Bioengineering IV

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The University of Hong Kong

Catalyzing Therapeutic Breakthroughs: Engineering Targeted Extracellular Vesicles for Liver Fibrosis Treatment

CONTROLLED RELEASE SOCIETY
CRS 2024 Annual Meeting AND Exposition
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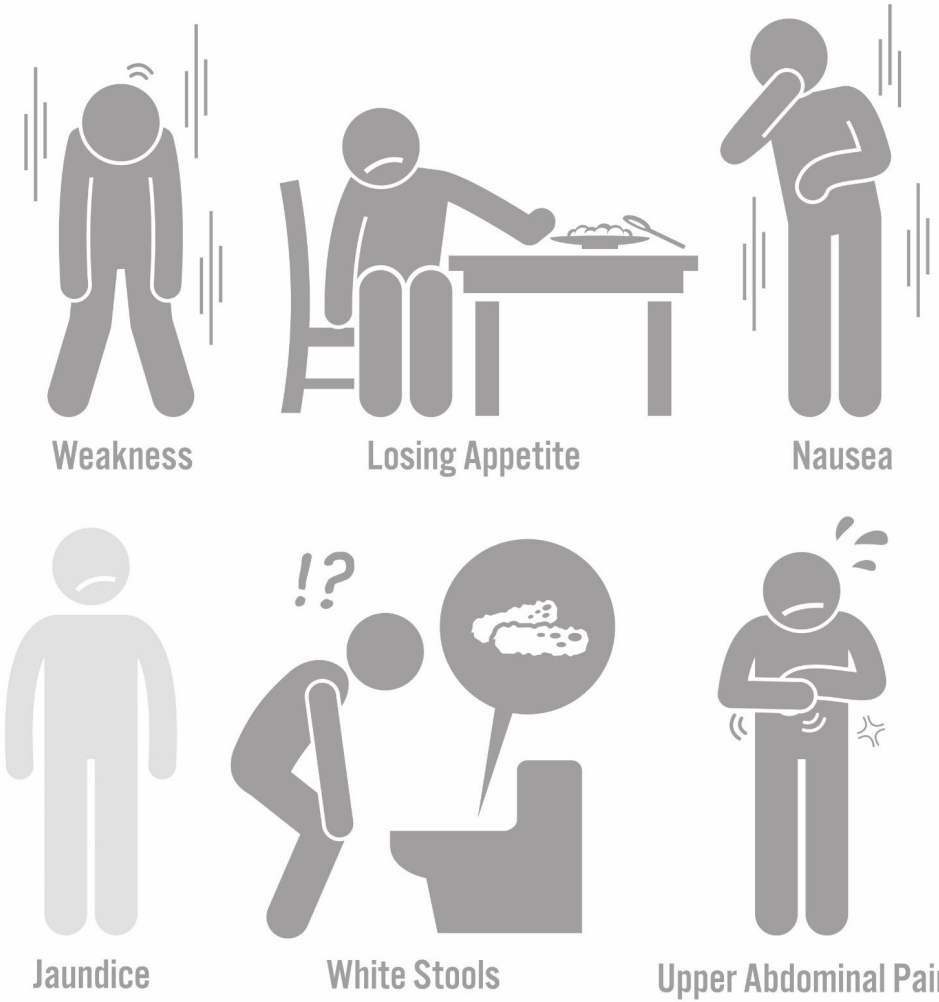
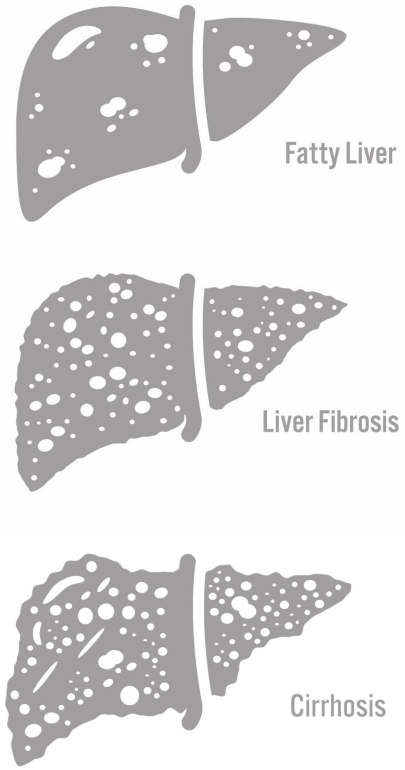
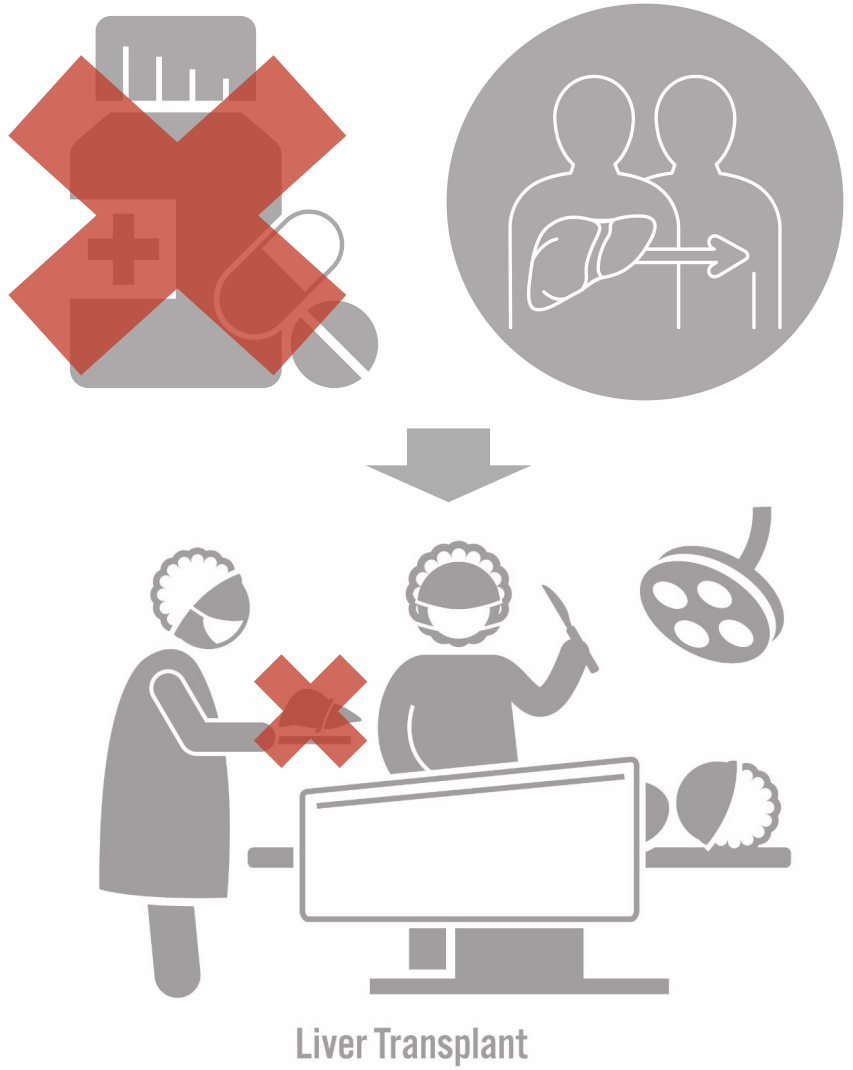
INTEGRATING
Delivery Science
ACROSS DISCIPLINES

