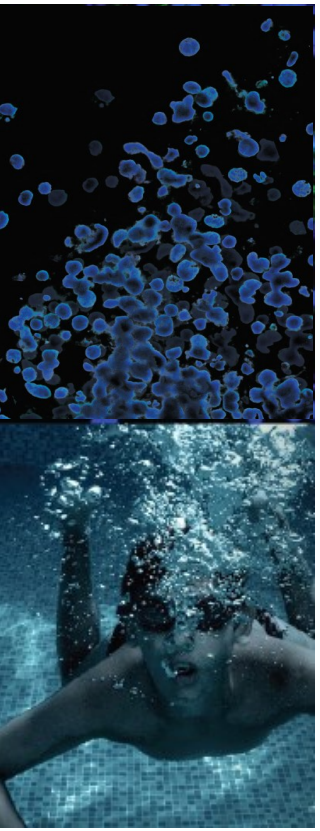
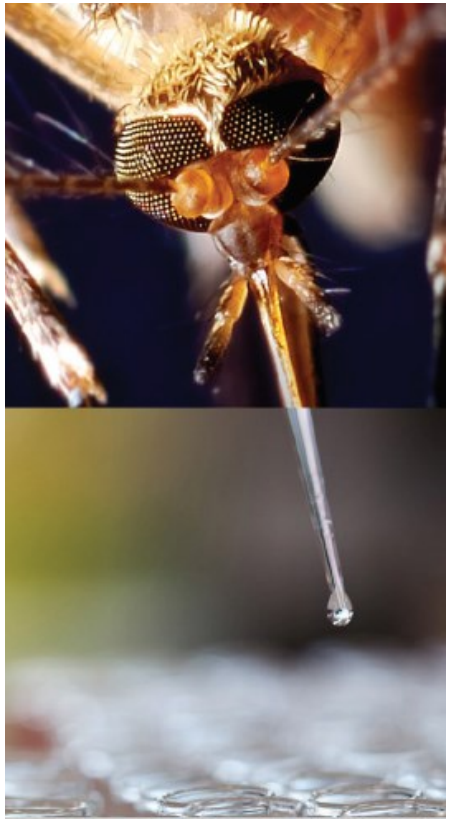
Large Scale Manufacturing, Characterization, and Functionality of Extracellular Vesicles

Heather Branscome, PhD
Supervisor, Laboratory Operations, ATCC

Credible Leads to Incredible™





About ATCC

- Founded in 1925, ATCC is a non-profit organization with HQ in Manassas, VA, and an R&D and Services center in Gaithersburg, MD
- World's largest, most diverse biological materials and information resource for microbes – the "*gold standard*"
- Innovative R&D company featuring gene editing, microbiome, NGS, advanced models
- cGMP biorepository
- Partner with government, industry, and academia
- Leading global supplier of authenticated cell lines, viral and microbial standards
- Sales and distribution in 150 countries, 18 international distributors
- Talented team of 450+ employees, over one-third with advanced degrees

ATCC®

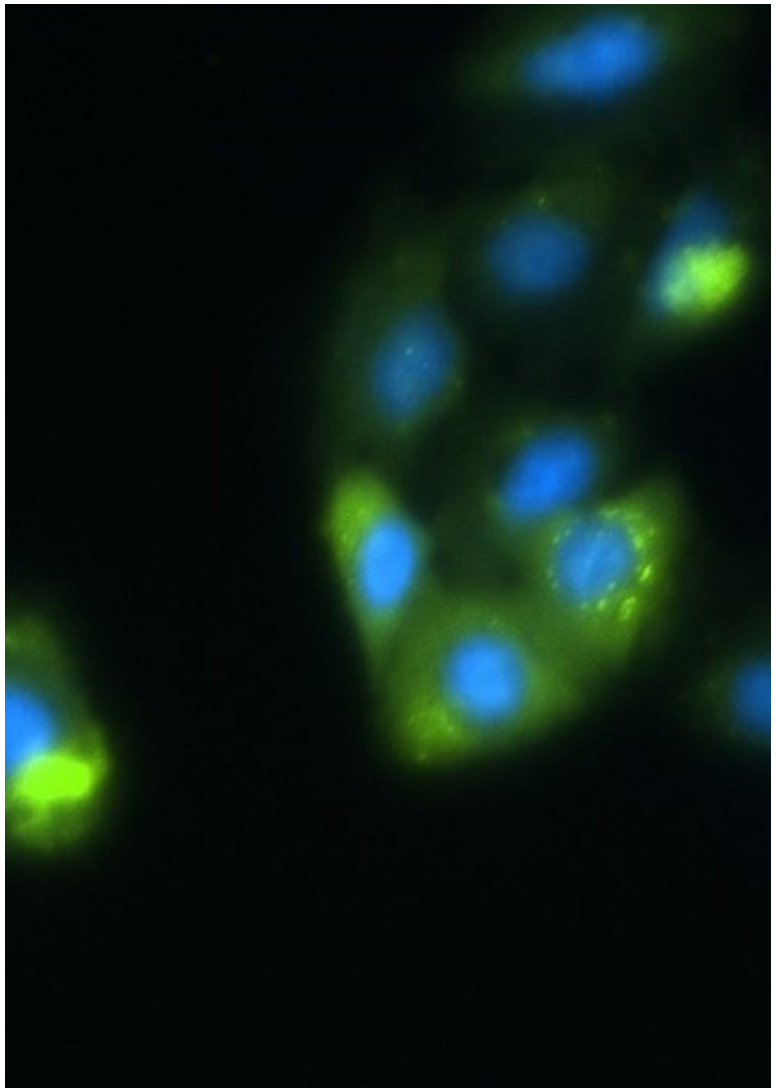
Agenda

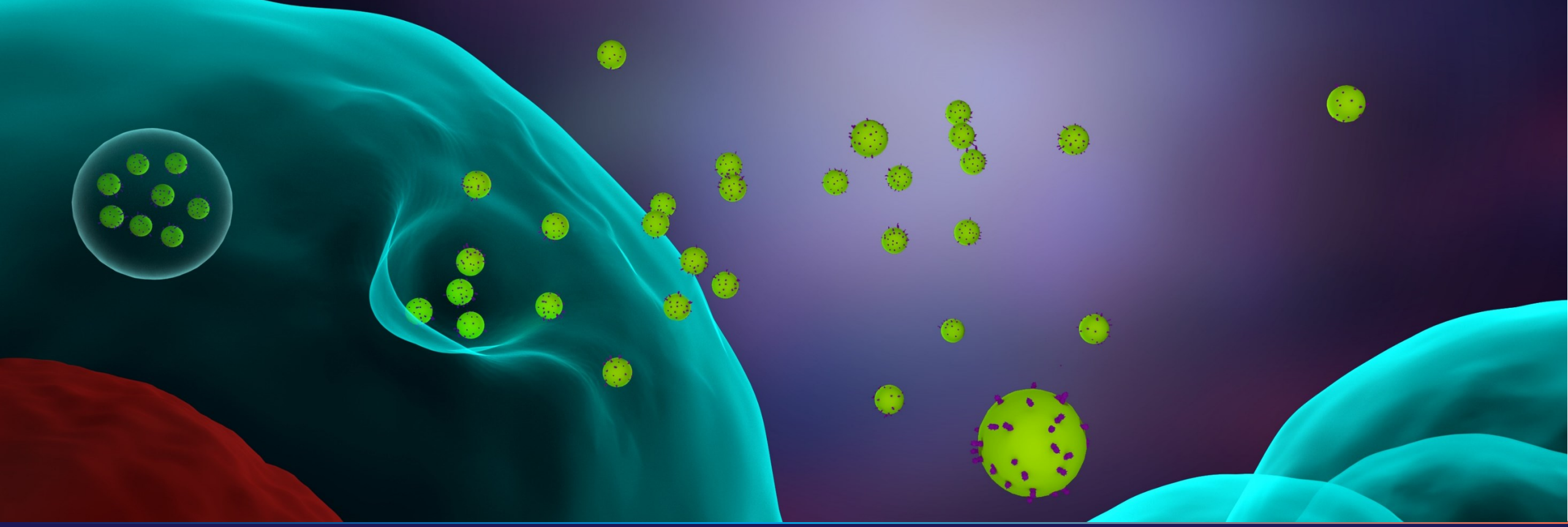
I. Large scale extracellular vesicle (EV) manufacturing

II. ATCC EV characterization and application data

III. EV functionality in 2D and 3D models

IV. Future directions



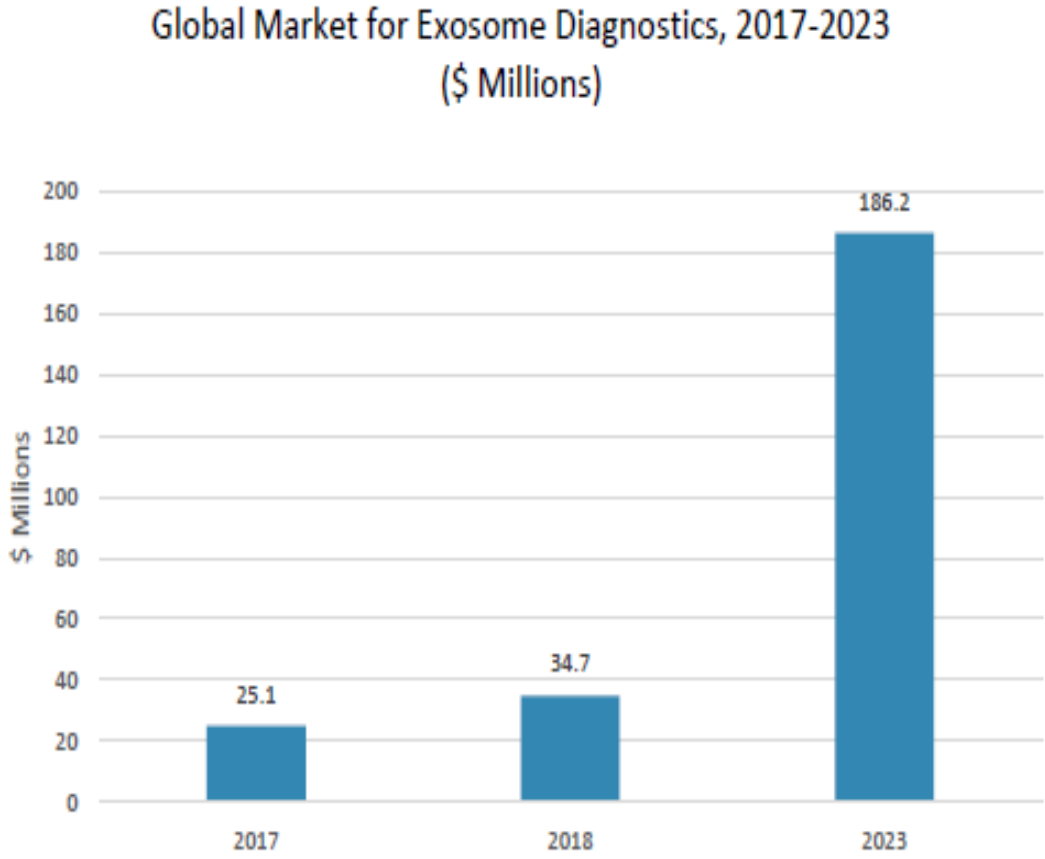


Large Scale EV Manufacturing and Characterization

ATCC®

Outstanding Need for EV Reference Standards

- Reference standards reduce time and costs associated with developmental work
- Reference standards increase assay reproducibility
- Reference standards add value to research work and/or product development
- Reference standards regulate the quality of one's own research



Source: bccResearch.com.

EVs as Biomarkers/Reference Standards

International Journal of Nanomedicine — Dovepress

REVIEW

Cancer-Derived Exosomes: Their Role in Cancer Biology and Biomarker Development

Victor C Kok, Cheng-Chia Yu

UICC — IJC International Journal of Cancer

Exosome-encapsulated microRNAs as circulating biomarkers for breast cancer

Doireann P. Joyce, Michael J. Kerin and Róisín M. Dwyer

Discipline of Surgery, School of Medicine, Lambe Institute for Translational Research, National University of Ireland Galway, Galway, Ireland

RESEARCH ARTICLE — WILEY

Tumor-derived exosomal miRNA-320d as a biomarker for metastatic colorectal cancer

Youyong Tang[1,2] | Yajing Zhao[1,2] | Xingguo Song[3] | Xianrang Song[2] | Limin Niu[2] | Li Xie[2]

International Journal of Molecular Sciences — MDPI

Review

Role of Exosomal miRNA in Bladder Cancer: A Promising Liquid Biopsy Biomarker

Xuan-Mei Piao [1], Eun-Jong Cha [2,3], Seok Joong Yun [1,4] and Wun-Jae Kim [1,3,*]

ESMO GOOD SCIENCE BETTER MEDICINE BEST PRACTICE

REVIEW

Exosome-based liquid biopsies in cancer: opportunities and challenges

W. Yu[1], J. Hurley[1], D. Roberts[1], S. K. Chakrabortty[1], D. Enderle[2], M. Noerholm[2], X. O. Breakefield[3,4] & J. K. Skog[1*]

[1]Exosome Diagnostics, Inc., a Bio-Techne brand, Waltham, USA; [2]Exosome Diagnostics GmbH, a Bio-Techne brand, Martinsried, Germany; [3]Department of Neurology, Massachusetts General Hospital, Boston; [4]Neuroscience Program, Harvard Medical School, Boston, USA

ANNALS OF ONCOLOGY — driving innovation in oncology

SCIENTIFIC REPORTS — nature research

OPEN

The proteomic analysis of breast cell line exosomes reveals disease patterns and potential biomarkers

Yousef Risha[1], Zoran Minic[2], Shahrokh M. Ghobadloo[3] & Maxim V. Berezovski[1,2,3]

SCIENTIFIC REPORTS

OPEN

Exosomal miR-126 as a circulating biomarker in non-small-cell lung cancer regulating cancer progression

Received: 20 October 2016
Accepted: 27 October 2017
Published online: 10 November 2017

Franco Grimolizzi[1], Federica Monaco[2], Francesca Leoni[1], Massimo Bracci[2], Sara Staffolani[2], Cristiana Bersaglieri[2], Simona Gaetani[2], Matteo Valentino[2], Monica Amati[2], Corrado Rubini[3], Franca Saccucci[1], Jiri Neuzil[4,5], Marco Tomasetti[2] & Lory Santarelli[2]

REVIEW — Cancer Medicine — WILEY

Exosomal miRNAs as biomarkers for diagnostic and prognostic in lung cancer

Jing Wu[1] | Zuojun Shen[1,2]

Review Article

Exosomes in Cancer: Circulating Immune-Related Biomarkers

Alicja Głuszko,[1] Mirosław J. Szczepański,[1] Nils Ludwig,[2,3] Shafaq M. Mirza,[1] and Wioletta Olejarz [4,5]

