecular regulators in kidney pathology and hold promise for future biomarker discovery and therapeutic advancements.

AKI and CKD affect millions worldwide, with AKI accounting for a significant proportion of hospital and intensive care unit admissions. The sudden decline in kidney function leads to severe complications and, if left untreated, can progress to CKD, ultimately resulting in renal fibrosis and organ failure. Given the increasing burden of kidney diseases, identifying reliable and early diagnostic markers is a medical priority.

The review sheds light on how exosomes, small extracellular vesicles carrying nucleic acids, proteins, and lipids, serve as crucial messengers in cellular communication. Within these vesicles, lncRNAs influence gene expression, modulating key pathways involved in kidney injury and repair. The ability of lncRNAs to regulate inflammation,
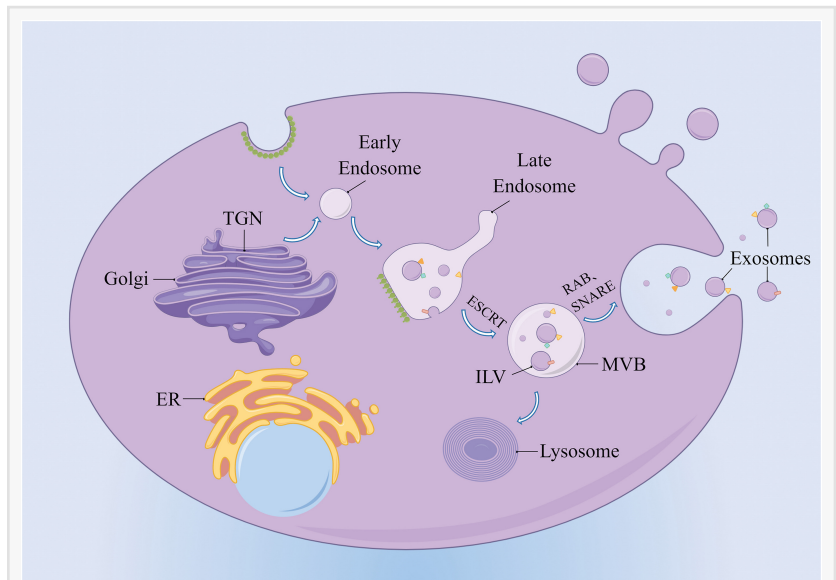

Biogenesis of the exosomes.
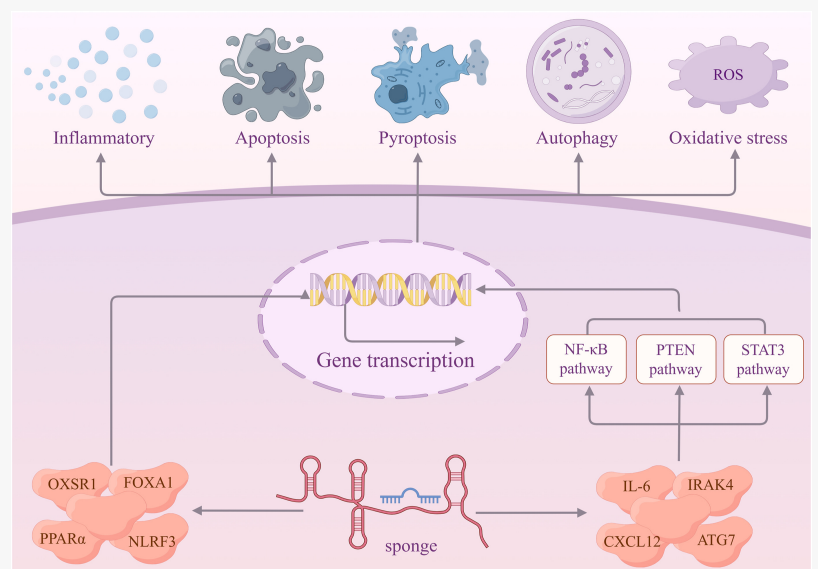
lncRNAs in sepsis-induced acute kidney injury.

fibrosis, and apoptosis presents them as powerful molecular targets for intervention.