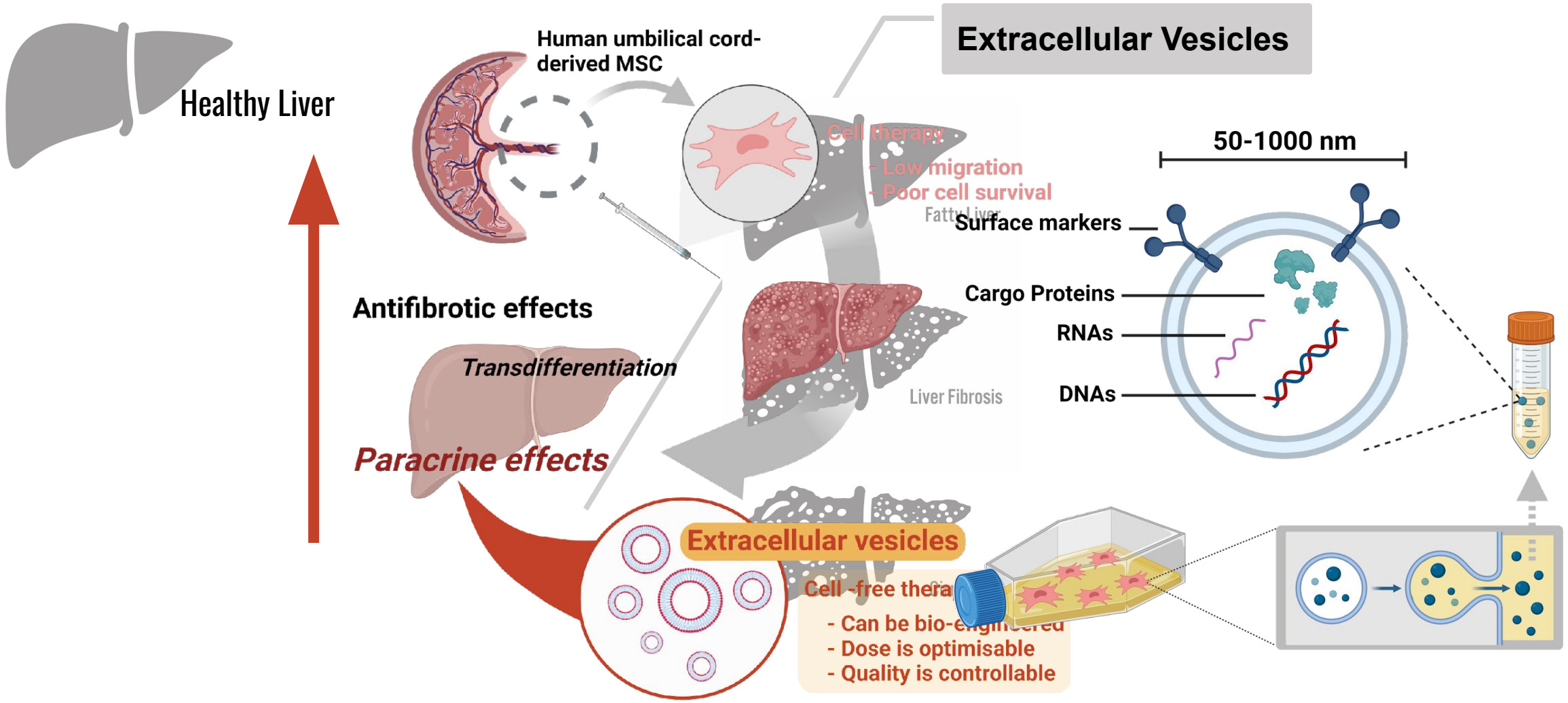
UNMET NEED







Promising solutions



Why EVs are ideal for targeted liver delivery

IVYSPRING INTERNATIONAL PUBLISHER

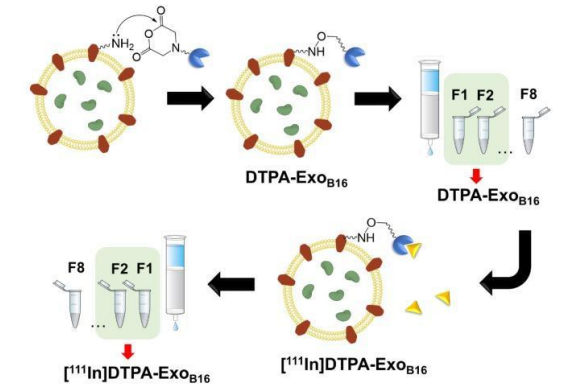
Theranostics

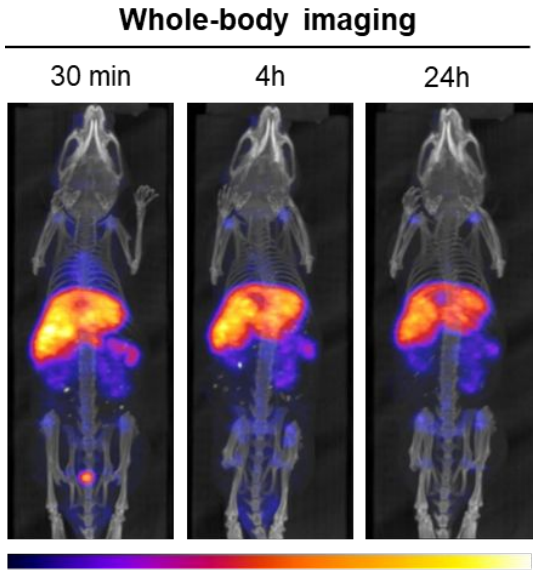
2019; 9(6): 1666-1682. doi: 10.7150/thno.27891

Research Paper

Membrane Radiolabelling of Exosomes for Comparative Biodistribution Analysis in Immunocompetent and Immunodeficient Mice – A Novel and Universal Approach

Farid N. Faruqu[1], Julie Tzu-Wen Wang[1], Lizhou Xu[1], Luke McNickle[1], Eden Ming-Yiu Chong[1], Adam Walters[1], Mark Gurney[2], Aled Clayton[2], Lesley A. Smyth[3], Robert Hider[1], Jane Sosabowski[4] ✉, Khuloud T. Al-Jamal[1] ✉



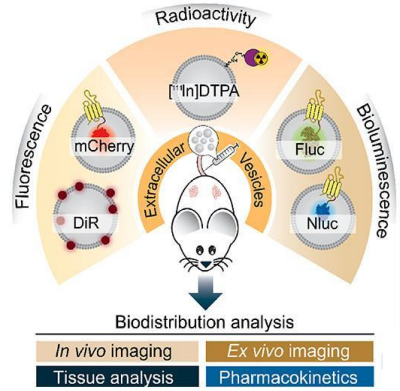


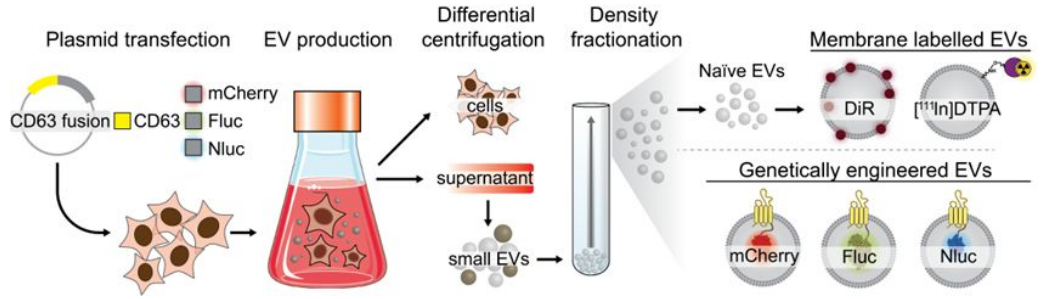
ACS NANO

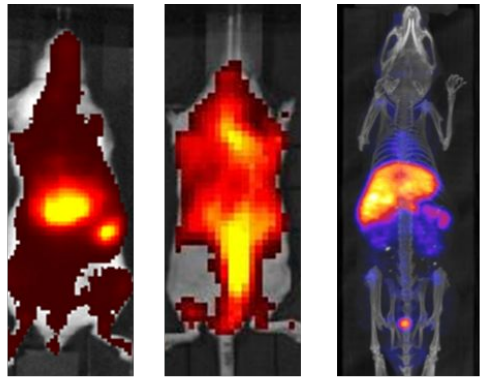
www.acsnano.org

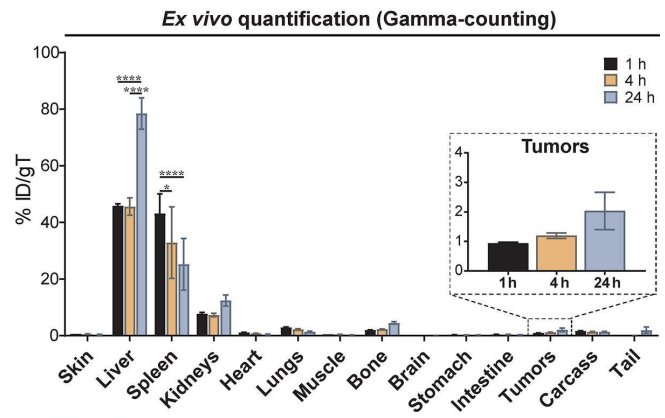
Selection of Fluorescent, Bioluminescent, and Radioactive Tracers to Accurately Reflect Extracellular Vesicle Biodistribution *in Vivo*

Elisa Lázaro-Ibáñez,*,# Farid N. Faruqu,# Amer F. Saleh, Andreia M. Silva, Julie Tzu-Wen Wang, Janusz Rak, Khuloud T. Al-Jamal,* and Niek Dekker*









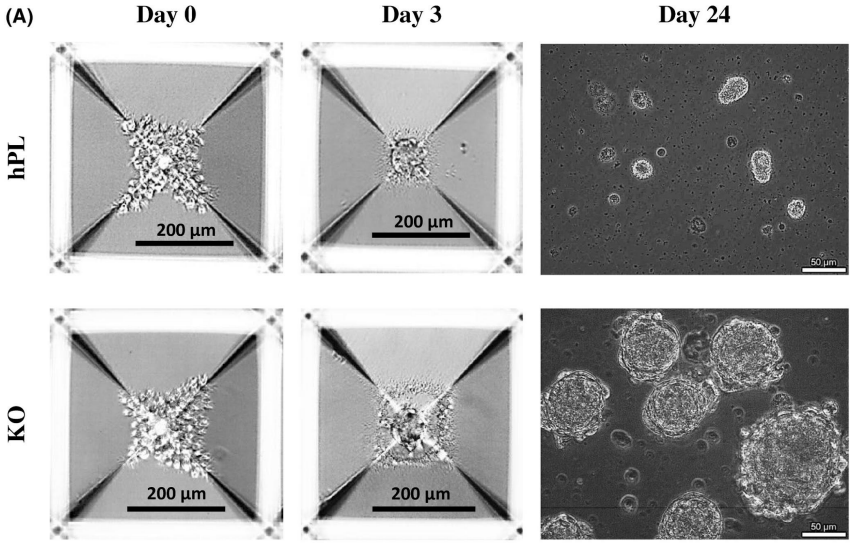
MSC-derived EVs as powerful agents for regeneration