[1]Chair and Department of Biochemistry, Medical University of Warsaw, Poland
[2]Department of Pathology, University of Pittsburgh School of Medicine, Pittsburgh, PA 15213, USA
[3]University of Pittsburgh Cancer Institute, Hillman Cancer Center, Pittsburgh, PA 15213, USA
[4]Department of Biochemistry and Pharmacogenomics, Faculty of Pharmacy, Medical University of Warsaw, Poland
[5]Laboratory of Biochemistry and Clinical Chemistry at the Centre for Preclinical Research, Medical University of Warsaw, Poland

REVIEW — Open Access

Exosomes as a new frontier of cancer liquid biopsy

Dan Yu[1], Yixin Li[1], Maoye Wang[1], Jianmei Gu[2], Wenrong Xu[1], Hui Cai[3], Xinjian Fang[4*] and Xu Zhang[1,3,4*]

OPEN ACCESS Freely available online — PLOS ONE

Circulating Exosomal microRNAs as Biomarkers of Colon Cancer

Hiroko Ogata-Kawata[1], Masashi Izumiya[3], Daisuke Kurioka[1,4], Yoshitaka Honma[5], Yasuhide Yamada[5], Koh Furuta[6], Toshiaki Gunji[7], Hideki Ohta[8], Hiroyuki Okamoto[8], Hikaru Sonoda[8], Masatoshi Watanabe[4], Hitoshi Nakagama[2], Jun Yokota[1,9], Takashi Kohno[1], Naoto Tsuchiya[1*]

frontiers in Immunology

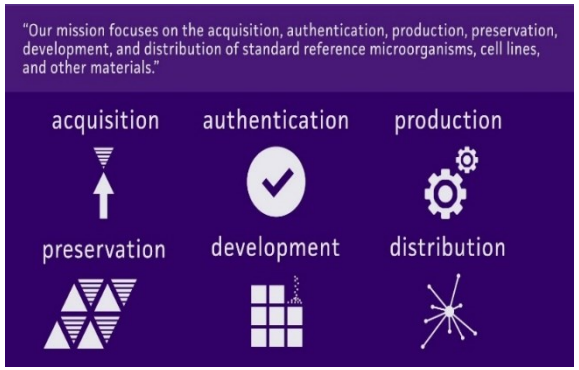
The Potential Biomarkers and Immunological Effects of Tumor-Derived Exosomes in Lung Cancer

Shamila D. Alipoor[1], Esmaeil Mortaz[2,3*], Mohammad Varahram[4], Mehrnaz Movassaghi[3], Aletta D. Kraneveld[5,6], Johan Garssen[5,7] and Ian M. Adcock[8,9]

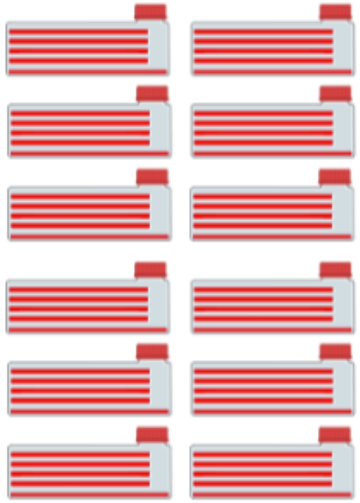
ATCC

ATCC EV Manufacturing

Mission

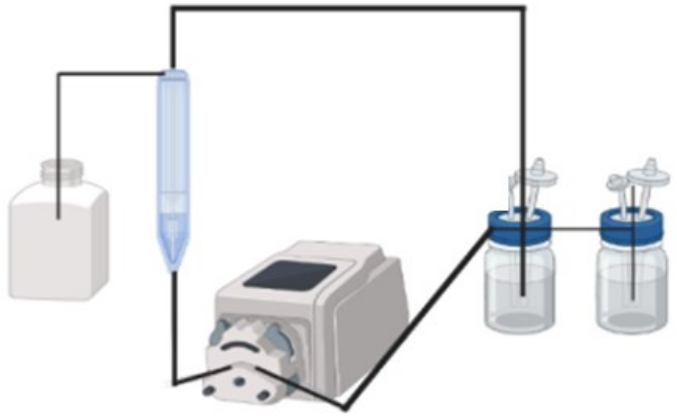


Scale-up

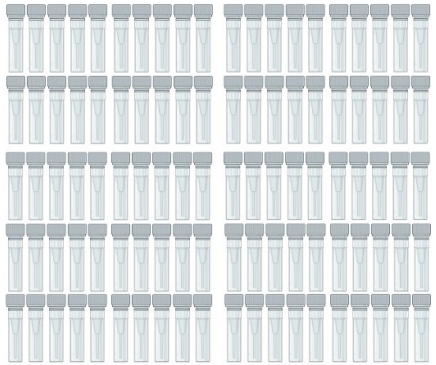


Centrifugation

Tangential flow filtration



Sterile vialing



QC testing

- Nanoparticle tracking analysis
- Western blot
- Sterility
- Mycoplasma testing

Application data

- Cryo-EM
- Mutiplex analysis
- Functional testing
- Long-term storage

Research collaborators

GEORGE MASON UNIVERSITY

MSD

ASIC

NIST NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY U.S. DEPARTMENT OF COMMERCE

ATCC

ATCC EV Portfolio

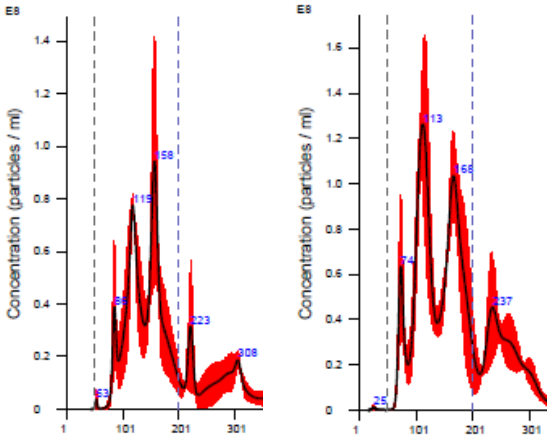
ATCC® No.	Parental Cell Designation	Cancer Model
SCRC-4000-EXM™	hTERT-immortalized adipose-derived mesenchymal stem cell (MSC)	N/A
CCL-185-EXM™	A549	Carcinoma, lung
CRL-1435-EXM™	PC-3	Adenocarcinoma, prostate
CCL-247-EXM™	HCT 116	Carcinoma, colorectal
CRL-1740-EXM™	LNCaP	Carcinoma, prostate

Attributes	Test	Specification
Protein concentration/vial	BCA	Report results
Particle number/vial	NTA	≥ 10^9 particles
Size distribution (% particles within 50-200 nm)	NTA	Cell type dependent
Protein marker expression	Western Blot	Positive expression of 1 transmembrane protein and 1 cytosolic protein
Sterility	iAST bottle (aerobic) at 32.5°C iNST bottle (anaerobic) at 32.5°C	No growth detected
Mycoplasma	PCR based assay	Negative

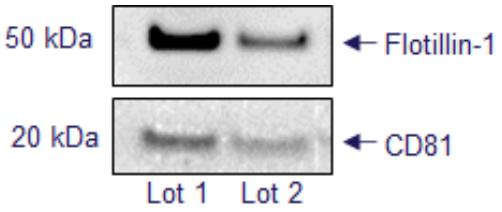
EV Manufacturing & Reproducibility

a)

HCT 116

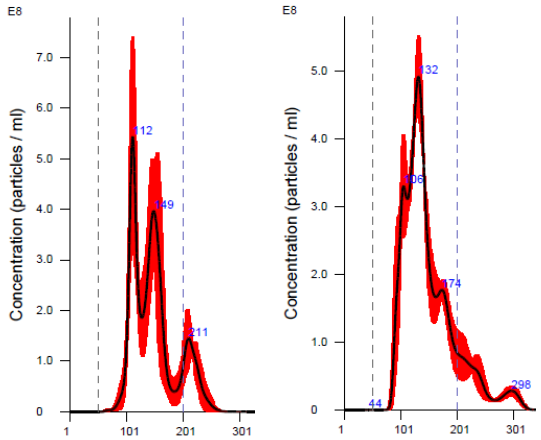


Batch	% between 50-200 nm	Percent variance
Lot 1	82.1%	3.0%
Lot 2	79.7	

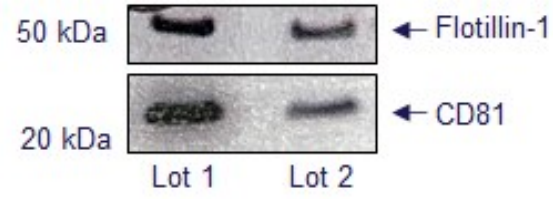


b)

LNCaP

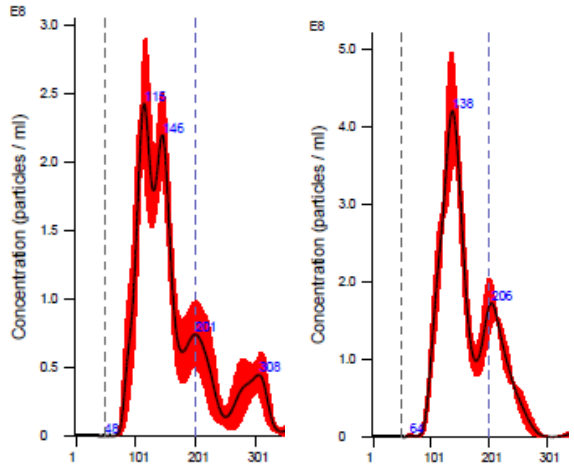


Batch	% between 50-200 nm	Percent variance
Lot 1	89.9%	2.1%
Lot 2	91.8%	

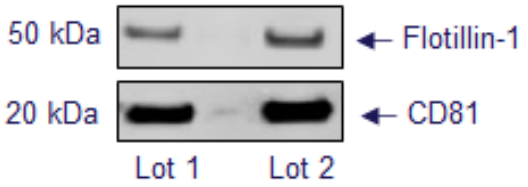


c)

PC3

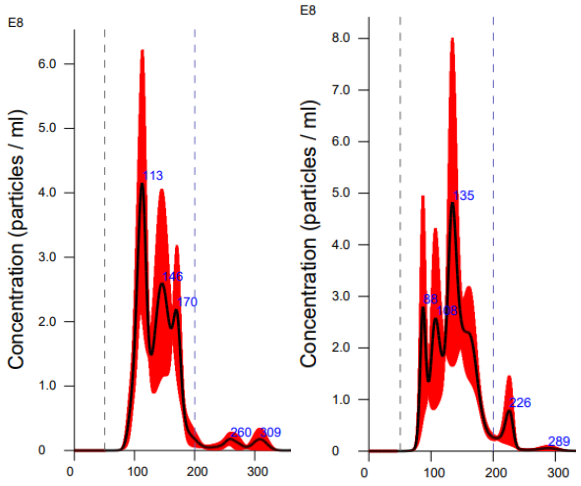


Batch	% between 50-200 nm	Percent variance
Lot 1	84.4%	1.9%
Lot 2	82.9%	

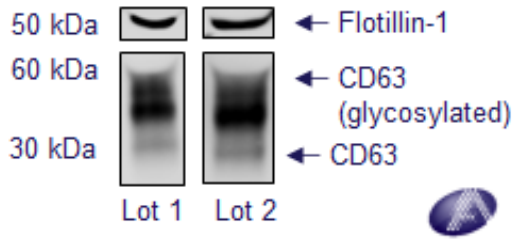


d)

