



# Exosome-based Diagnostics and Therapeutics

Exosomes- Extracellular and Exciting

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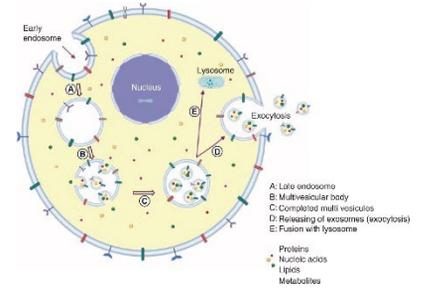
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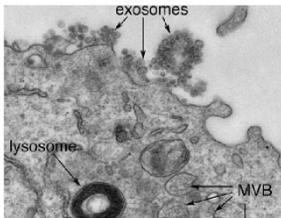
## Highlights

**Exosomes** are nano-sized vesicles secreted by most cells that contain a variety of biological molecules, such as lipids, proteins and nucleic acids. They have been recognized as important mediators for long-distance cell-to-cell communication and are involved in a variety of biological processes. Exosomes have unique advantages, positioning them as highly effective drug delivery tools and providing a distinct means of delivering various therapeutic agents to target cells. In addition, as a new clinical diagnostic biomarker, exosomes play an important role in many aspects of human health and disease, including endocrinology, inflammation, cancer, and cardiovascular disease.

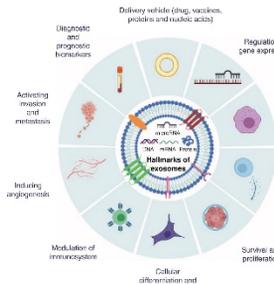
The discovery of exosomes as natural carriers of functional small RNA and proteins has raised great interest in the **drug delivery field**, as it may be possible to harness these vesicles for therapeutic delivery of miRNA, siRNA, mRNA, lncRNA, peptides, and synthetic drugs.



**Figure 1.** The biogenesis of exosomes and release pathway. (Dilsiz N. *Future Science oA*, Vol. 8, NO.1 review).



**Figure 2.** A transmission electron micrograph of a cancerous B cell that has secreted exosomes. Credit: *BMC Biology* 2016. <https://doi.org/10.1186/s12915-016-0268-z>. CC BY 4.0.



**Figure 3.** Hallmarks of exosomes categorized according to their functions:  
• Regulation of gene expression  
• Intracellular signaling and cell-to-cell communication  
• Reprogramming of target cell  
• Survival and proliferation  
• Cellular differentiation and neoplasia  
• Modulation of immunosystem  
• Inducing angiogenesis  
• Activating invasion and metastasis  
• Diagnostic and prognostic biomarkers  
• Delivery vehicle (drugs, vaccines, proteins and nucleic acids). (Dilsiz N. *Future Science oA*, Vol. 8, NO.1 review).

## Projects

- Pseudotyping exosomes for enhanced protein delivery in mammalian cells.

*Example:* How a vesicular stomatitis virus glycoprotein (VSVG) can both load protein cargo onto exosomes and increase their delivery ability via a pseudotyping mechanism?

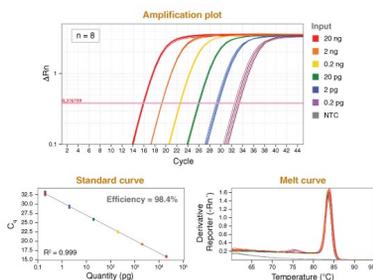
- The role of exosome in autoimmune connective tissue disease.

*Example:* How circulating exosomes from patients with autoimmune diseases can induce a proinflammatory immune response?

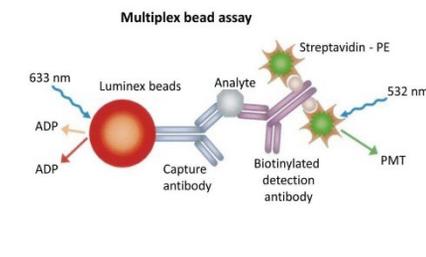
## Techniques

Cell culture *in vitro* and *ex-vivo* models, virology, Q-PCR, immunoassays, ELISA and others

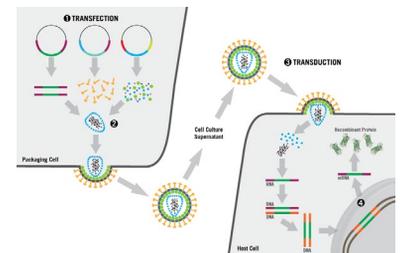
*Examples:*



**Figure 4.** Real-time PCR detection principles



**Figure 4.** Bead-based multiplex assay using Luminex technology



**Figure 5.** Production of lentiviral particles

## Publications relevant to the project

Dilsiz N. Hallmarks of exosomes. *Future Sci OA*. 2021 Nov 5;8(1):FSO764. doi: 10.2144/foa-2021-0102. PMID: 34900338; PMCID: PMC8656295.