RESEARCH ARTICLE

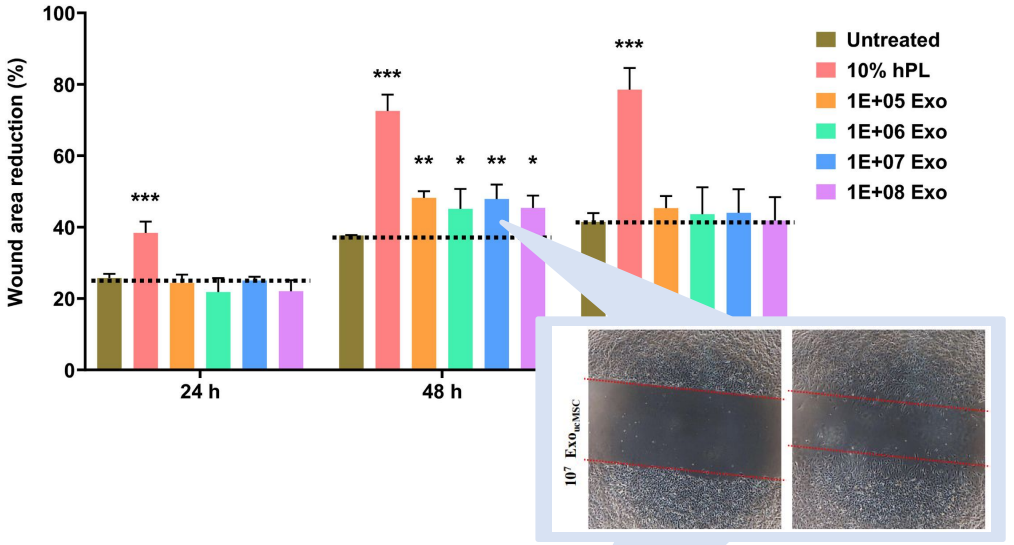
FASEB JOURNAL

Defined serum-free three-dimensional culture of umbilical cord-derived mesenchymal stem cells yields exosomes that promote fibroblast proliferation and migration in vitro

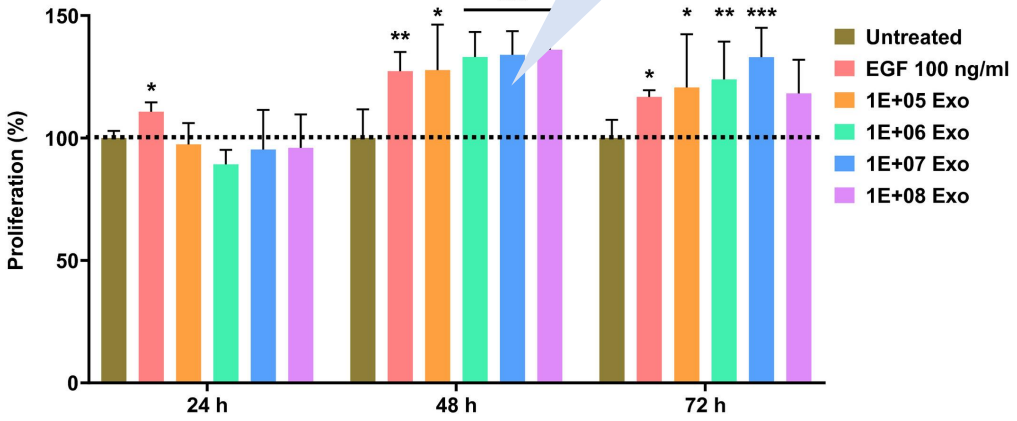
Farid N. Faruqu | Revadee Liam-Or | Shuai Zhou | Rebecca Nip | Khuloud T. Al-Jamal



Fibroblast migration tested by scratch wound healing assay



Stimulation of fibroblast proliferation by MSC-derived EVs



Advancements in EV protein corona research

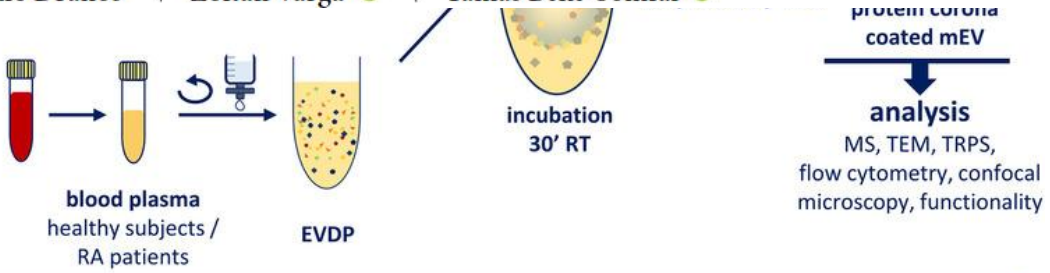
RESEARCH ARTICLE

Formation of a protein corona on the surface of extracellular vesicles in blood plasma

SHORT COMMUNICATION

Removal and identification of external protein corona members from RBC-derived extracellular vesicles by surface manipulating antimicrobial peptides

Priyanka Singh[1,2] | Imola Cs. Szigyártó[1] | Maria Ricci[1] | Anikó Gaál[3] | Mayra Maritza Quemé-Peña[1,2] | Diána Kitka[2,3] | Lívia Fülöp[4] | Lilla Turiák[5] | László Drahos[5] | Zoltán Varga[3] | Tamás Beke-Somfai[1]



Toth *et al*., 2021

RESEARCH ARTICLE

A functional corona around extracellular vesicles enhances angiogenesis, skin regeneration and immunomodulation

Martin Wolf[1] | Rodolphe W. Poupardin[1] | Patricia Ebner-Peking[1] | André Cronemberger Andrade[1] | Constantin Blöchl[2] | Astrid Obermayer[2] | Fausto Gueths Gomes[1,3] | Balazs Vari[1] | Nicole Maeding[1] | Essi Eminger[1] | Heide-Marie Binder[1] | Anna M. Raninger[1] | Sarah Hochmann[1] | Gabriele Brachtl[1]

Nanoscale Advances

ROYAL SOCIETY OF CHEMISTRY

PAPER

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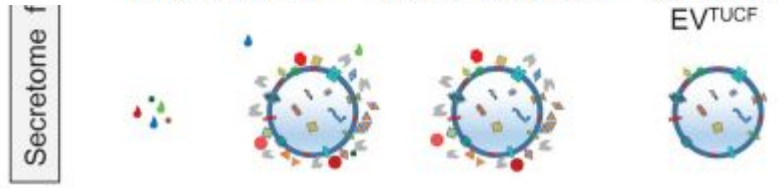
Cite this: *Nanoscale Adv.*, 2023, 5, 4703

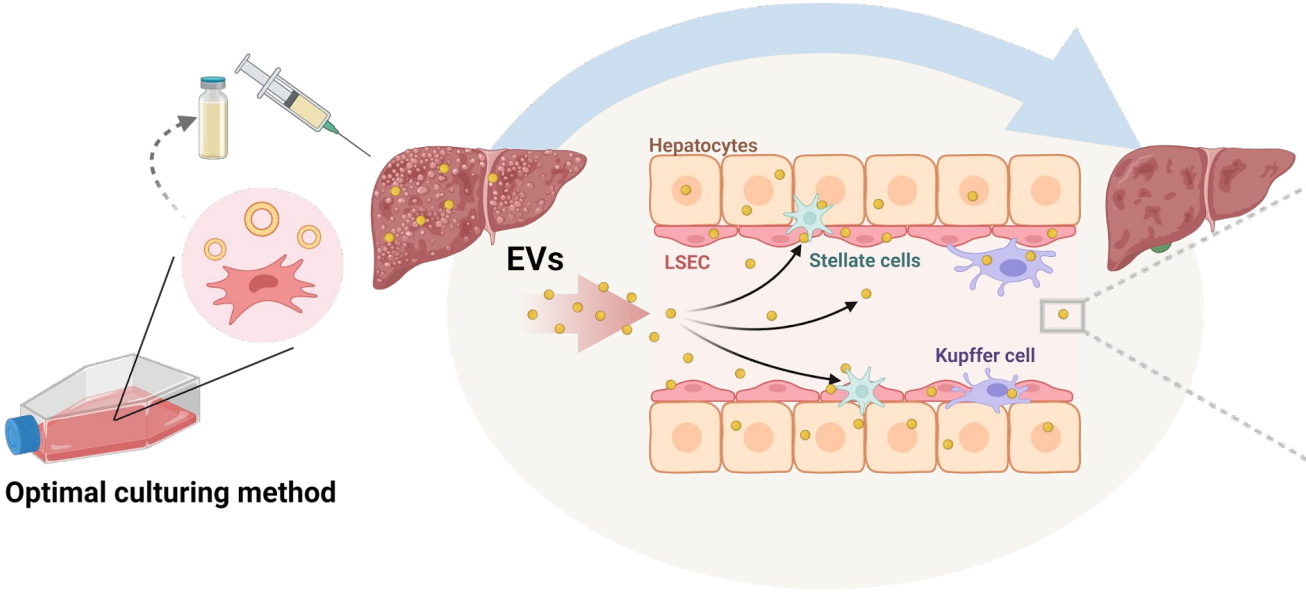
Surface functionalization of extracellular vesicle nanoparticles with antibodies: a first study on the protein corona "variable"†

Angelo Musicò,‡[ab] Rossella Zenatelli,‡[ab] Miriam Romano,[ab] Andrea Zendrini,[ab] Silvia Alacqua,[ab] Selene Tassoni,[a] Lucia Paolini,[bc] Chiara Urbinati,[a] Marco Rusnati,[a] Paolo Bergese,[abd] Giuseppe Pomarico*[ab] and Annalisa Radeghieri*[ab]



Wolf *et al*., 2021

Revolutionizing liver fibrosis treatment with MSC EVs



nature nanotechnology

Article

https://doi.org/10.1038/s41565-023-01585-y

Cellular uptake and in vivo distribution of mesenchymal-stem-cell-derived extracellular vesicles are protein corona dependent