hTERT MSC

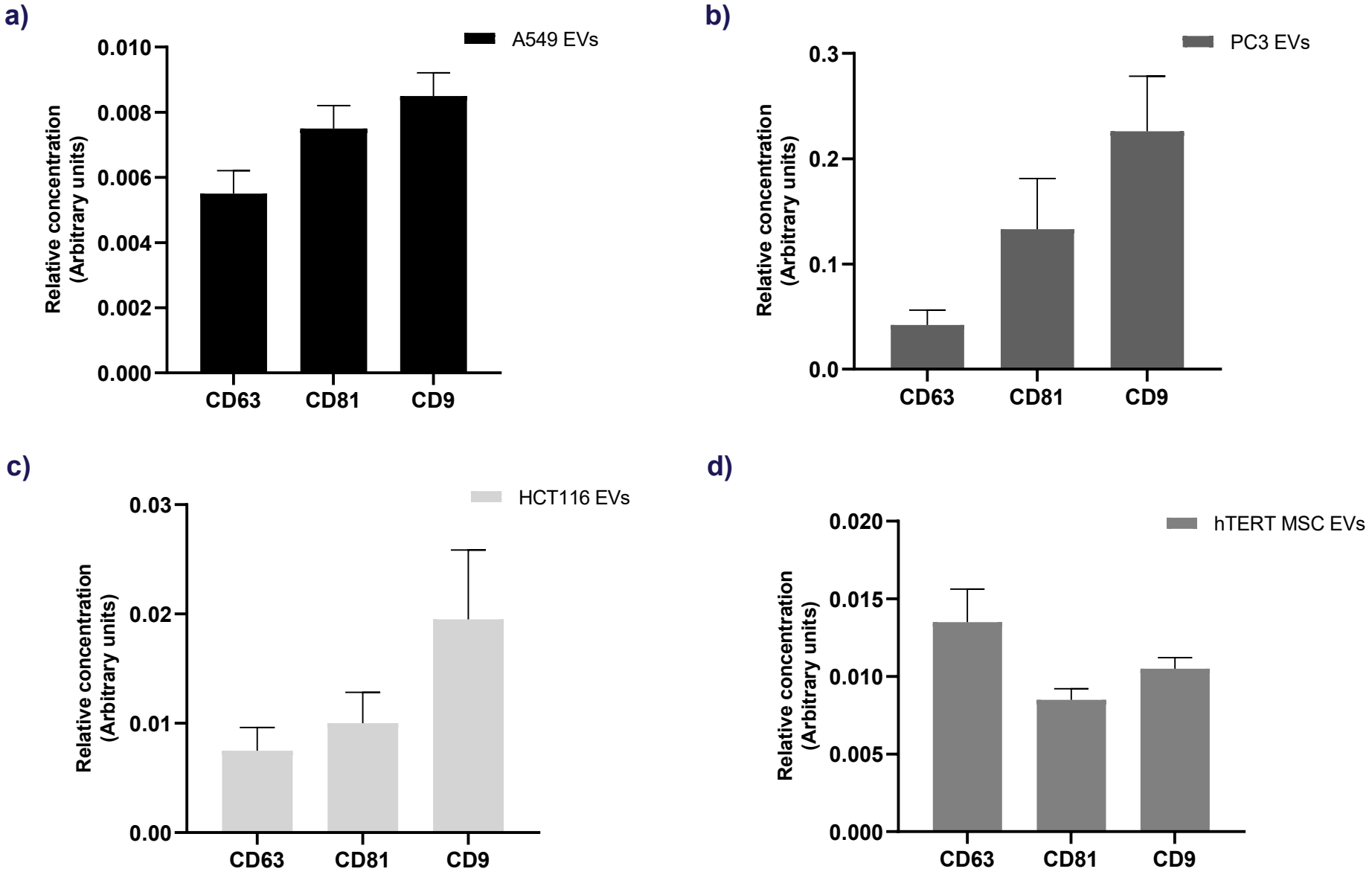


Batch	% between 50-200 nm	Percent variance
Lot 1	92.4%	1.4%
Lot 2	91.1%	



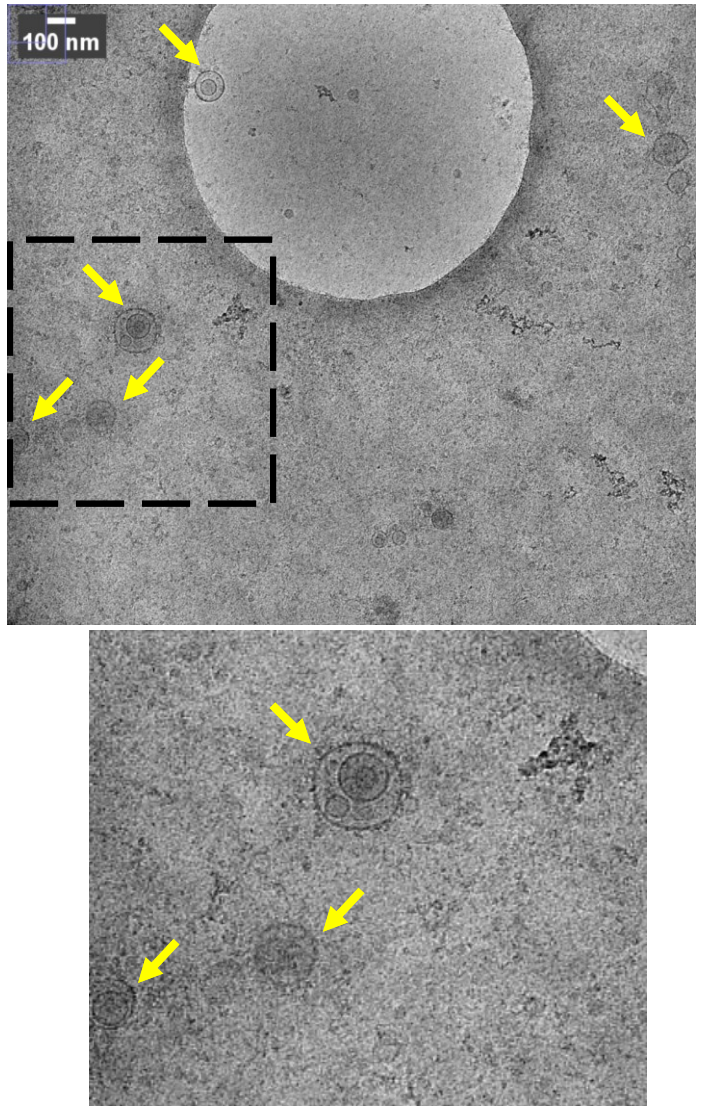
ATCC

EV Characterization

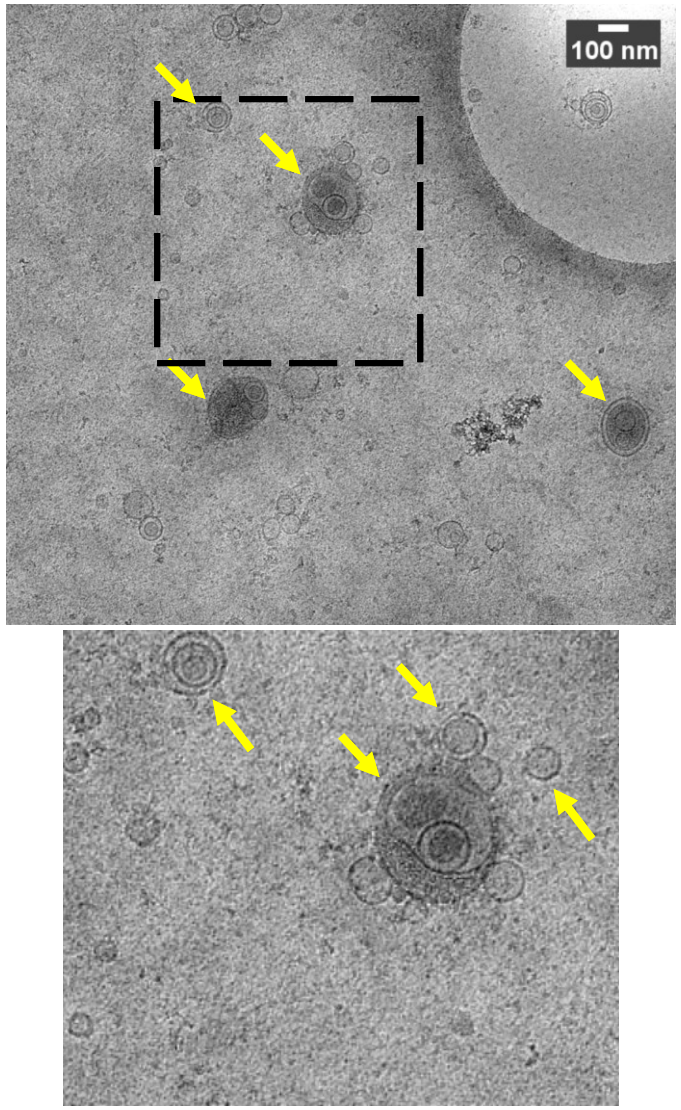


EV Characterization

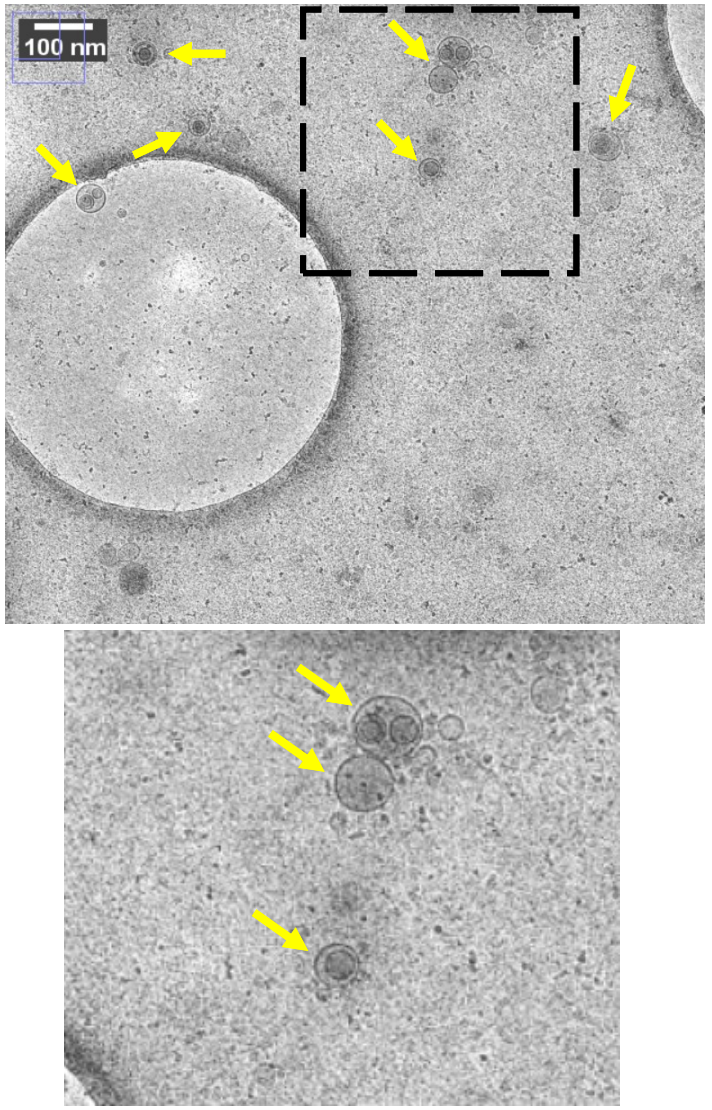
a) PC-3 EVs



b) HCT 116 EVs

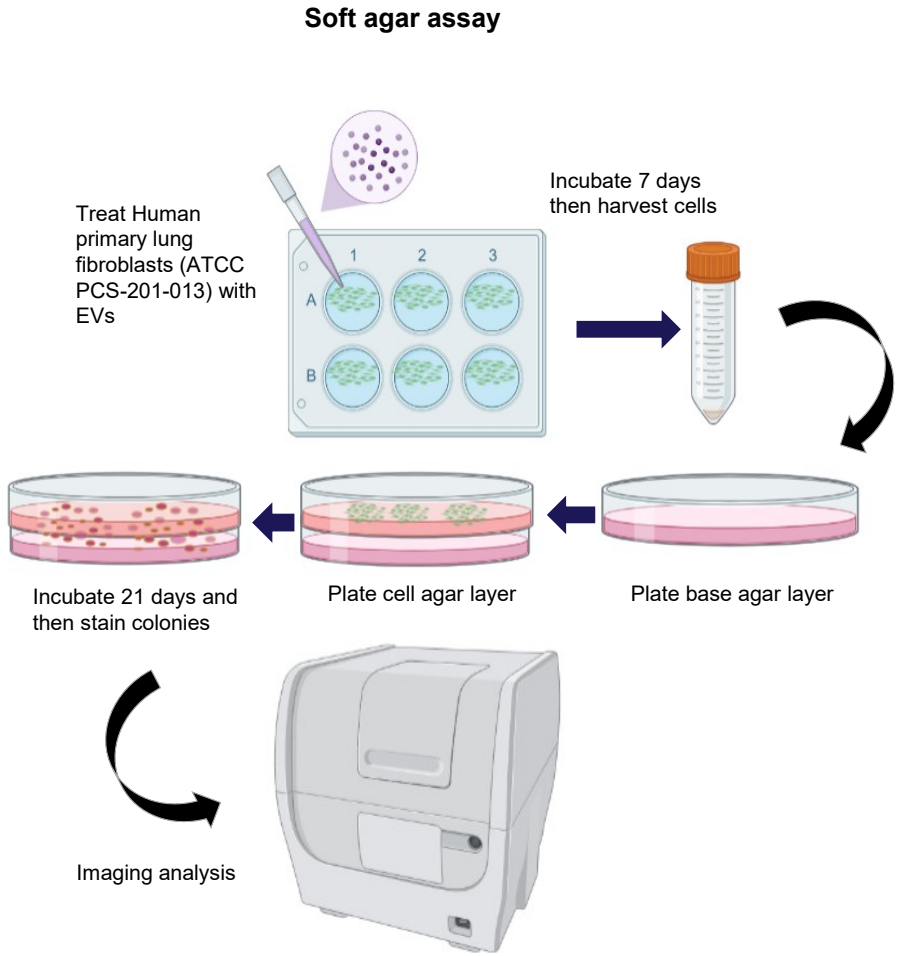


c) LNCaP EVs

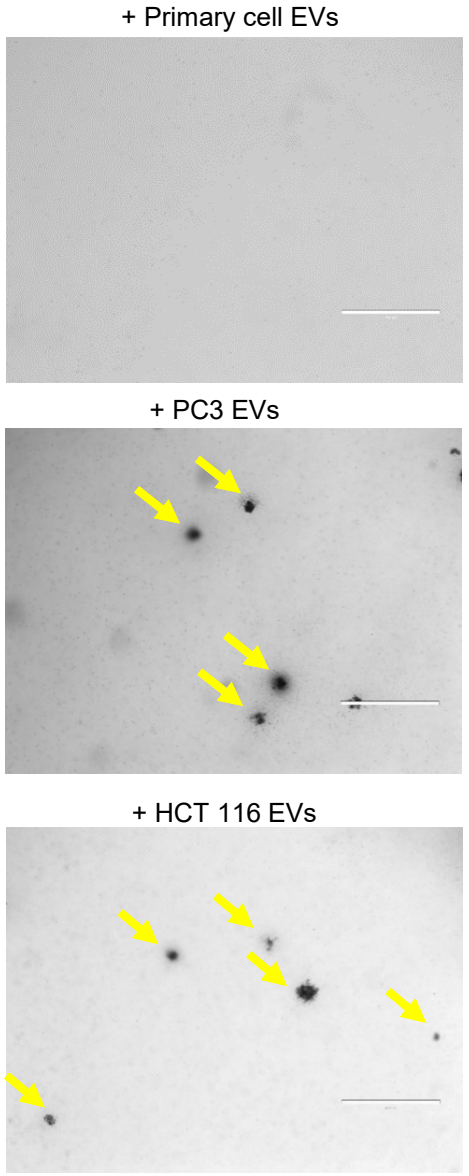


EV Application Data

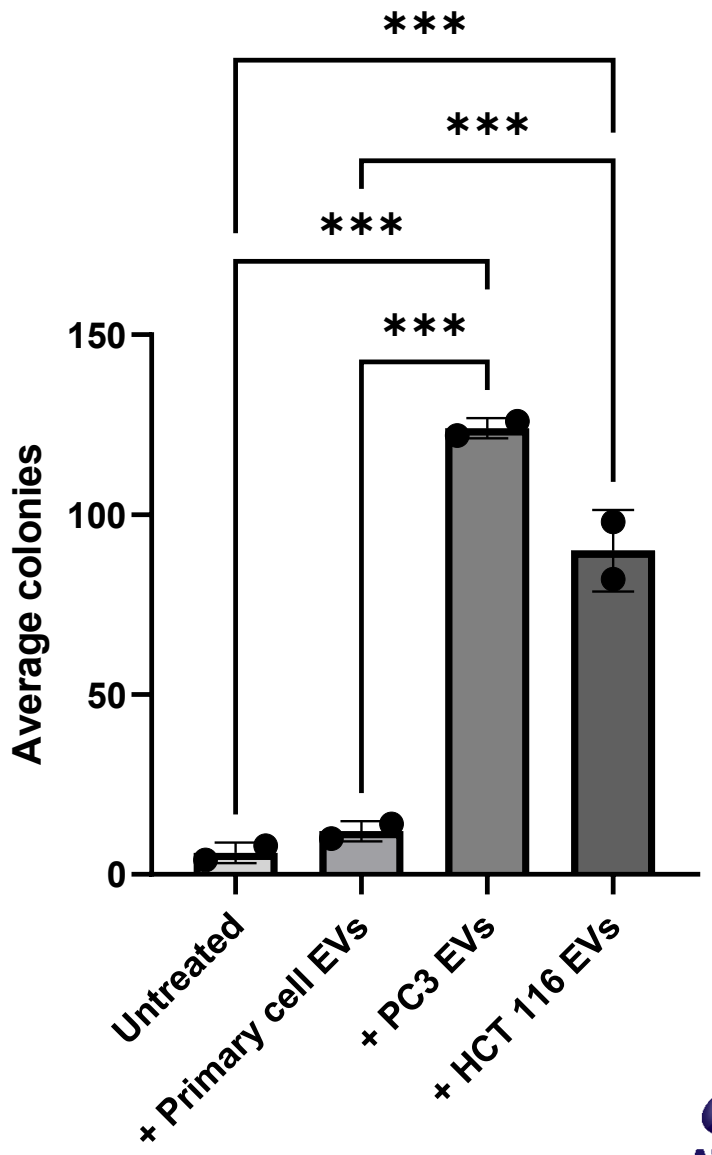
a)



b)