In addition to their role in disease progression, circulating lncRNAs offer a minimally invasive method for early detection. Unlike traditional biomarkers, lncRNA signatures in exosomes are more stable and specific, making them highly effective for precision medicine applications. This emerging knowledge paves the way for developing lncRNA-based therapies, utilizing innovative delivery systems such as nanoparticles, liposomes, and adenoviral vectors to target renal disease at the molecular level.

lncRNAs in ischemia–reperfusion injury-induced acute kidney injury.
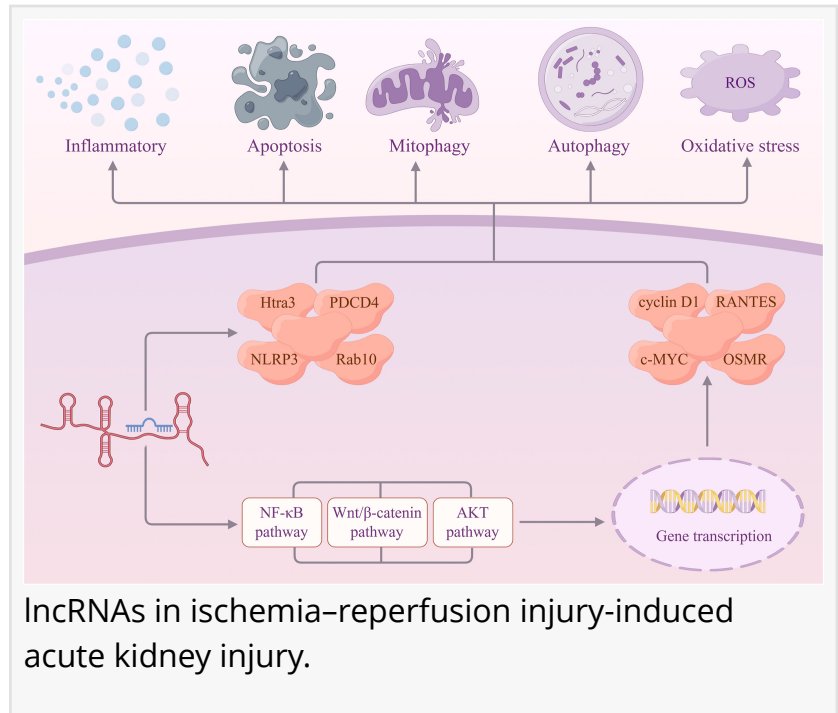
Despite the promise of lncRNA-targeting strategies, challenges remain. The refinement of exosomal isolation techniques is essential to enhance the purity and efficacy of lncRNA-based diagnostics and treatments. Additionally, further advancements in therapeutic delivery methods are needed to improve clinical translation.

This review underscores the potential of exosomal lncRNAs as a transformative approach to diagnosing and treating kidney diseases. By harnessing their regulatory capabilities, the medical community moves closer to offering new hope for patients with AKI, CKD, and renal fibrosis. As research progresses, the integration of lncRNA-based biomarkers and therapies into routine clinical practice could revolutionize nephrology, reducing disease burden and improving patient outcomes.

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Genes & Diseases publishes rigorously peer-reviewed and high quality original articles and authoritative reviews that focus on the molecular bases of human diseases. Emphasis is placed on hypothesis-driven, mechanistic studies relevant to pathogenesis and/or experimental therapeutics of human diseases. The journal has worldwide authorship, and a broad scope in basic and translational biomedical research of molecular biology, molecular genetics, and cell biology, including but not limited to cell proliferation and apoptosis, signal transduction, stem cell biology, developmental biology, gene regulation and epigenetics, cancer biology, immunity and infection, neuroscience, disease-specific animal models, gene and cell-based therapies, and regenerative medicine.

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Reference
Minhui Zheng, Zixuan Yang, Lei Shi, Liyuan Zhao, Kelan Liu, Naping Tang, The role of lncRNAs in AKI and CKD: Molecular mechanisms, biomarkers, and potential therapeutic targets, Genes & Diseases, Volume 12, Issue 3, 2025, 101509, https://doi.org/10.1016/j.gendis.2024.101509

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