Received: 8 November 2022

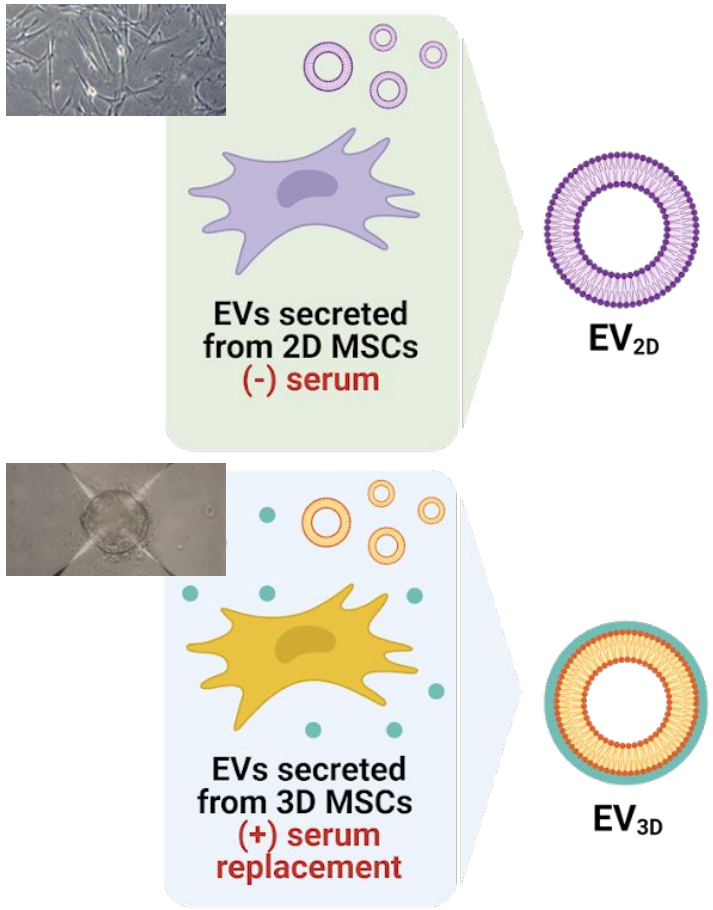
Accepted: 27 November 2023

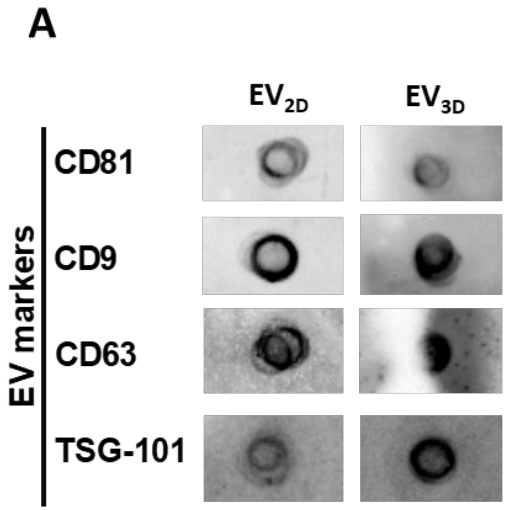
Published online: 16 February 2024

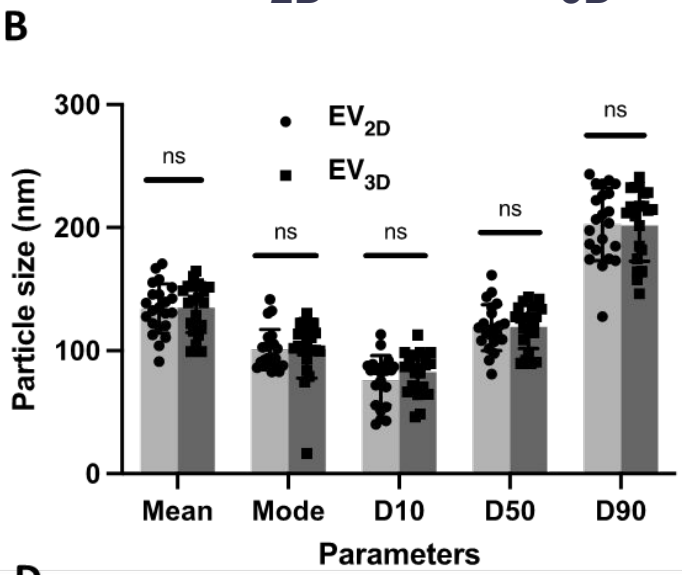
Revadee Liam-Or[1], Farid N. Faruqu[1,2], Adam Walters[1], Shunping Han[1], Lizhou Xu[1], Julie Tzu-Wen Wang[1], Jennifer Oberlaender[3,4], Alberto Sanchez-Fueyo[5], Giovanna Lombardi[6], Francesco Dazzi[7], Volker Mailaender[3,4] & Khuloud T. Al-Jamal[1]

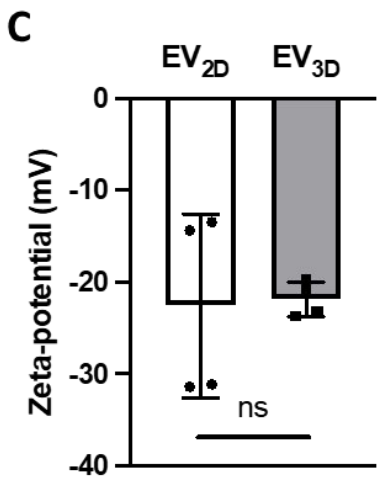
To prepare EVs derived from MSCs with favourable liver delivery properties and anti-fibrotic effects.

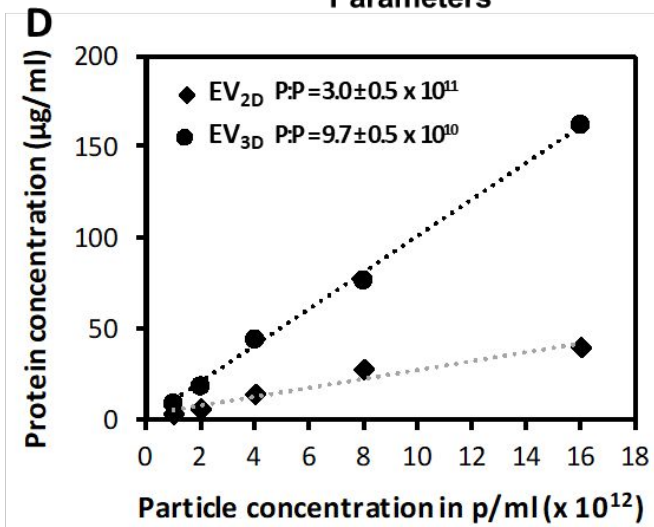
Unveiling the physicochemical and biochemical traits of EV_{2D} and EV_{3D}