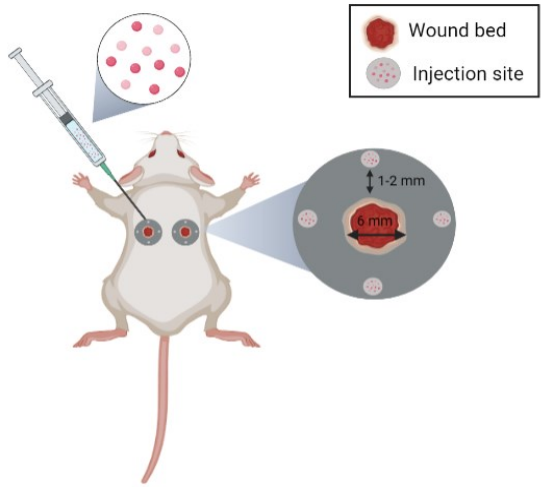
c)



EV Application Data

a)

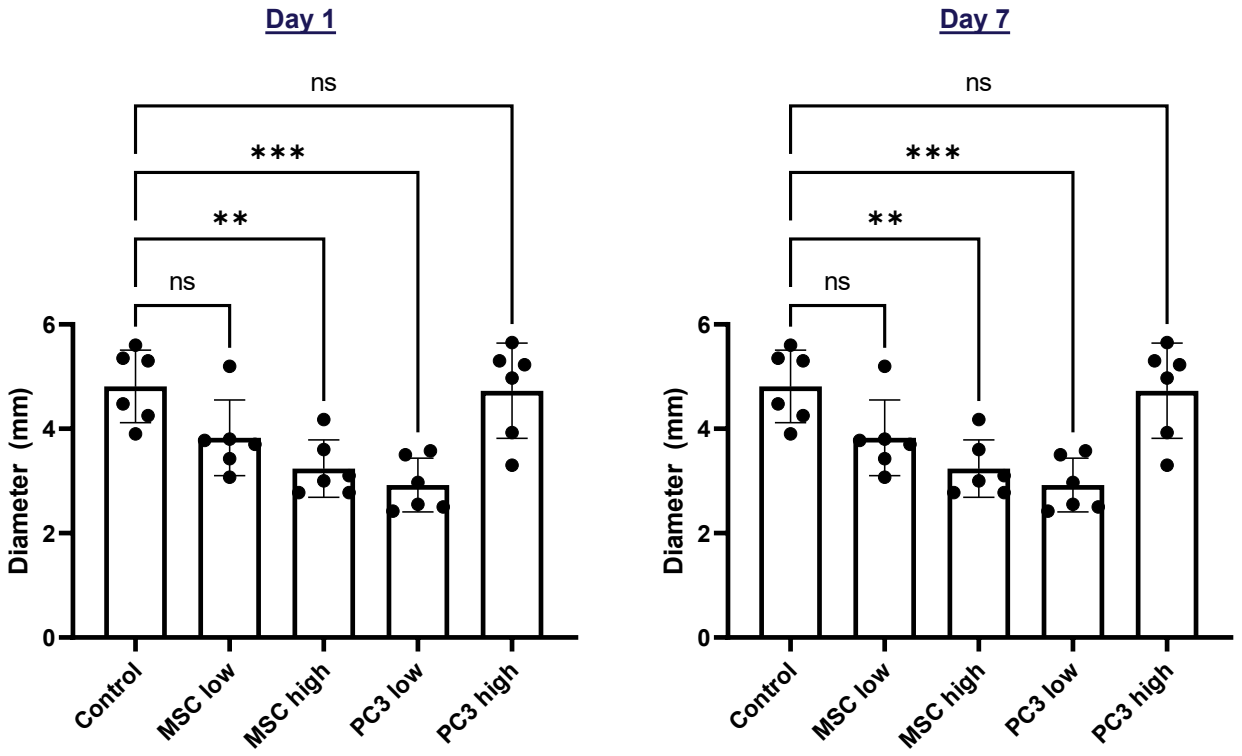
In vivo wound healing assay



b)

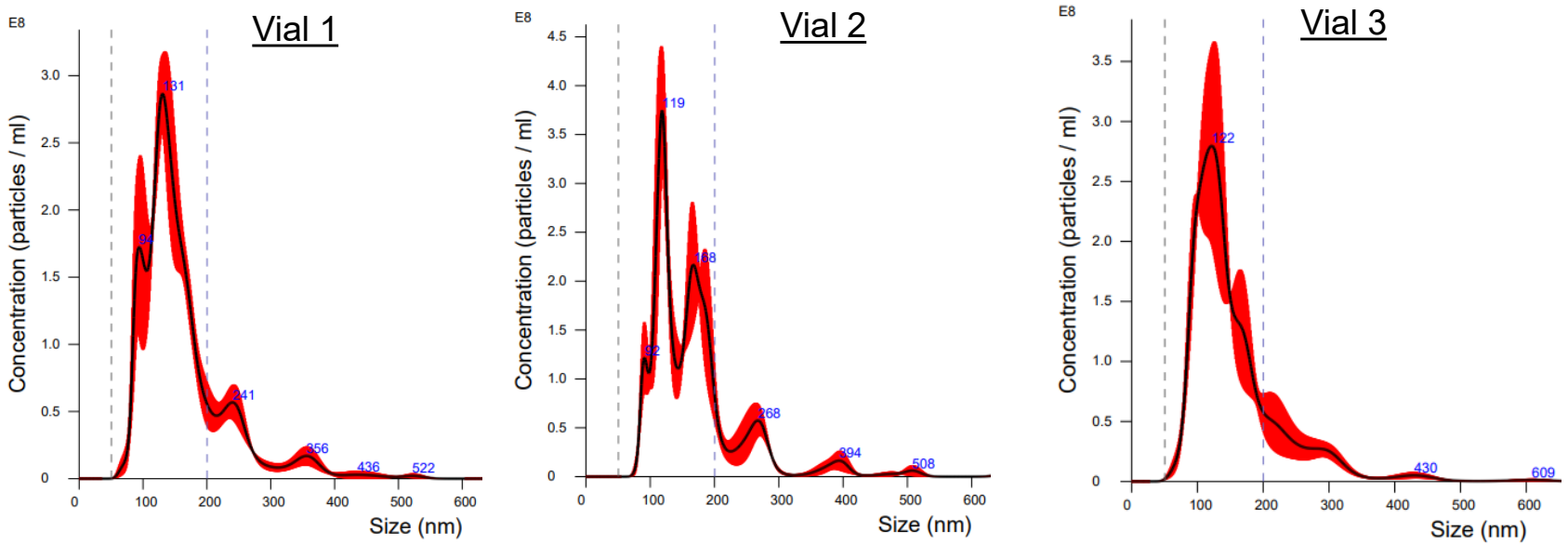
Untreated PBS	
MSC low dose 10 µg	
MSC high dose 100 µg	
PC3 low dose 10 µg	
PC3 high dose 100 µg	

b)

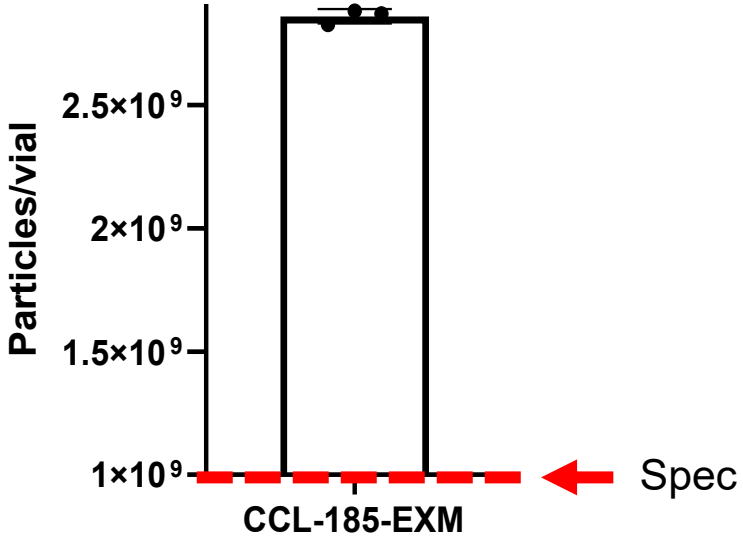


Long-term (3 Year) EV Storage

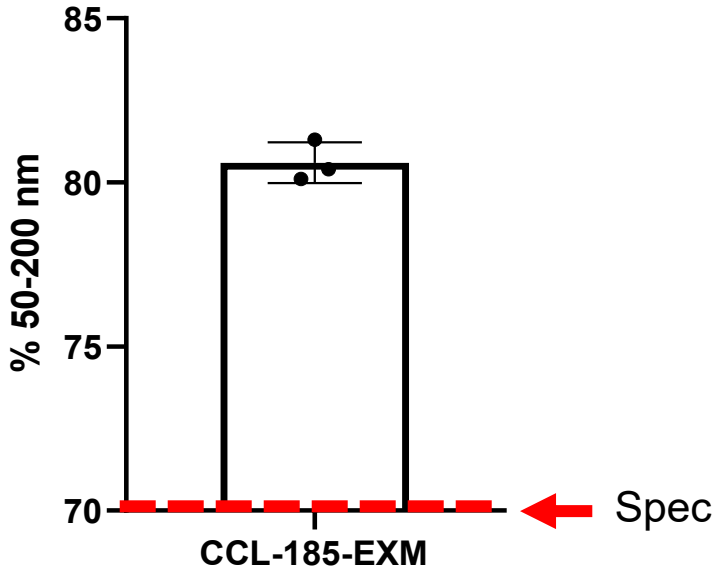
a)

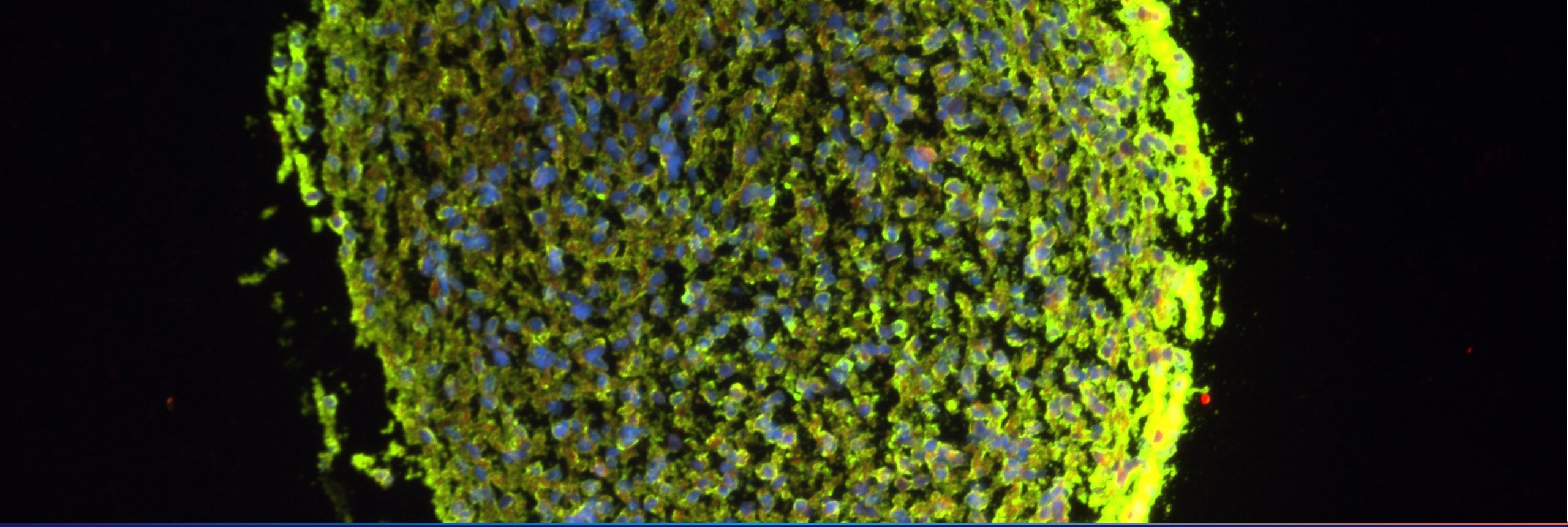


b)



c)





Functionality of ATCC EVs

Stem Cell EVs

- Contain various biological cargo (miRNAs, lncRNAs, proteins, cytokines) that can be transferred to recipient cells
- Proposed to play a role in homeostasis through tissue repair, regeneration, and immunomodulation
- **Potential alternative to stem cell therapy due to higher potency, increased stability/shelf life, and lower immunogenicity**
- Widely studied for **reparative functions** (*eg*, skin/wound healing, cardiac repair, CNS-related pathologies)

ATCC

Stem Cell EVs and CNS Repair

SCIENTIFIC REPORTS

OPEN

Human Mesenchymal Stromal Cell-Derived Extracellular Vesicles Modify Microglial Response and Improve Clinical Outcomes in Experimental Spinal Cord Injury

Received: 27 September 2017
Accepted: 17 December 2017
Published online: 11 January 2018

Katherine A. Ruppert, Tin T. Nguyen, Karthik S. Prabhakara, Naama E. Toledano Furman, Amit K. Srivastava, Matthew T. Harting, Charles S. Cox Jr. & Scott D. Olson

Journal of Neurotrauma, Vol. 36, No. 1 | Original Articles

Mesenchymal Stem Cell-Derived Exosomes Provide Neuroprotection and Improve Long-Term Neurologic Outcomes in a Swine Model of Traumatic Brain Injury and Hemorrhagic Shock

Aaron M. Williams, Isabel S. Dennahy, Umar F. Bhatti, Ihab Halaweish, Ye Xiong, Panpan Chang, Vahagn C. Nikolian, Kirill Chtraklin, Jordana Brown, Yanlu Zhang, Zheng Gang Zhang, Michael Chopp, Benjamin Buller, and Hasan B. Alam

Cellular Physiology and Biochemistry

Cell Physiol Biochem 2018;50:1535-1559

Karger Open access

1535

Original Paper

Mesenchymal Stem Cell-Derived Exosomes Reduce A1 Astrocytes via Downregulation of Phosphorylated NFκB P65 Subunit in Spinal Cord Injury

Lin Wang[a] Shuang Pei[a] Linlin Han[a] Bin Guo[a] Yanfei Li[a] Ranran Duan[a] Yaobing Yao[a] Bohan Xue[b] Xuemei Chen[b] Yanjie Jia[a]

[a]The First Affiliated Hospital of Zhengzhou University, Zhengzhou, [b]School of Basic Medical Sciences, Zhengzhou University, Zhengzhou, China

HHS Public Access
Author manuscript
Neurochem Int. Author manuscript; available in PMC 2018 December 01.

