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Isolation and Applications of Exosomes - Stem cell therapy

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Exosomes are small extracellular vesicles (30–150 nm) secreted by cells, carrying proteins, lipids, nucleic acids, and other bioactive molecules. First identified in 1986, they play a crucial role in intercellular communication, immune regulation, tissue regeneration, and disease progression. Their unique ability to reflect the physiological state of parent cells makes them promising candidates as disease biomarkers and therapeutic agents. Exosomes can be isolated through several methods. Differential ultracentrifugation is the most widely used, separating vesicles by size and density. Ultrafiltration employs sequential filters to eliminate debris and collect vesicles. Size-exclusion chromatography allows separation based on particle size, while precipitation techniques use hydrophilic polymers to induce aggregation. Immunoaffinity-based isolation utilizes antibodies against exosome-specific markers for high selectivity. Each technique differs in purity, yield, and scalability, influencing clinical translation. Therapeutic applications of exosomes span diverse fields. In neuroprotection, exosomes loaded with catalase reduce oxidative stress and amyloid toxicity in neurodegenerative diseases. In dermatology, they promote skin repair, collagen synthesis, and anti-inflammatory effects, benefiting conditions like acne, eczema, and aging. As natural carriers, they can be engineered to deliver drugs such as curcumin and eugenol, enhancing bioavailability, antimicrobial action, and anticancer effects.

KEYWORDS: Exosomes, Extracellular vesicles, Isolation Techniques, Regenerative Medicines, Biomarkers