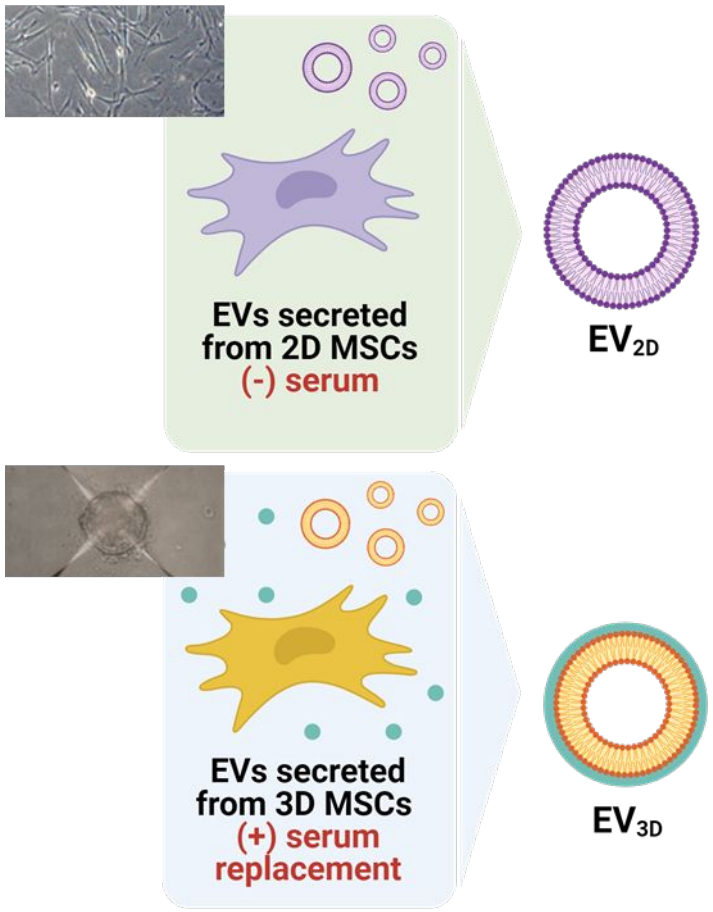


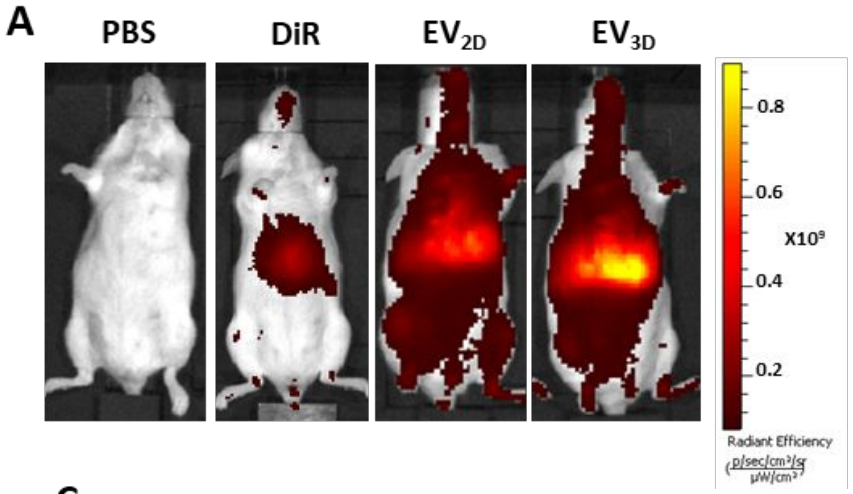


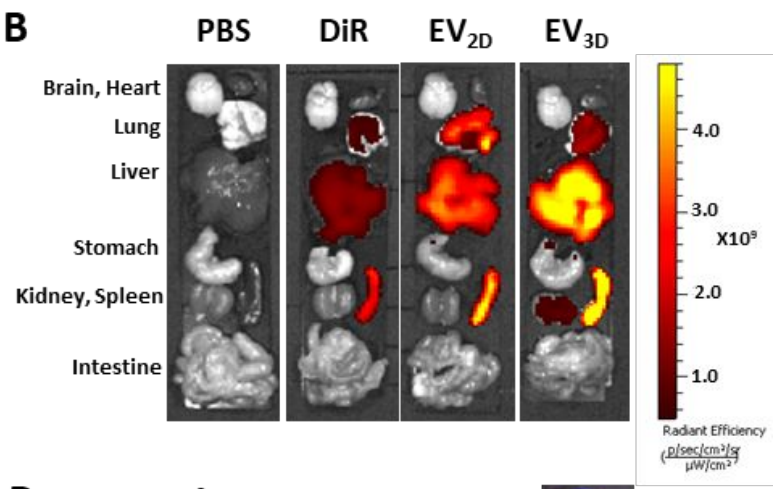


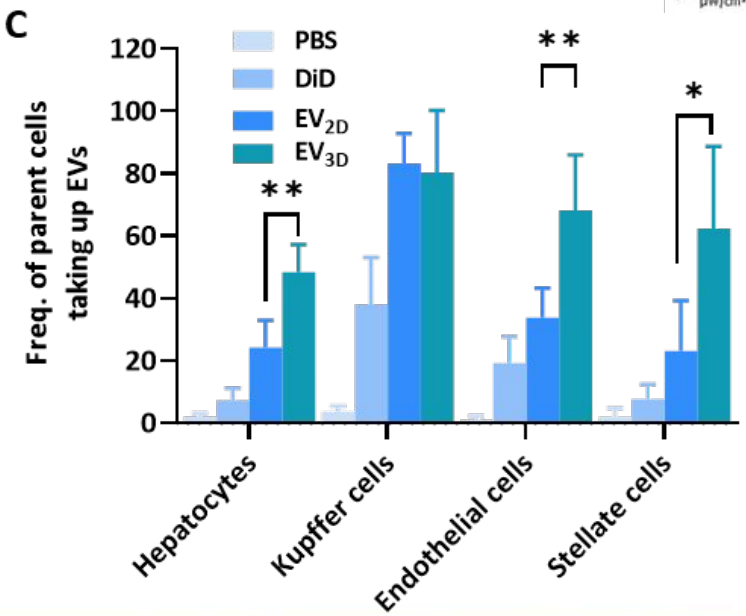


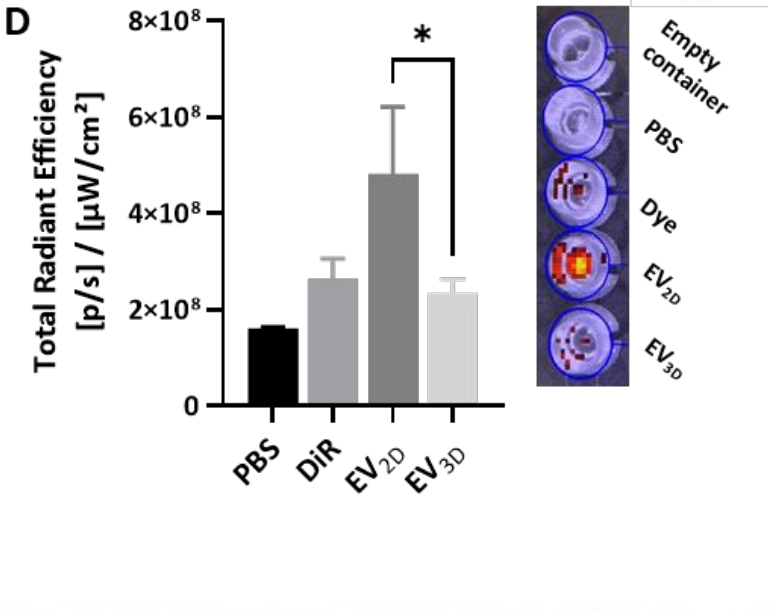
In vivo behaviour and cellular uptake of EV_{2D} and EV_{3D}



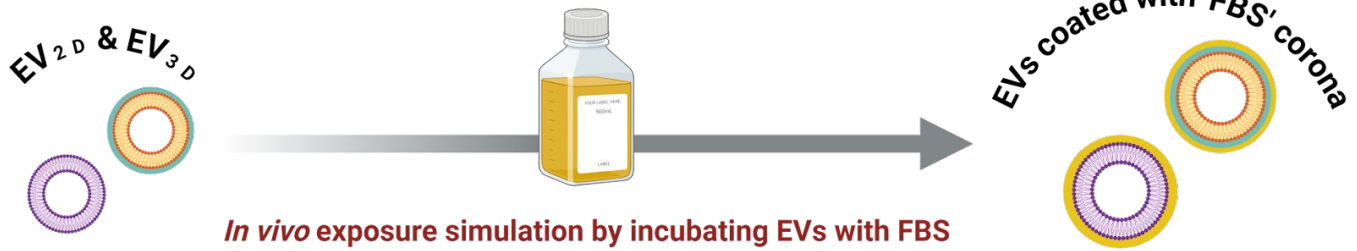


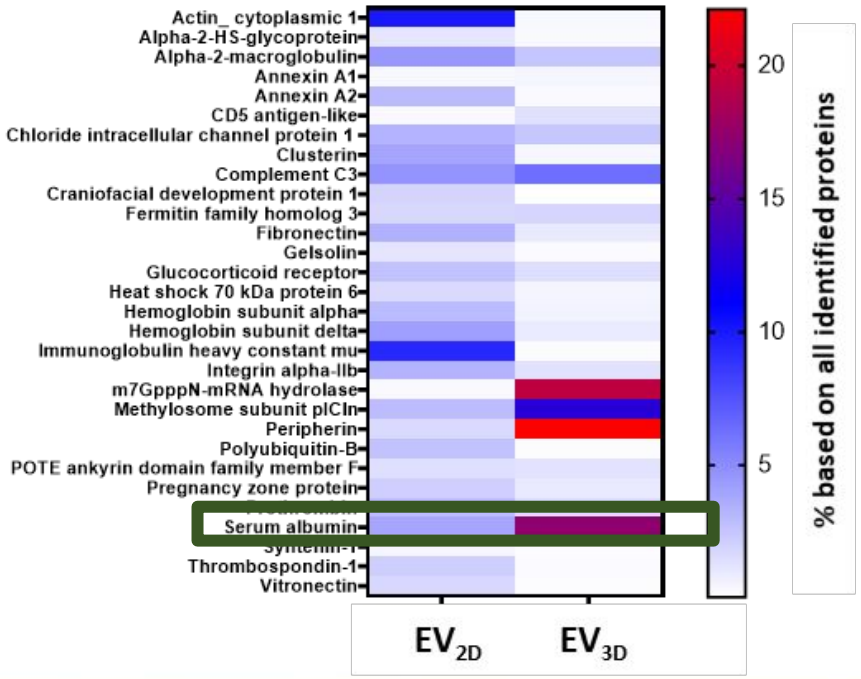


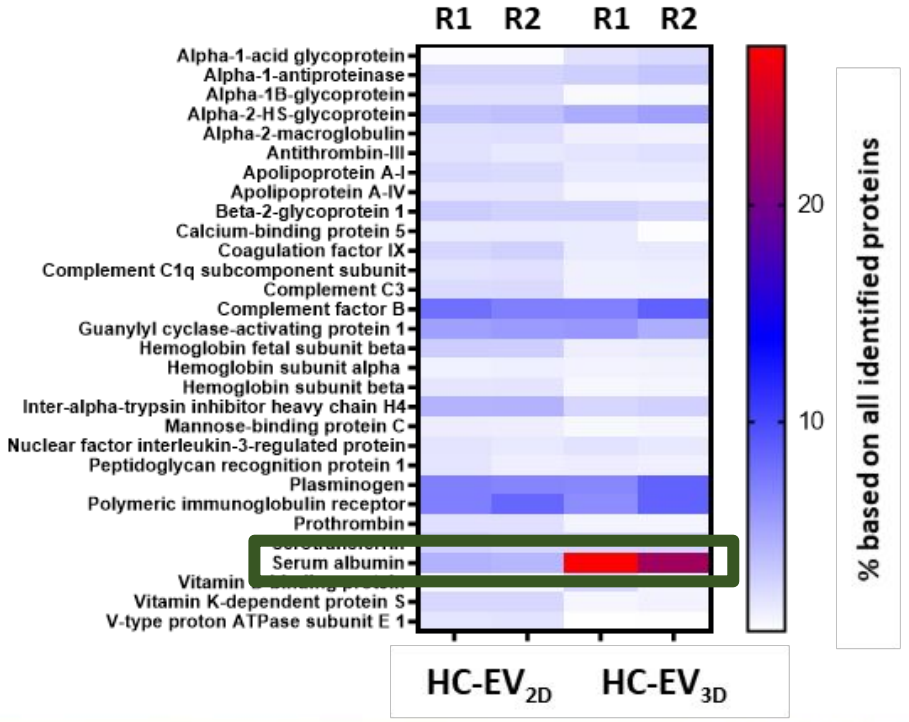




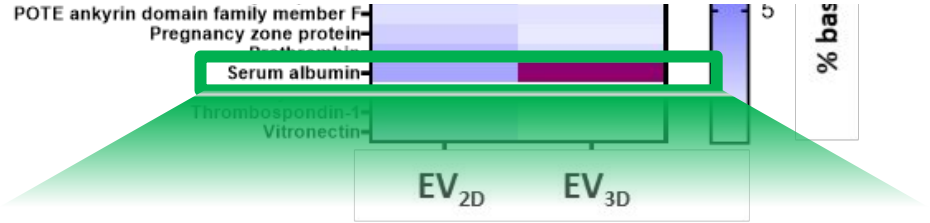
Proteomic insights from *in vitro* and *in vivo* experiments