Published in final edited form as:
Neurochem Int. 2017 December ; 111: 69–81. doi:10.1016/j.neuint.2016.08.003.

Systemic administration of cell-free exosomes generated by human bone marrow derived mesenchymal stem cells cultured under 2D and 3D conditions improves functional recovery in rats after traumatic brain injury

Yanlu Zhang, MS, MD[1], Michael Chopp, PhD[2,3], Zheng Gang Zhang, MD, PhD[2], Mark Katakowski, PhD[2], Hongqi Xin, PhD[2], Changsheng Qu, MD[1], Meser Ali, PhD[4], Asim Mahmood, MD[1], and Ye Xiong, MD, PhD[1]

frontiers in Neuroscience

ORIGINAL RESEARCH

Exosomes Derived From Bone Mesenchymal Stem Cells Ameliorate Early Inflammatory Responses Following Traumatic Brain Injury

Haoqi Ni[1,2], Su Yang[1,2], Felix Siaw-Debrah[1,2], Jiangnan Hu[3], Ke Wu[1,2], Zibin He[1,2], Jianjing Yang[1,2], Sishi Pan[1,2], Xiao Lin[1,2], Haotuo Ye[1,2], Zhu Xu[1,2], Fan Wang[1,2], Kunlin Jin[1,2], Qichuan Zhuge[1,2]* and Lijie Huang[1,2]*

HHS Public Access
Author manuscript
Neurorehabil Neural Repair. Author manuscript; available in PMC 2020 July 02.

Published in final edited form as:
Neurorehabil Neural Repair. 2020 July ; 34(7): 616–626. doi:10.1177/1545968320926164.

Mesenchymal stem cell-derived exosomes improve functional recovery in rats after traumatic brain injury: a dose response and therapeutic window study

Yanlu Zhang, MS, MD[1], Yi Zhang, PhD[2], Michael Chopp, PhD[2,3], Zheng Gang Zhang, MD, PhD[2], Asim Mahmood, MD[1], Ye Xiong, MD, PhD[1]

[1]Department of Neurosurgery, Henry Ford Hospital, Detroit, MI 48202, USA

[2]Department of Neurology, Henry Ford Hospital, Detroit, MI 48202, USA

[3]Department of Physics, Oakland University, Rochester, MI 48309, USA

cells

MDPI

Article

Intracerebral Injection of Extracellular Vesicles from Mesenchymal Stem Cells Exerts Reduced Aβ Plaque Burden in Early Stages of a Preclinical Model of Alzheimer's Disease

Chiara A. Elia[1,2], Matteo Tamborini[1], Marco Rasile[1,3], Genni Desiato[1,4], Sara Marchetti[1,5,†], Paolo Swuec[6,7], Sonia Mazzitelli[1,†], Francesca Clemente[5,8,§], Achille Anselmo[8], Michela Matteoli[1,3], Maria Luisa Malosio[1,2,*] and Silvia Coco[5,*]

Journal of Neurotrauma, Vol. 34, No. 24 | Original Articles

Systemic Administration of Exosomes Released from Mesenchymal Stromal Cells Attenuates Apoptosis, Inflammation, and Promotes Angiogenesis after Spinal Cord Injury in Rats

Jiang-Hu Huang, Xiao-Ming Yin, Yang Xu, Chun-Cai Xu, Xi Lin, Fu-Biao Ye, Yong Cao, and Fei-Yue Lin

Chen et al. *Cell Death and Disease* (2020)11:288
https://doi.org/10.1038/s41419-020-2473-5

Cell Death & Disease

ARTICLE Open Access

Exosomes derived from mesenchymal stem cells repair a Parkinson's disease model by inducing autophagy

Hong-Xu Chen[1,2], Fu-Chao Liang[2,3], Ping Gu[1], Bian-Ling Xu[2,4], Hong-Jun Xu[2,3], Wen-Ting Wang[1], Jia-Yang Hou[2,3], Dong-Xiao Xie[5], Xi-Qing Chai[1] and Sheng-Jun An[2,3]

Neurochem Res. 2018 Nov;43(11):2165-2177. doi: 10.1007/s11064-018-2641-5. Epub 2018 Sep 26.

Exosomes Isolated From Human Umbilical Cord Mesenchymal Stem Cells Alleviate Neuroinflammation and Reduce Amyloid-Beta Deposition by Modulating Microglial Activation in Alzheimer's Disease

Mao Ding[1], Yang Shen[1], Ping Wang[2], Zhaohong Xie[2], Shunliang Xu[2], ZhengYu Zhu[2], Yun Wang[2], Yongtao Lyu[3], Dewei Wang[2], Linlin Xu[2], JianZhong Bi[4], Hui Yang[3]

Neural Regeneration Research

Home
Current issue
Instructions
Submit article

Neural Regen Res. 2019 Sep; 14(9): 1626–1634.
doi: 10.4103/1673-5374.255978

PMCID: PMC6557105
PMID: 31089063

Mesenchymal stem cell-derived exosomes promote neurogenesis and cognitive function recovery in a mouse model of Alzheimer's disease

Edwin E. Reza-Zaldivar,[1] Mercedes A. Hernández-Sapiéns,[1] Yanet K. Gutiérrez-Mercado,[1] Sergio Sandoval-Ávila,[1] Ulises Gomez-Pinedo,[2] Ana L. Márquez-Aguirre,[1] Estefanía Vázquez-Méndez,[1] Eduardo Padilla-Camberos,[1] and Alejandro A. Canales-Aguirre[1]*

Cui et al. *Immunity & Ageing* (2019) 16:10
https://doi.org/10.1186/s12979-019-0150-2

Immunity & Ageing

RESEARCH Open Access

RVG-modified exosomes derived from mesenchymal stem cells rescue memory deficits by regulating inflammatory responses in a mouse model of Alzheimer's disease

Guo-hong Cui[1†], Hai-dong Guo[2†], Han Li[2†], Yu Zhai[1], Zhang-bin Gong[3], Jing Wu[1], Jian-sheng Liu[1], You-rong Dong[1], Shuang-xing Hou[4*] and Jian-ren Liu[1*]

frontiers in Cellular Neuroscience

BRIEF RESEARCH REPORT

Stem Cell-Derived Exosomes Protect Astrocyte Cultures From *in vitro* Ischemia and Decrease Injury as Post-stroke Intravenous Therapy

Xiaoyun Sun[1], Ji-Hye Jung[2,3], Oiva Arvola[1], Michelle R. Santoso[2], Rona G. Giffard[1], Phillip C. Yang[2,3]* and Creed M. Stary[1]*

STEM CELLS TRANSLATIONAL MEDICINE

ENABLING TECHNOLOGIES FOR CELL-BASED CLINICAL TRANSLATION

Extracellular Vesicles Improve Post-Stroke Neuroregeneration and Prevent Postischemic Immunosuppression

Thorsten R. Doeppner,[a,b,*] Josephine Herz,[a,c,*] André Görgens,[b] Jana Schlechter,[a] Anna-Kristin Ludwig,[b] Stefan Radtke,[b] Kyra de Miroschedji,[b] Peter A. Horn,[b] Bernd Giebel,[b] Dirk M. Hermann[a]

STROKE

Lippincott Williams & Wilkins
Open Access

Stroke. 2018 May; 49(5): 1248–1256.
Published online 2018 Apr 12.
doi: 10.1161/STROKEAHA.117.020353

PMCID: PMC5916046
NIHMSID: NIHMS952221
PMID: 29650593

Human Neural Stem Cell Extracellular Vesicles Improve Recovery in a Porcine Model of Ischemic Stroke

Robin L. Webb, PhD,[*,1,2] Erin E. Kaiser, BSA,[*,2,3] Brian J. Jurgielewicz, MS,[2] Samantha Spellicy, BS,[2] Shelley L. Scoville, BS,[1] Tyler A. Thompson, MS,[1] Raymond L. Swetenburg, PhD,[1] David C. Hess, MD,[4] Franklin D. West, PhD,[2,3] and Steven L. Stice, PhD[2]

Akbari and Rezaie *Stem Cell Research & Therapy* (2020) 11:356
https://doi.org/10.1186/s13287-020-01866-6

Stem Cell Research & Therapy

REVIEW Open Access

Potential therapeutic application of mesenchymal stem cell-derived exosomes in SARS-CoV-2 pneumonia

Stem Cells and Development, Vol. 29, No. 12 | Clinical Trial

Exosomes Derived from Bone Marrow Mesenchymal Stem Cells as Treatment for Severe COVID-19

Vikram Sengupta, Sascha Sengupta, Angel Lazo, Peter Woods, Anna Nolan, and Nicholas Bremer

Journal of Neuroimmune Pharmacology
https://doi.org/10.1007/s11481-019-09865-y

ORIGINAL ARTICLE

Stem Cell Extracellular Vesicles and their Potential to Contribute to the Repair of Damaged CNS Cells

Heather Branscome[1,2] · Siddhartha Paul[3] · Pooja Khatkar[1] · Yuriy Kim[1] · Robert A. Barclay[1] · Daniel O. Pinto[1] · Dezhong Yin[3] · Weidong Zhou[4] · Lance A. Liotta[4] · Nazira El-Hage[5] · Fatah Kashanchi[1]

frontiers in Cell and Developmental Biology

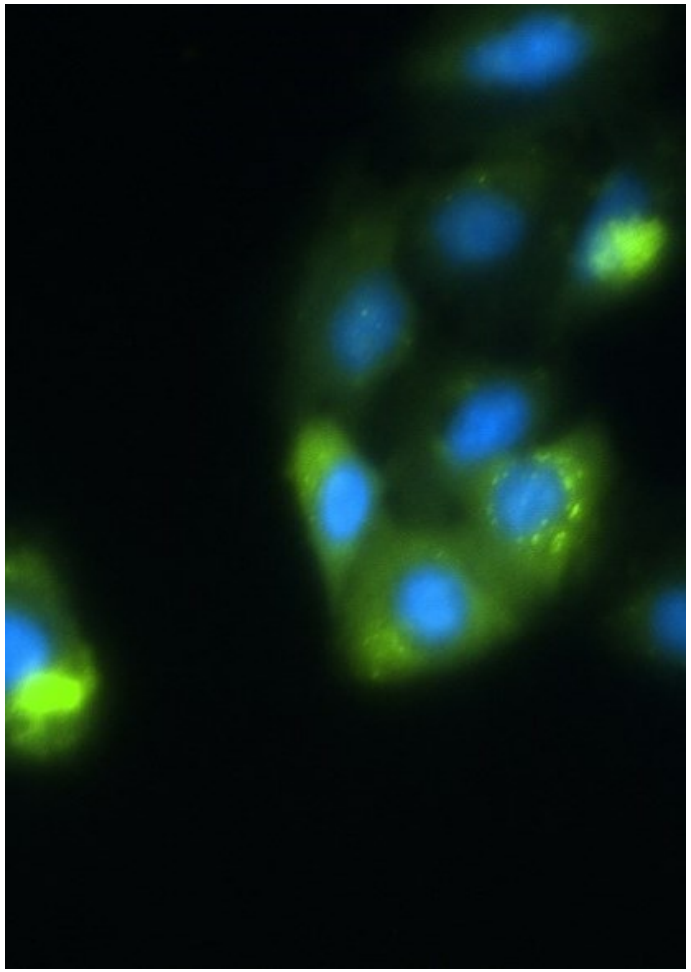
Use of Stem Cell Extracellular Vesicles as a "Holistic" Approach to CNS Repair

*Heather Branscome[1,2], Siddhartha Paul[2], Dezhong Yin[3], Nazira El-Hage[4], Emmanuel T. Agbottah[1], Mohammad Asad Zadeh[1], Lance A. Liotta[5] and Fatah Kashanchi[1]**

ATCC

EVs and Donor Cells

- **Mesenchymal Stem Cells (MSCs; ATCC® PCS-500-012™)**
  - Human, normal
  - Bone-marrow derived
  - Authenticated for characteristic surface marker expression (CD90, CD73, CD105 positive; CD14, CD34, CD45 negative)
  - Multi-lineage differentiation potential (adipocyte, chondrocyte, osteocyte)
- **Induced Pluripotent Stem Cells (iPSCs; ATCC® ACS-1019™)**
  - Human, normal
  - Foreskin fibroblast-derived
  - Sendai virus reprogrammed
  - Authenticated for expression of stem cell markers (TRA-1-60, SSEA-4 positive; SSEA-1 negative)
  - Evaluated for pluripotency
- **A549 Lung Carcinoma (ATCC® CCL-185™)**
  - Control used for large-scale manufacturing and isolation
  - Equivalent to CCL-185-EXM™ exosomes

