A landscape view

EXOSOMES IN THERAPEUTICS AND DIAGNOSTICS

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What are exosomes?

Function and Characterization
Why exosomes?

Natural

Innate stability  |  Biocompatibility  |  Low immunogenicity  |  Crosses blood-brain barrier

Synthetic

Low bioavailability  |  Rapid bloodstream clearance  |  Cytotoxicity
Exosomes at the human scale
For both therapeutics and diagnostic applications

Therapeutics

- exogenous
- autologous
- isolation
- combined

Diagnostics

- PCR
- Sequencing
- Proteomics
Exosome publications has increased over time
Research in exosomes is outpacing LNP
Cancer leads the way amongst a wide range of diseases.
There’s a challenge: isolating and purifying exosomes
With a wide range of approaches…

**Ultracentrifugation**
Density and size based sequential separations
- purity

**Ultrafiltration**
Filter membrane with defined size-exclusion limit
- purity, integrity

**Immunoaffinity**
Antigen–antibody specific recognition and binding
- yield, speed

**Polymer precipitation**
Polymer adhering and precipitating exosomes
- purity, speed

**Size exclusion chromatography**
Hydrodynamic radii exosome separation
- throughput, automation

**Microfluidics**
Imunoaffinity, size, density
- scale, speed
Advanced microfluidics are leading due to efficiency, speed, and high grade of purity.
# Exosome donor cells and disease correlation

## Therapy and diagnostics

<table>
<thead>
<tr>
<th>Disease Type</th>
<th>Dendritic Cells</th>
<th>Leucocytes</th>
<th>Endothelial Cells</th>
<th>Antigen-presenting Cells</th>
<th>Stem Cells</th>
<th>Erythrocytes</th>
<th>Platelets</th>
<th>Lymphocytes</th>
<th>Immune Cells</th>
<th>T-cells</th>
<th>Natural Killer Cells</th>
<th>Macrophages</th>
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<td><strong>Cancer</strong></td>
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Therapeutic and diagnostic growing in equal shares over time

Therapeutics lead in publication numbers

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<th>Therapy</th>
<th>Diagnostics</th>
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</table>

- Therapy: 44%
- Diagnostics: 56%
Twice as many pre-clinical studies
Suggests a wave of new drugs across a wide range of diseases

<table>
<thead>
<tr>
<th>Exosomes in clinical studies</th>
<th>Therapeutic Focus</th>
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<tbody>
<tr>
<td>bmMSC-derived exosomes</td>
<td>ARDS, IBD</td>
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<tr>
<td>bmMSC-derived exosomes</td>
<td>Wound healing</td>
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<tr>
<td>amniotic fluid derived exosomes</td>
<td>ARDS</td>
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<td>Purified exosome product</td>
<td>Wound healing/Myocardial infarction</td>
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<td>exosome with ASO-STAT6</td>
<td>Hepatocellular Carcinoma</td>
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<td>umbilical cord derived exosomes</td>
<td>ARDS</td>
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<tr>
<td>ginger exosomes</td>
<td>IBD</td>
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<tr>
<td>MSCs-derived exosome with KrasG12D siRNA</td>
<td>Pancreatic cancer</td>
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</table>
Exosome commercialization, from bench to bedside

Companies and their targeted diseases

- Anjarium Biosciences
- Carmine Therapeutics
- Citoa
- EV Therapeutics
- Unicyte
- Ilias Biologics
- Aethlon Medical
- Codiak Biosciences
- Aruna Bio
- Celltex Therapeutics
- Evox
- Florica Therapeutics
- Innocan Pharma
- ReNeuron
- VivaZome
- Capricor Therapeutics
- MDimune
- Xollent
- Organicell
- OmniSpirant
- Exogenus Therapeutics
- Aegle Therapeutics
- Avalon Globocare
- Direct Biologics
- Exopharm
- Vitti Labs
- Kimera Labs
- ExoCoBio
- RION
- Cells for Cells
- Evora BioSciences

Diseases:
- Cancer
- Neurological disease
- Lung disease
- Skin disease
- Infectious disease
- Wound healing
- Osteoarthritis
- Gastrointestinal disease
- Reproductive disorder
- Inflammatory disease
- Kidney disease
- Rare genetic disease
- Graft vs Host disease
- Organ transplant rejection
- Alopecia
- Heart disease
- Diabetes
- Bone disease
- Fibrotic disease
- Wound healing
- Ischemia
- Liver disease
- Eye disease
Acknowledgement
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- Rumiana Tenchov

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- Xinmei Wang

- Qiongqiong Angela Zhou
Gain insights on the emerging landscape of exosomes and more

Peer reviewed journal article
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