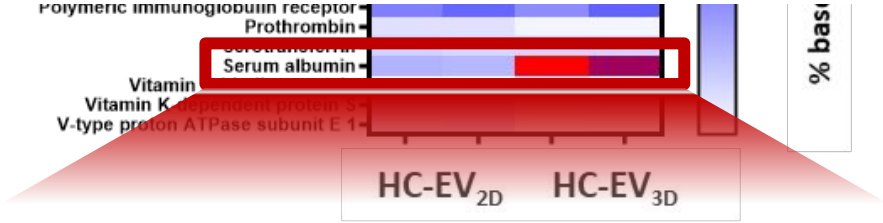


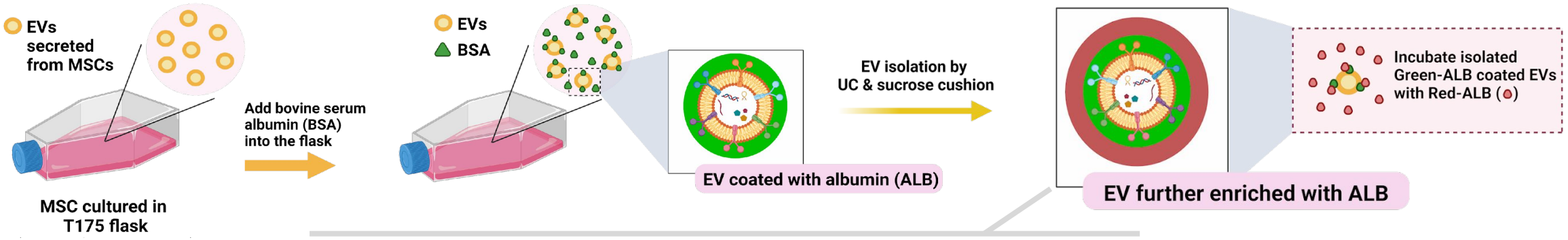


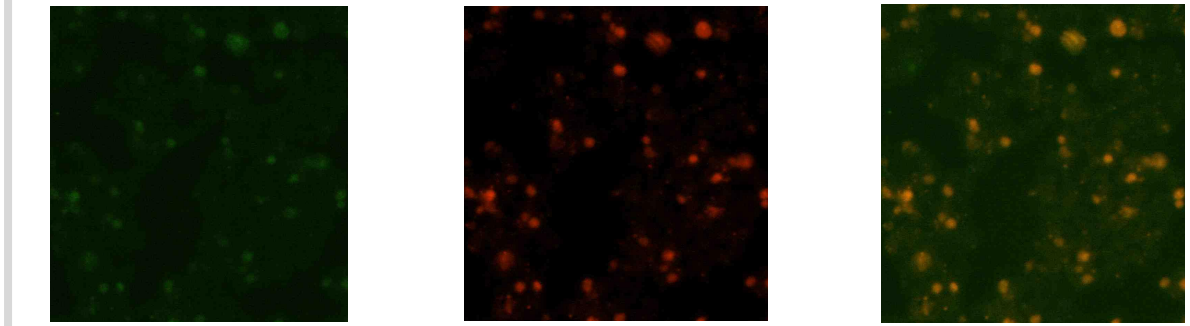


Confirming dual protein corona formation in EVs







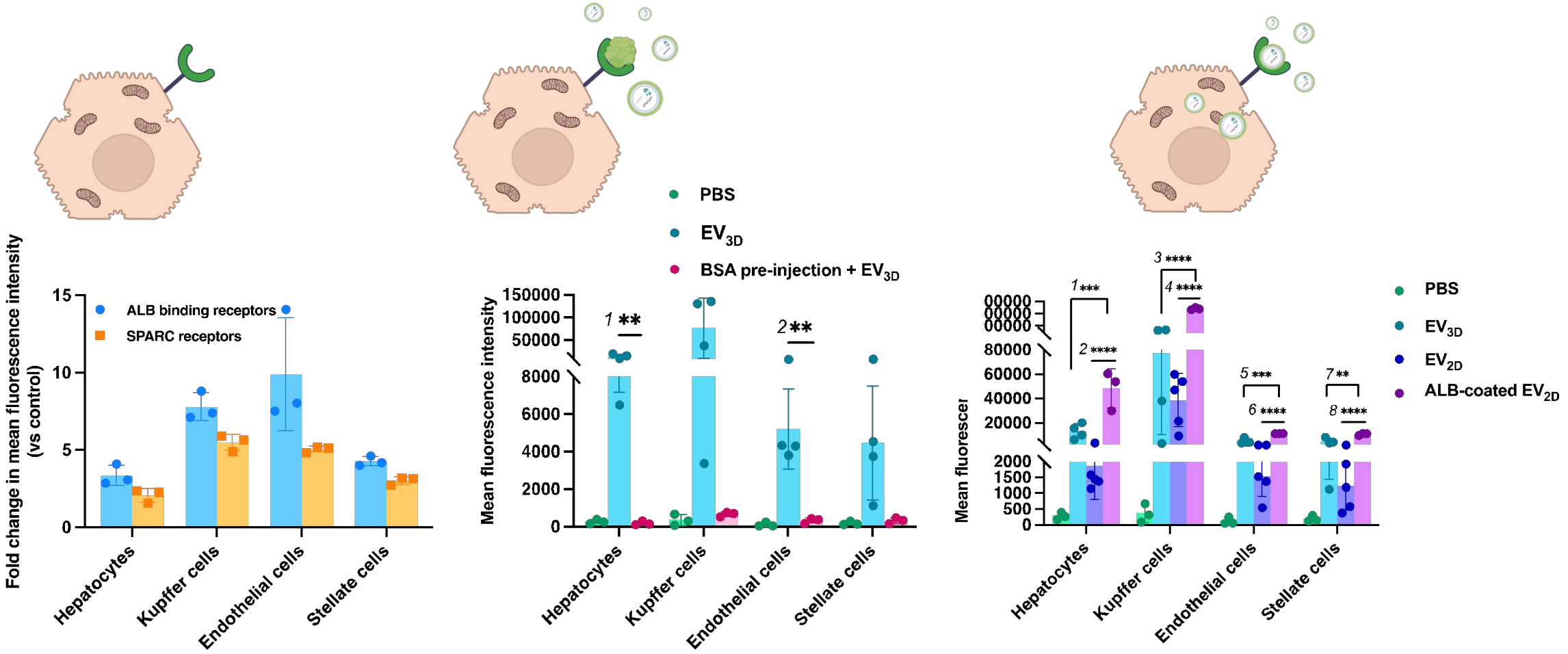


Green-labelled ALB on EVs

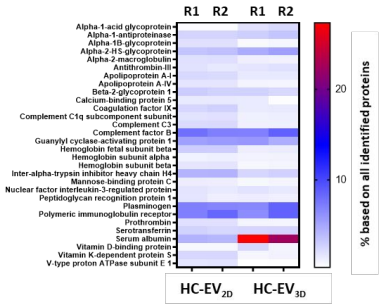
Red-labelled ALB on EVs

Overlay

In vivo proof-of-concept study confirming the contribution of ALB-enriched corona

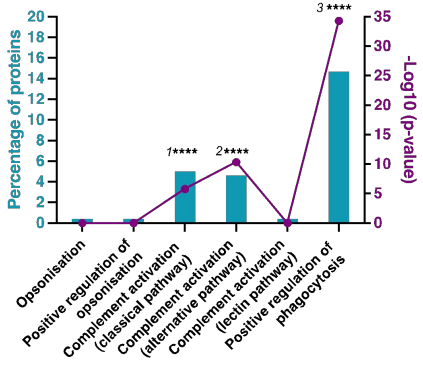


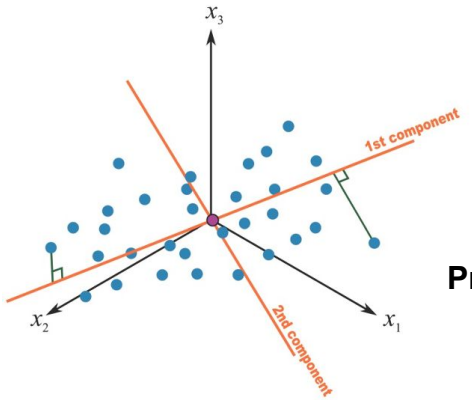
Corona analysis reveals differential protein enrichment in EV_{2D} and EV_{3D}