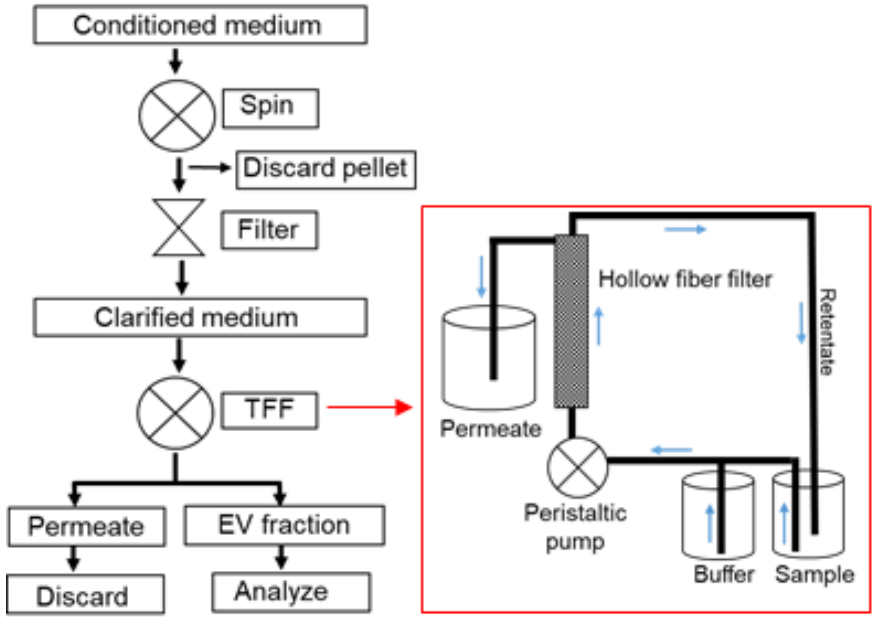


EV uptake in A549 cells

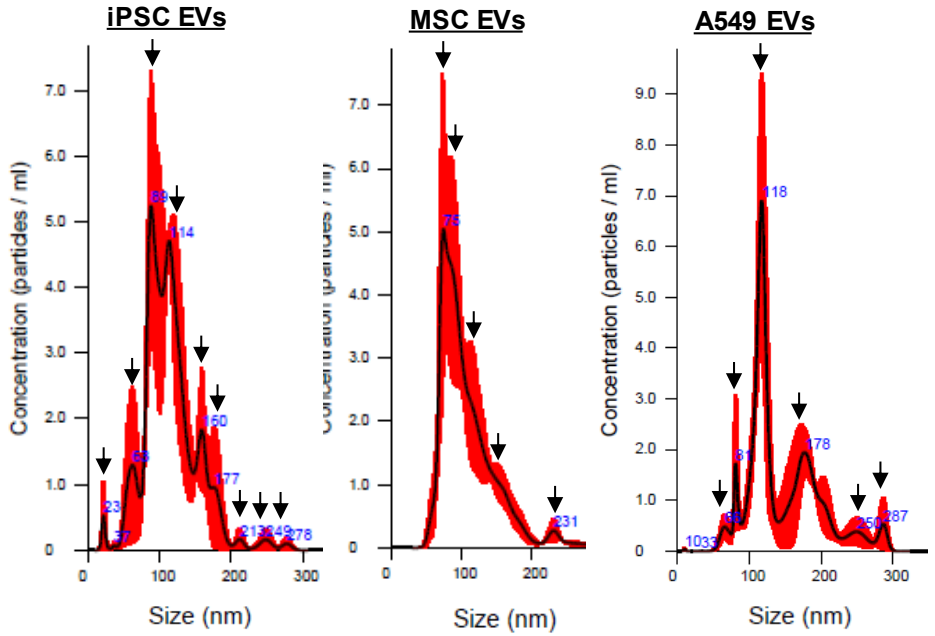
ATCC®

EV Isolation and Characterization

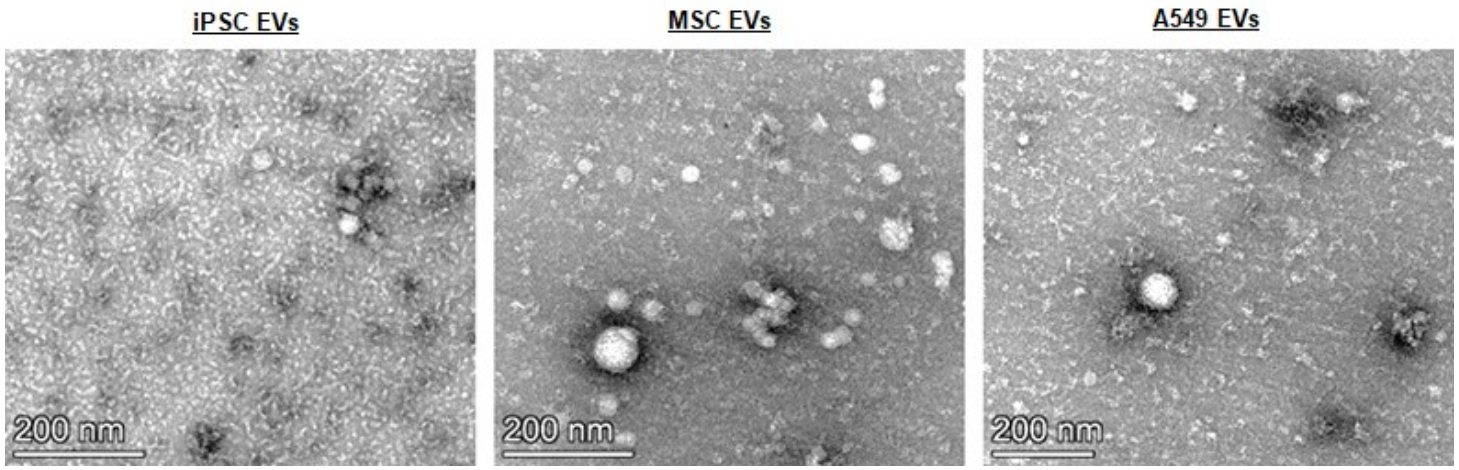
a)



b)



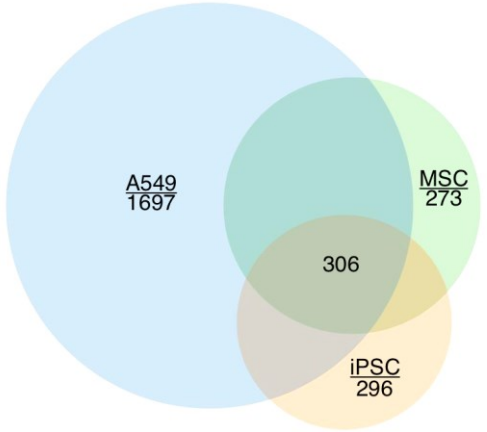
c)



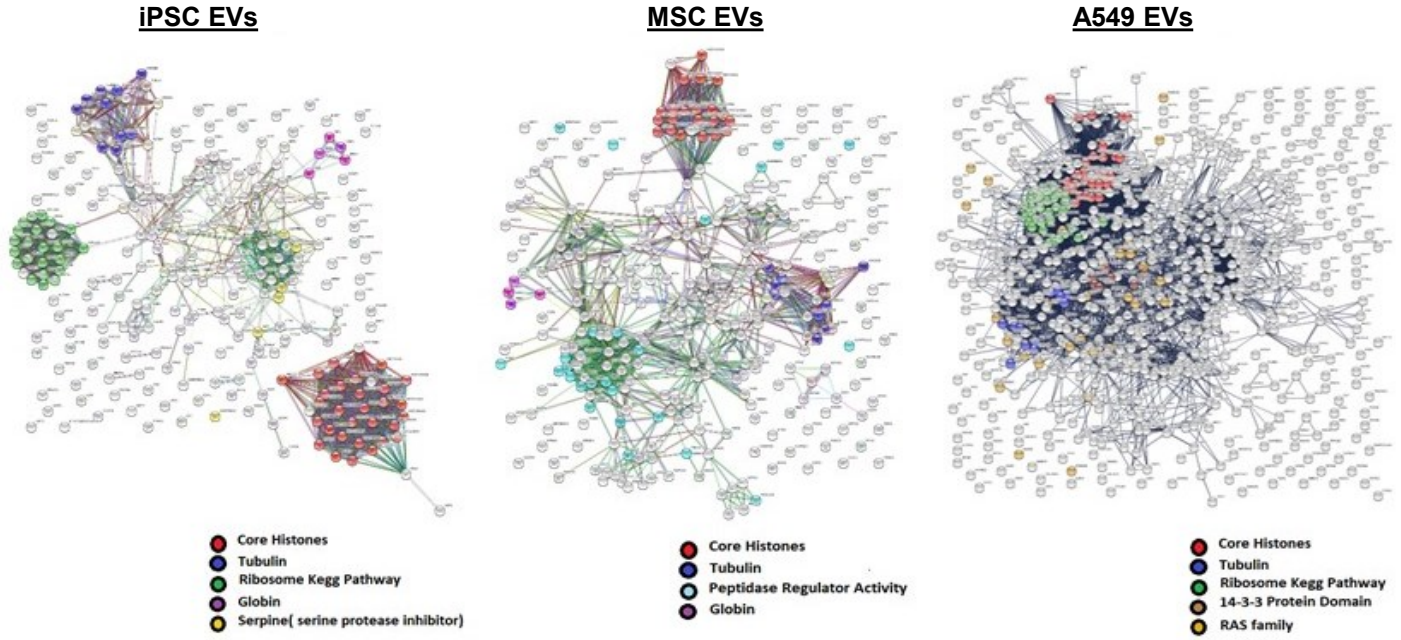
Branscome et al. 2021
Branscome et al. 2022

EV Characterization

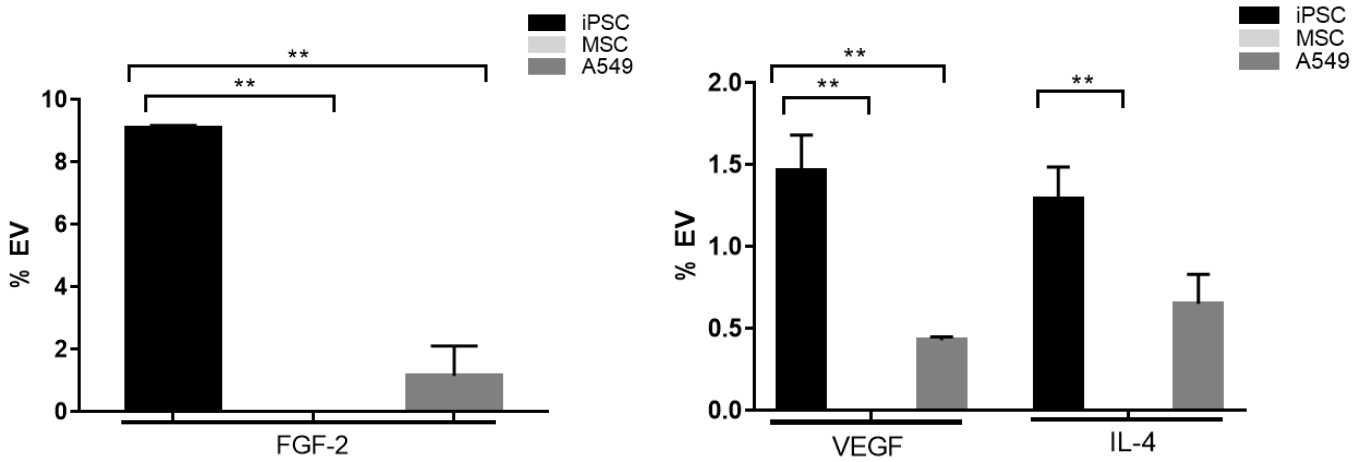
a)



b)



c)

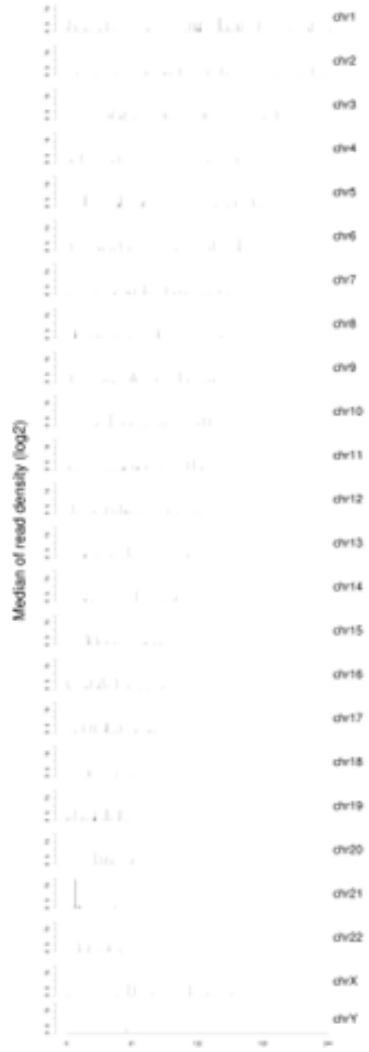


Branscome et al. 2021

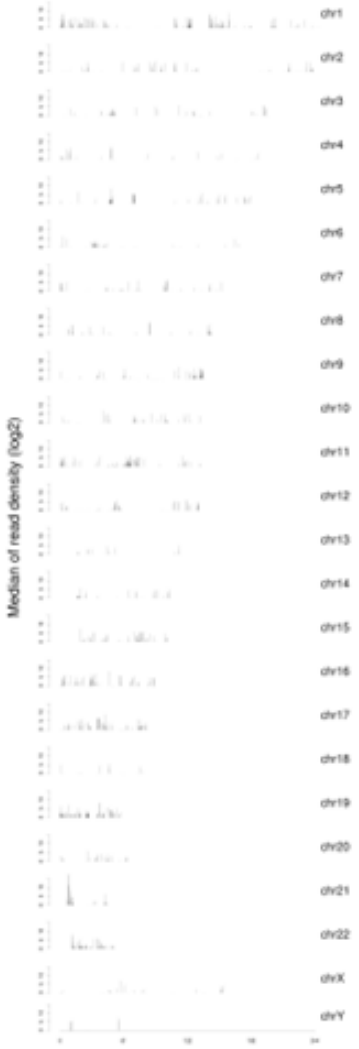
ATCC

EV Characterization

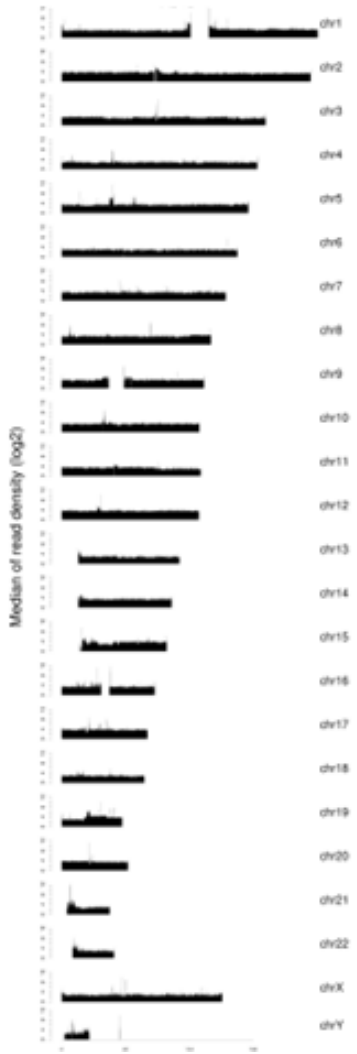
a) **iPSC EVs**



b) **MSC EVs**



c) **A549 EVs**

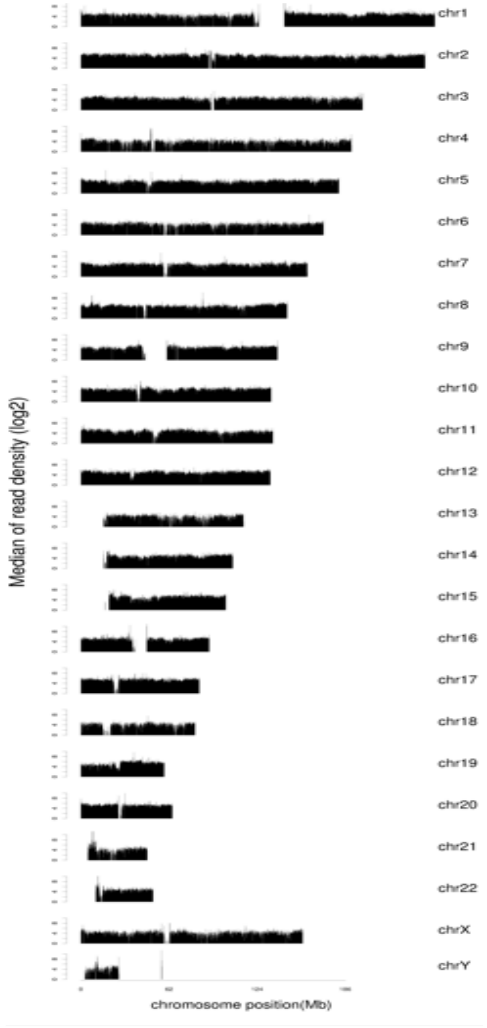


ATCC

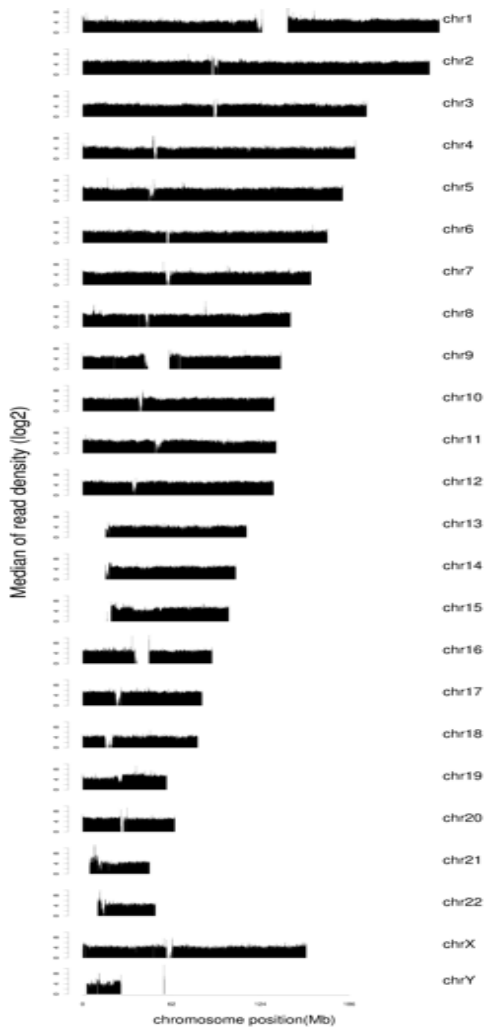
EV Characterization

d)

A549 EVs repeat 1

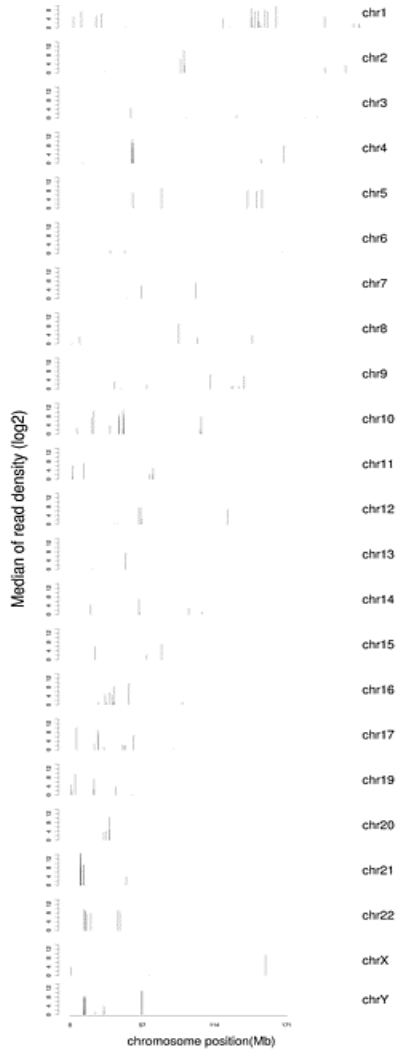


A549 EVSs repeat 2

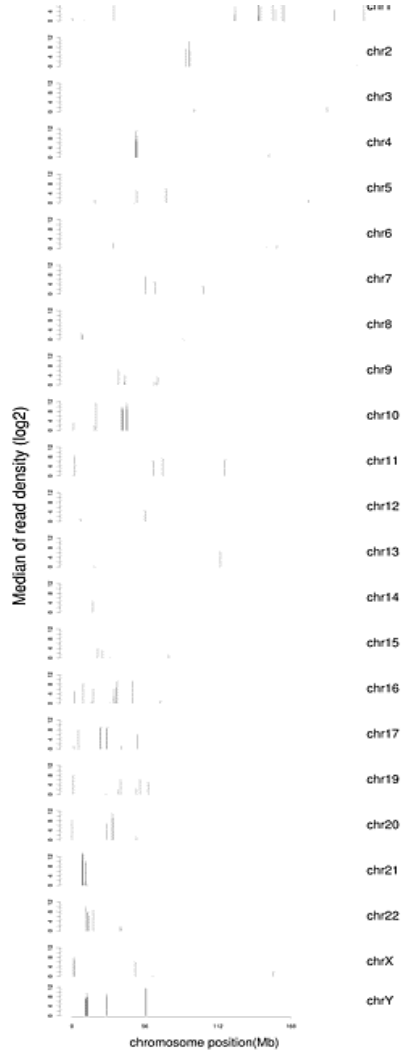


e)

MSC EVs repeat 1



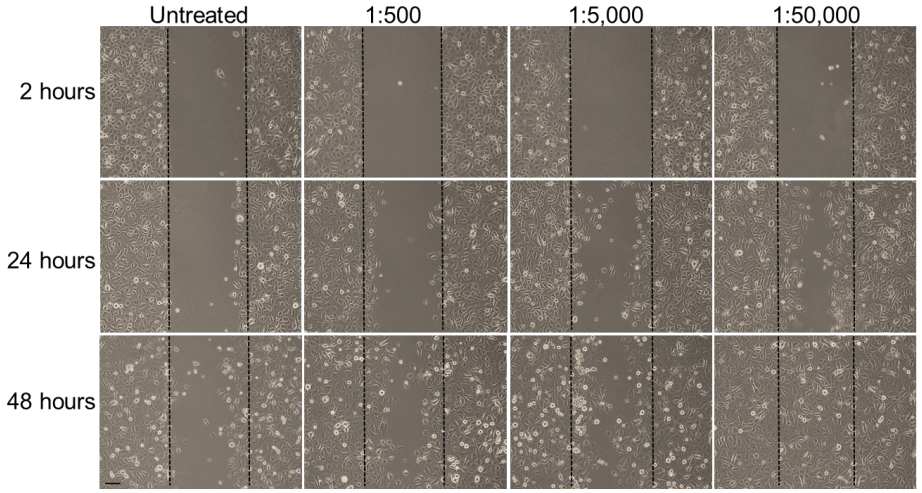
MSC EVs repeat 2



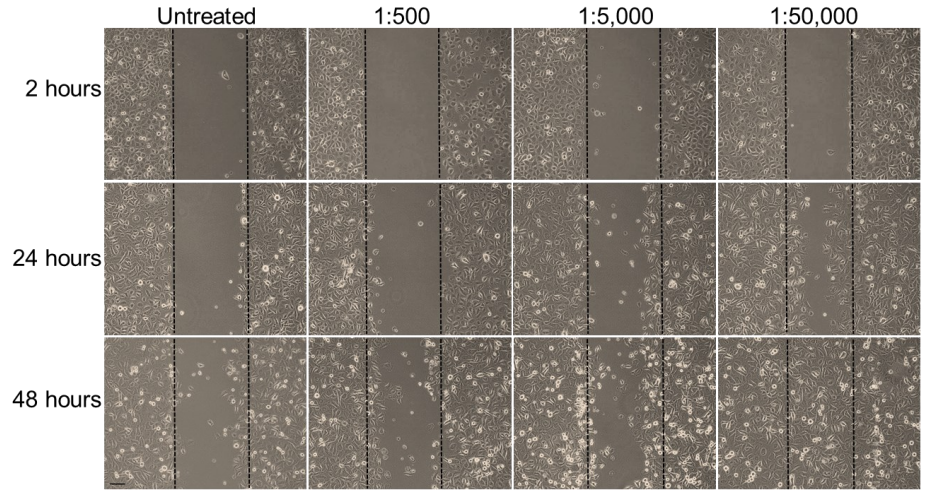
ATCC

EV Functionality

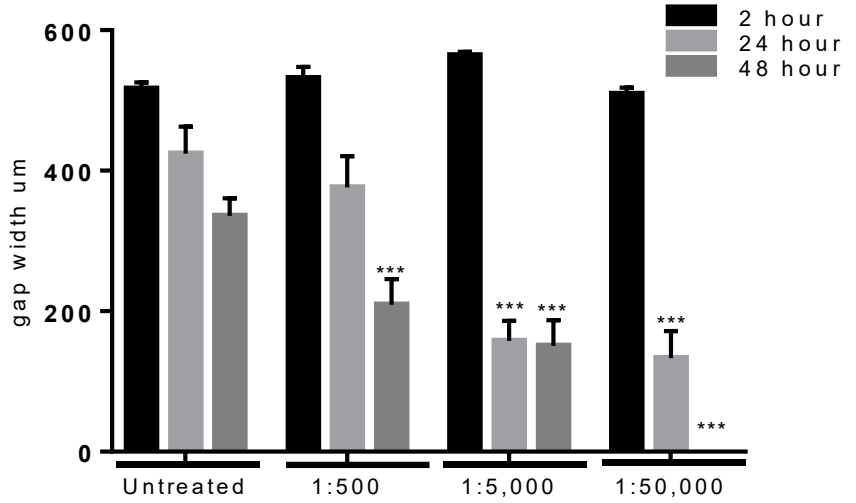
a)



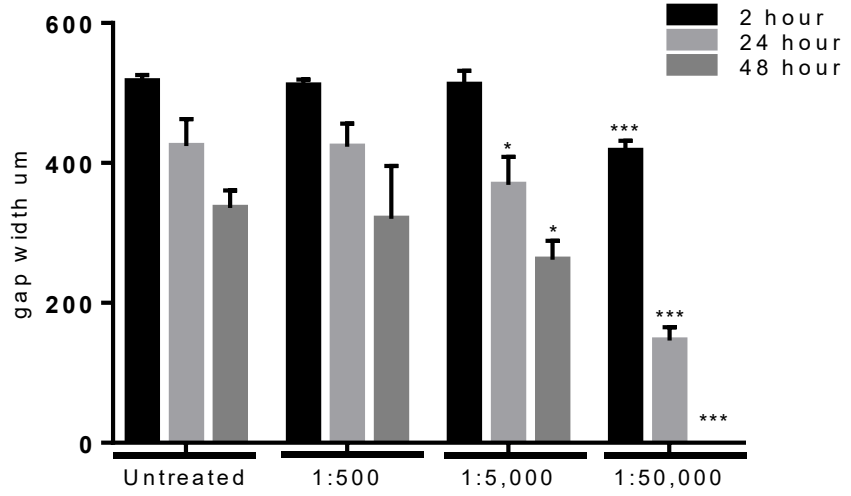
b)



c)



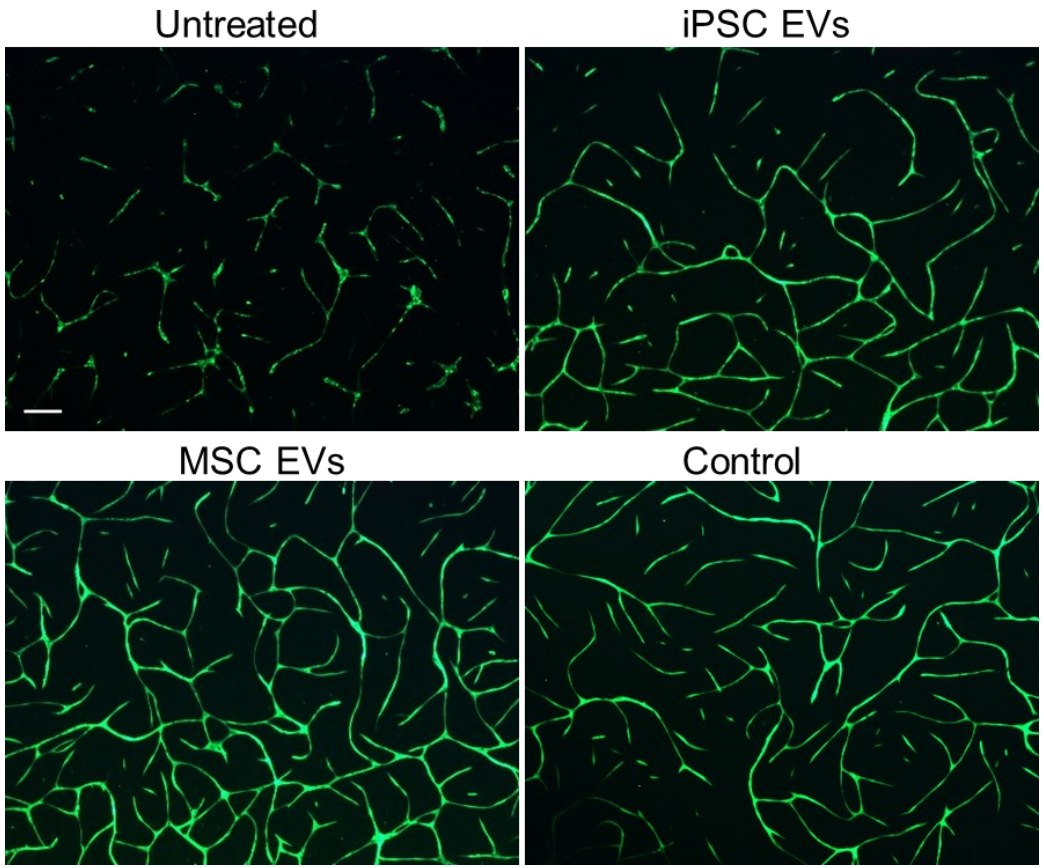
d)



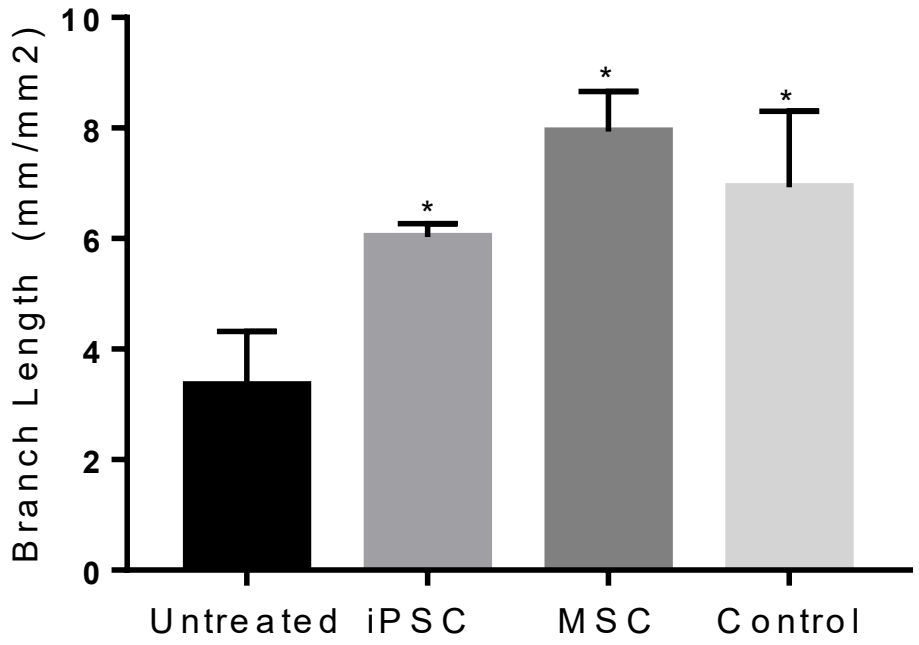
Branscome et al. 2021

EV Functionality

a)