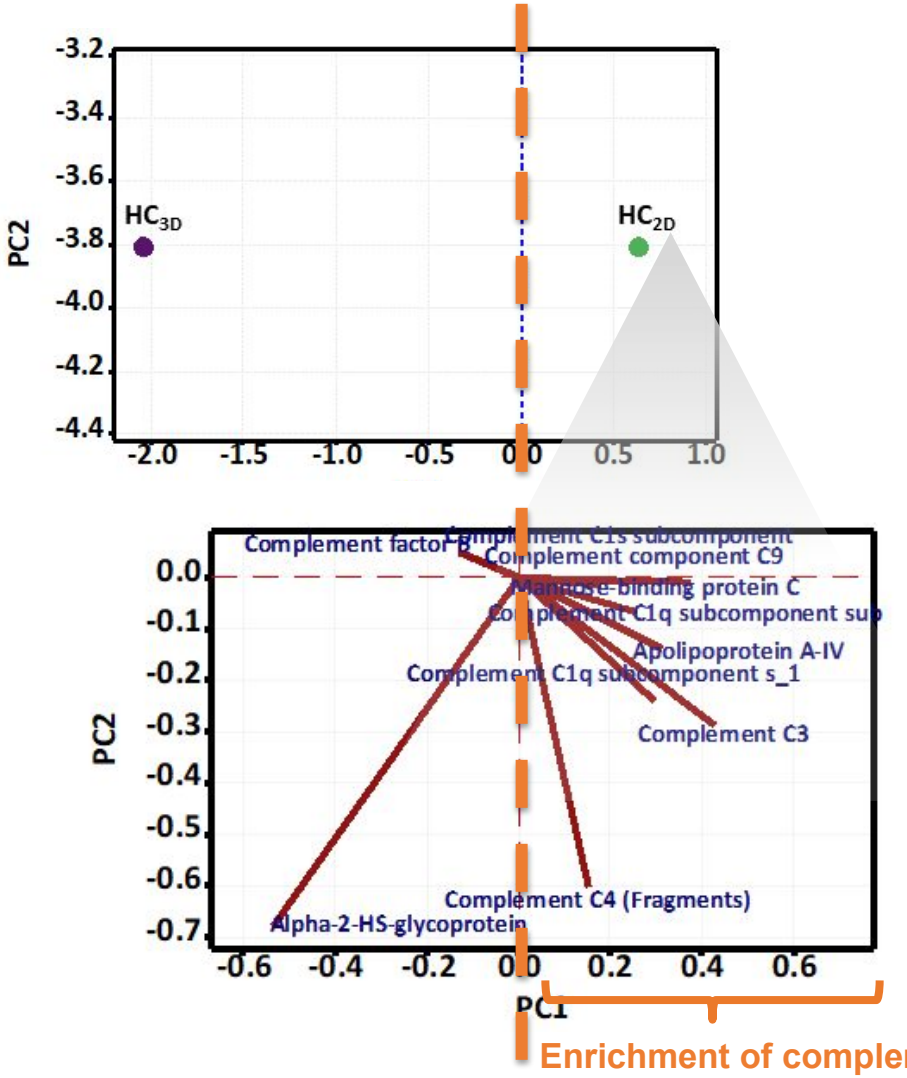
2nd corona

Gene ontology enrichment analysis



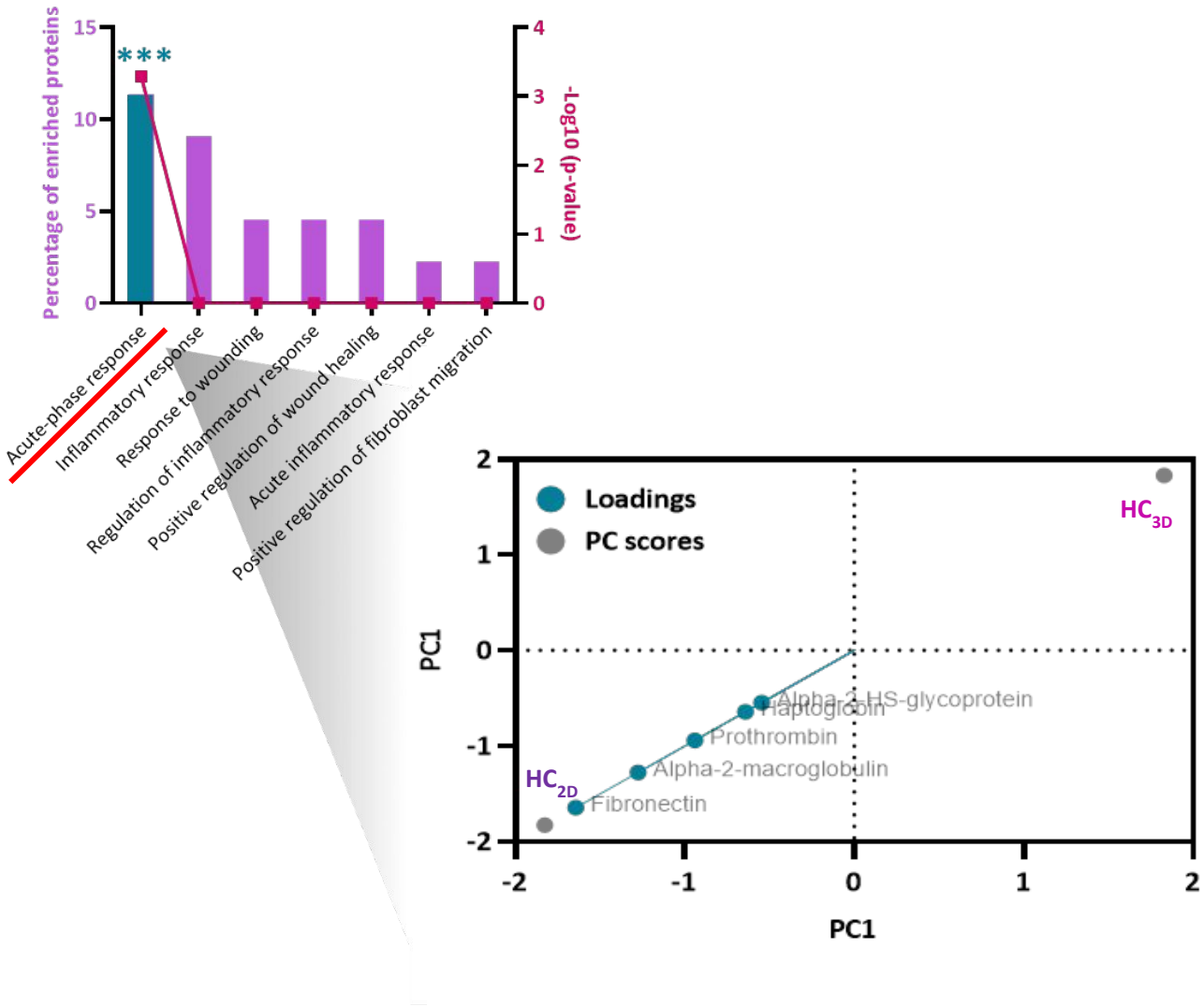


Principle component analysis (PCA)

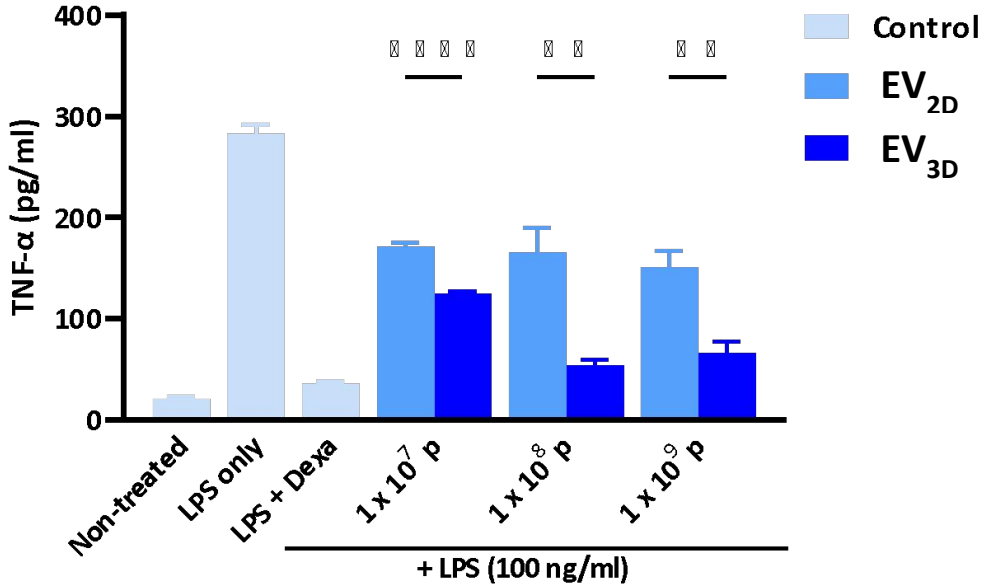


Enrichment of complements on EV_{2D}

Comparative therapeutic effects of EV_{2D} and EV_{3D} in inflammation and liver fibrosis

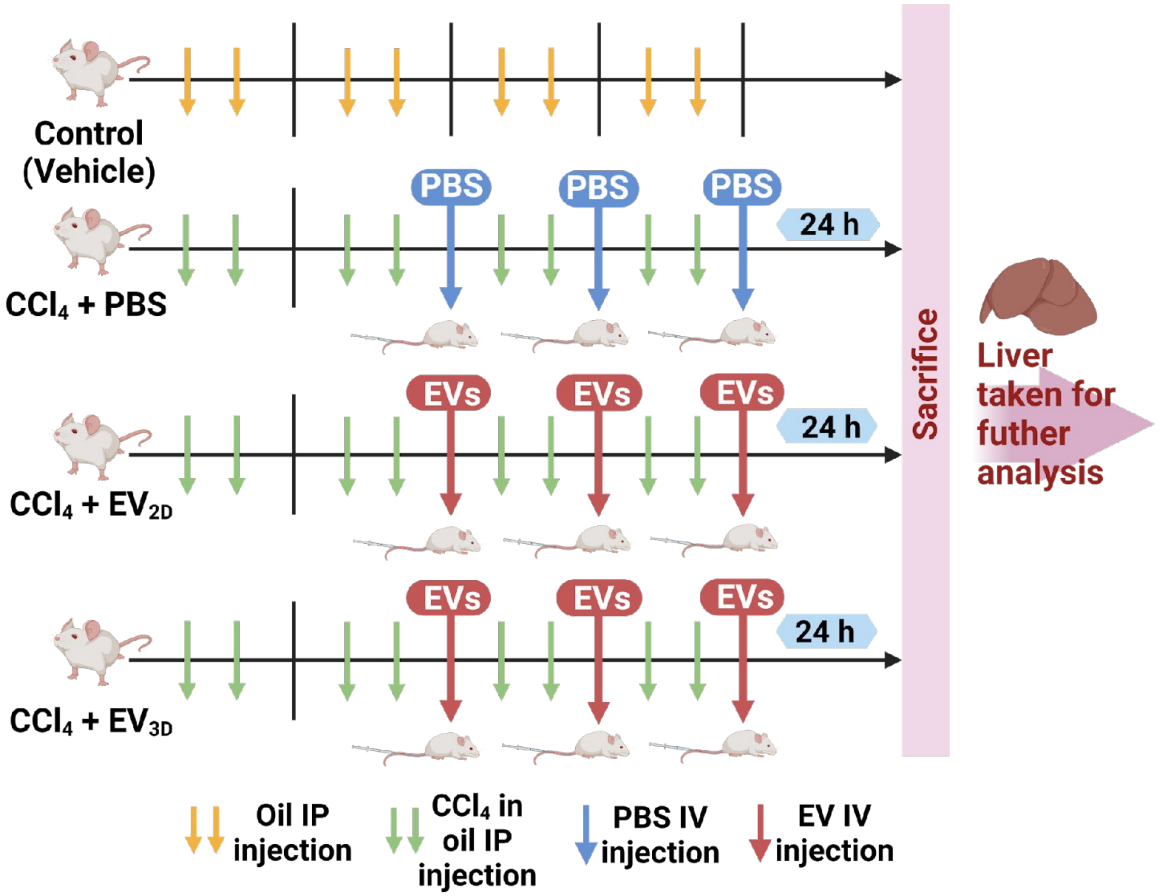


Anti-inflammatory effects on human monocyte-derived macrophages mediated by EV_{2D} and EV_{3D} *in vitro*

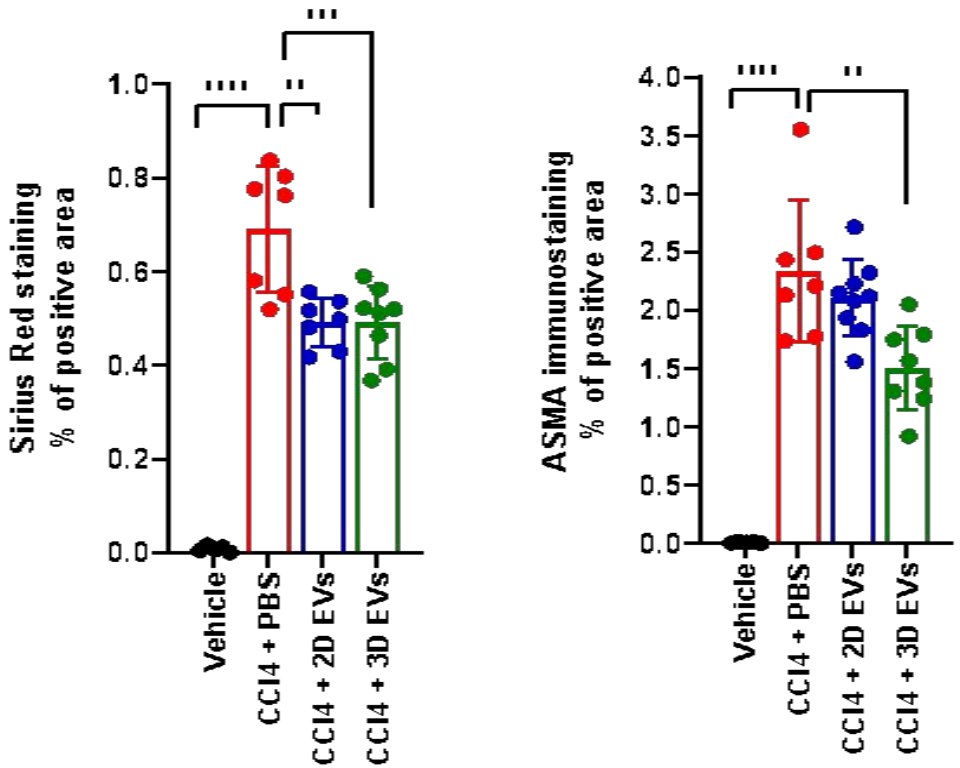


Liam-Or, Najimi & Al-Jamal et al, unpublished

Comparative therapeutic effects of EV_{2D} and EV_{3D} in inflammation and liver fibrosis



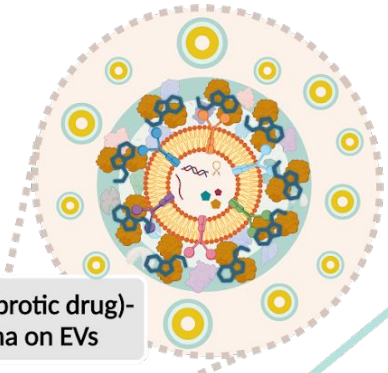
Anti-fibrotic effects in the CCl_4-liver fibrosis model



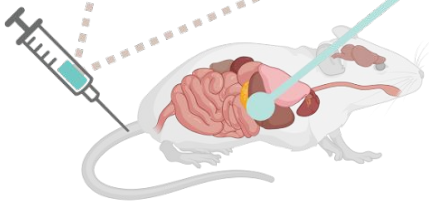
Liam-Or, Najimi & Al-Jamal et al, unpublished

Cultivating EVs for enhanced therapeutic applications and beyond

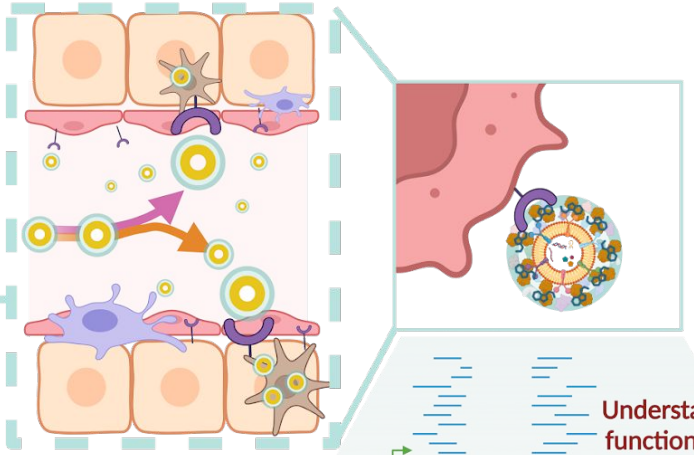
Engineering EVs as biotherapeutics



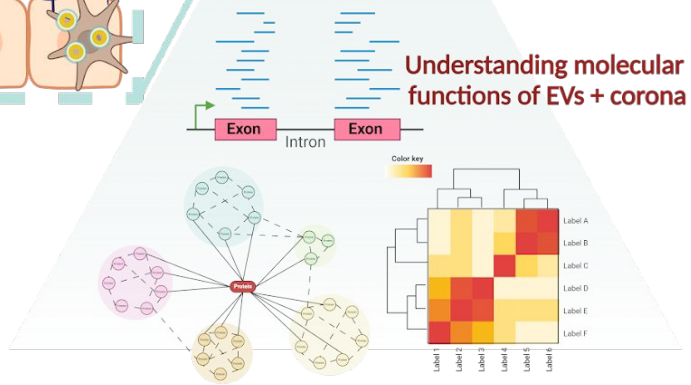
Albumin (± anti-fibrotic drug)-enriched corona on EVs



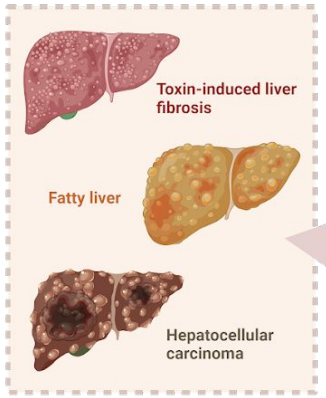
Precise targeting at key disease contributor



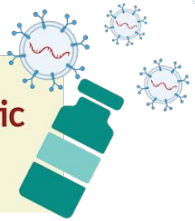
Understanding molecular functions of EVs + corona



Exploring therapeutic potentials across diverse liver diseases



New class of anti-fibrotic agents is born !



Applications for diversity of diseases

Acknowledgement

Prof Khuloud Al-Jamal
Prof Giovanna Lombardi
Prof Francesco Dazzi
Prof Alberto Sanchez Fueyo
Dr Farid Faruqu
Dr Julie Tzu-Wen Wang
Dr Adam Walters
& KAJ group members

Prof Volker Mailaender
Dr Jennifer Oberlaender

Dr Mustapha Najimi

King's International PGR Scholarship