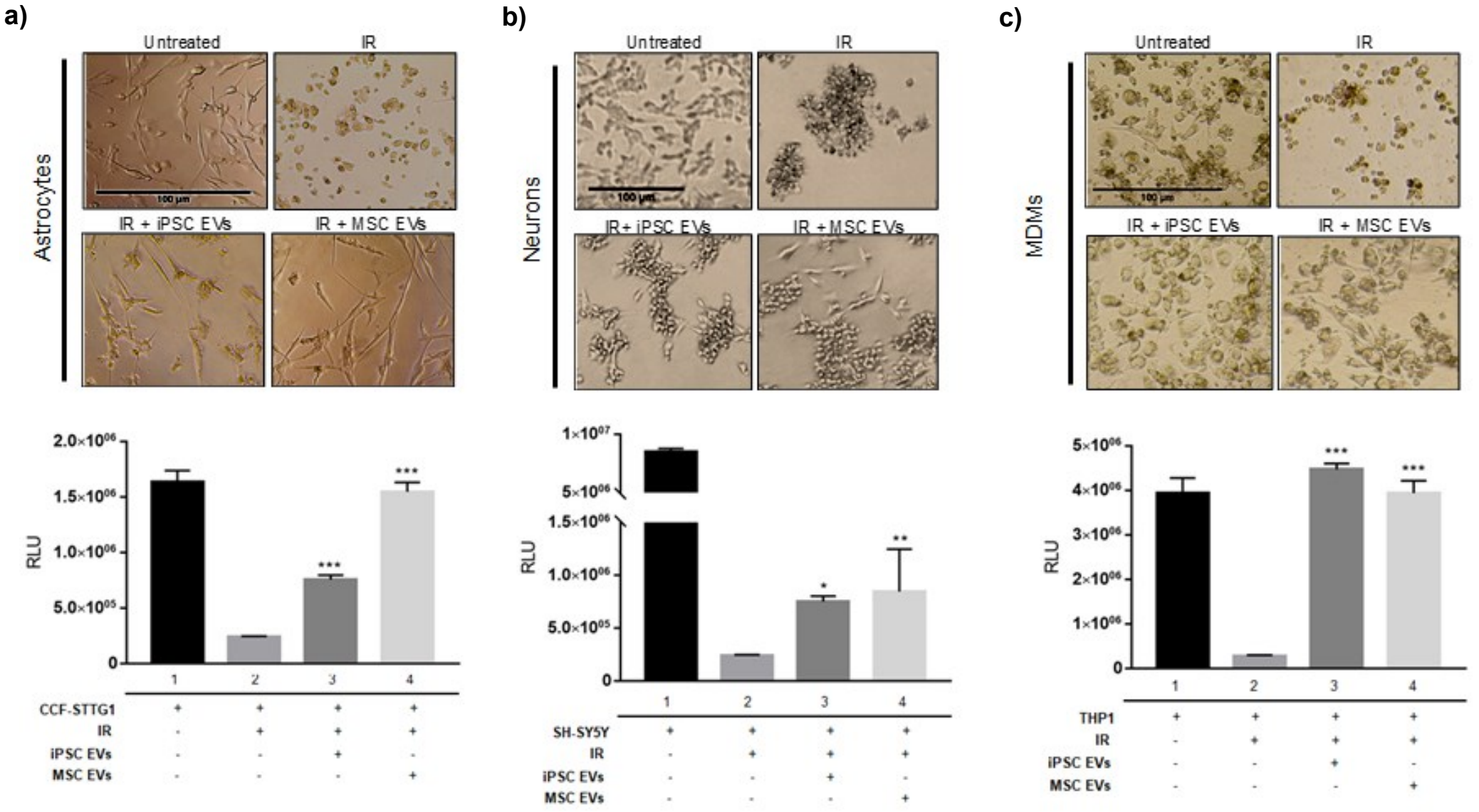
b)



Angio-***Ready***™ Angiogenesis Assay System (ATCC® ACS-2001-2™)

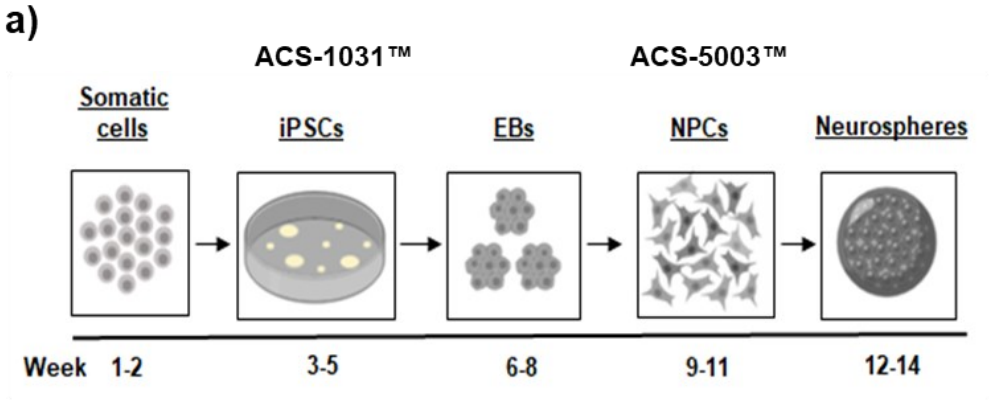
Branscome et al. 2021

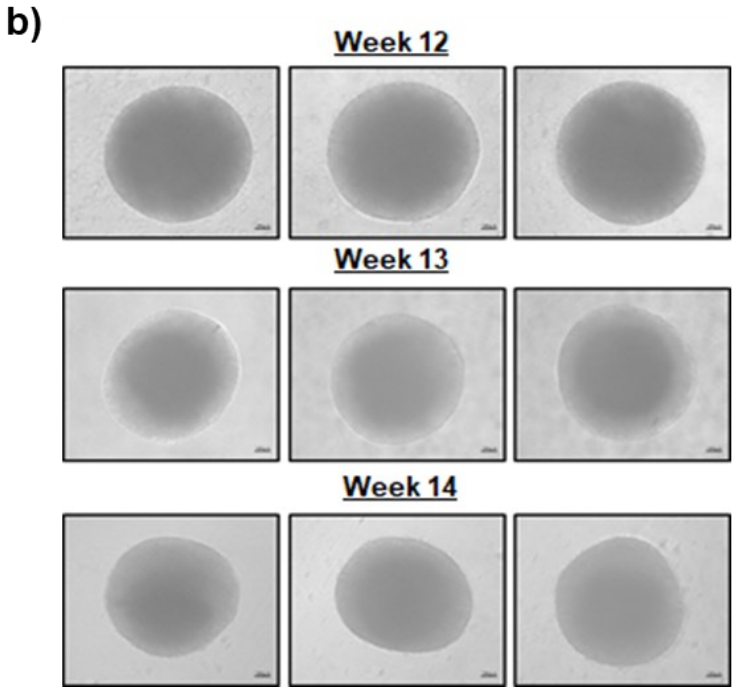
EV Functionality

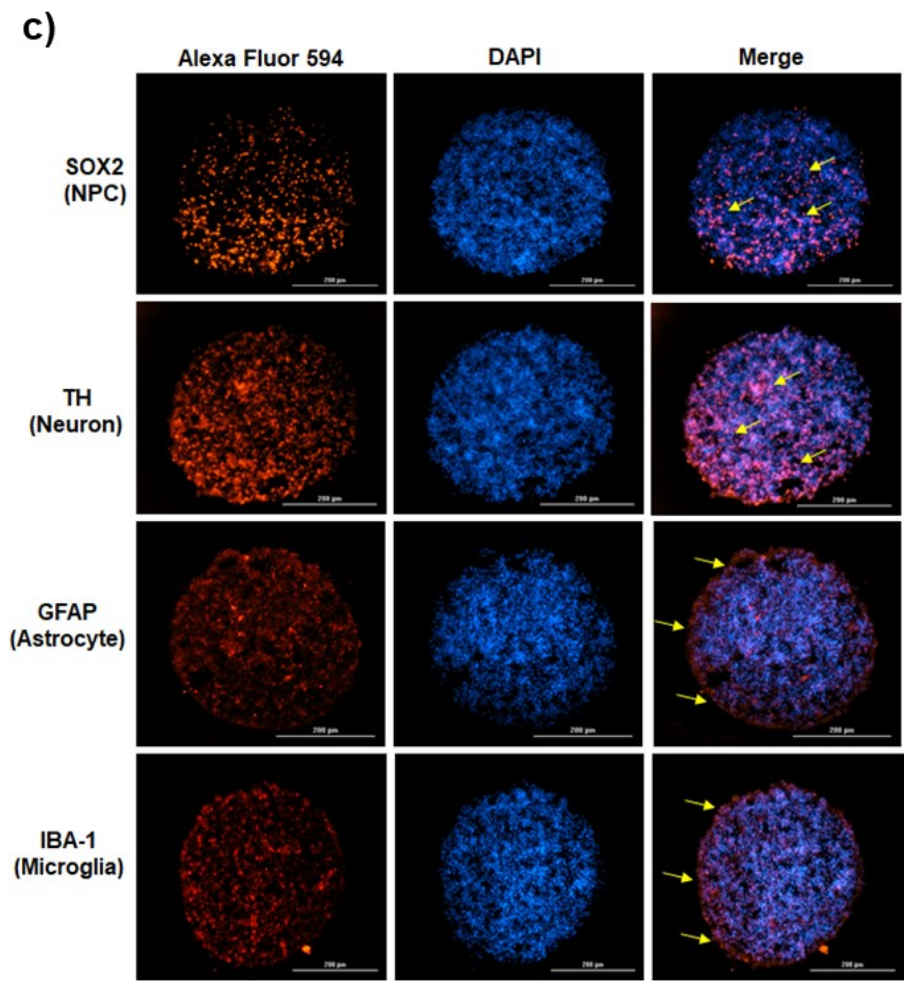


Branscome et al. 2021

Generation of Neurospheres

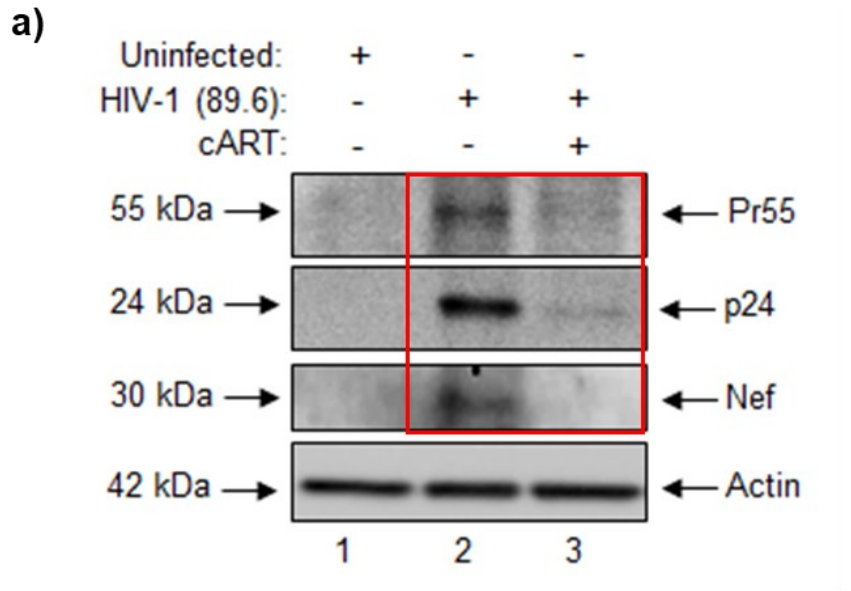


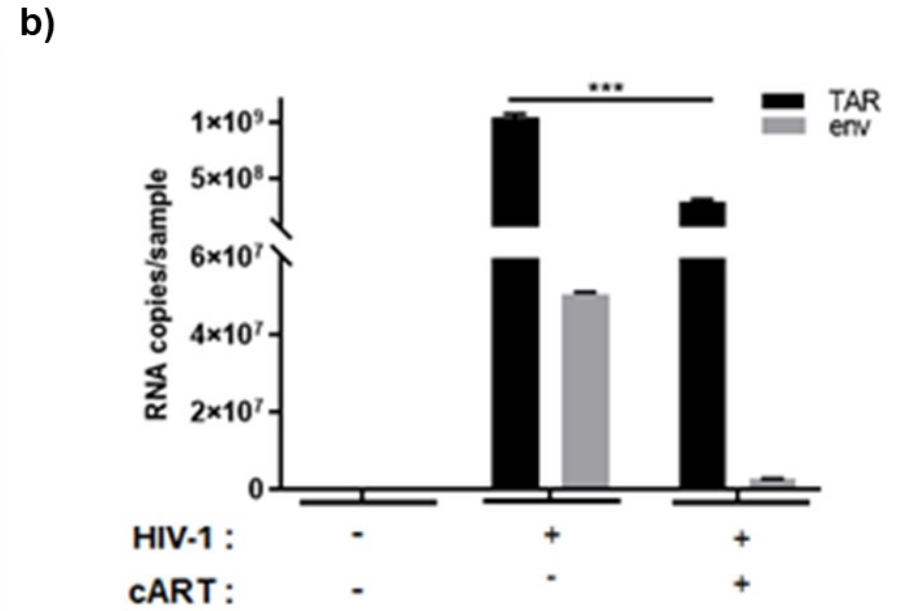


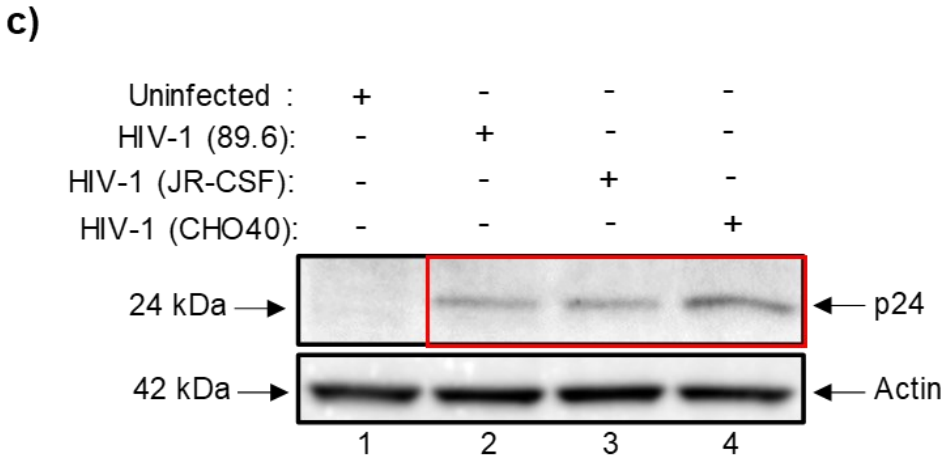


Branscome et al. 2022

Infection of Neurospheres

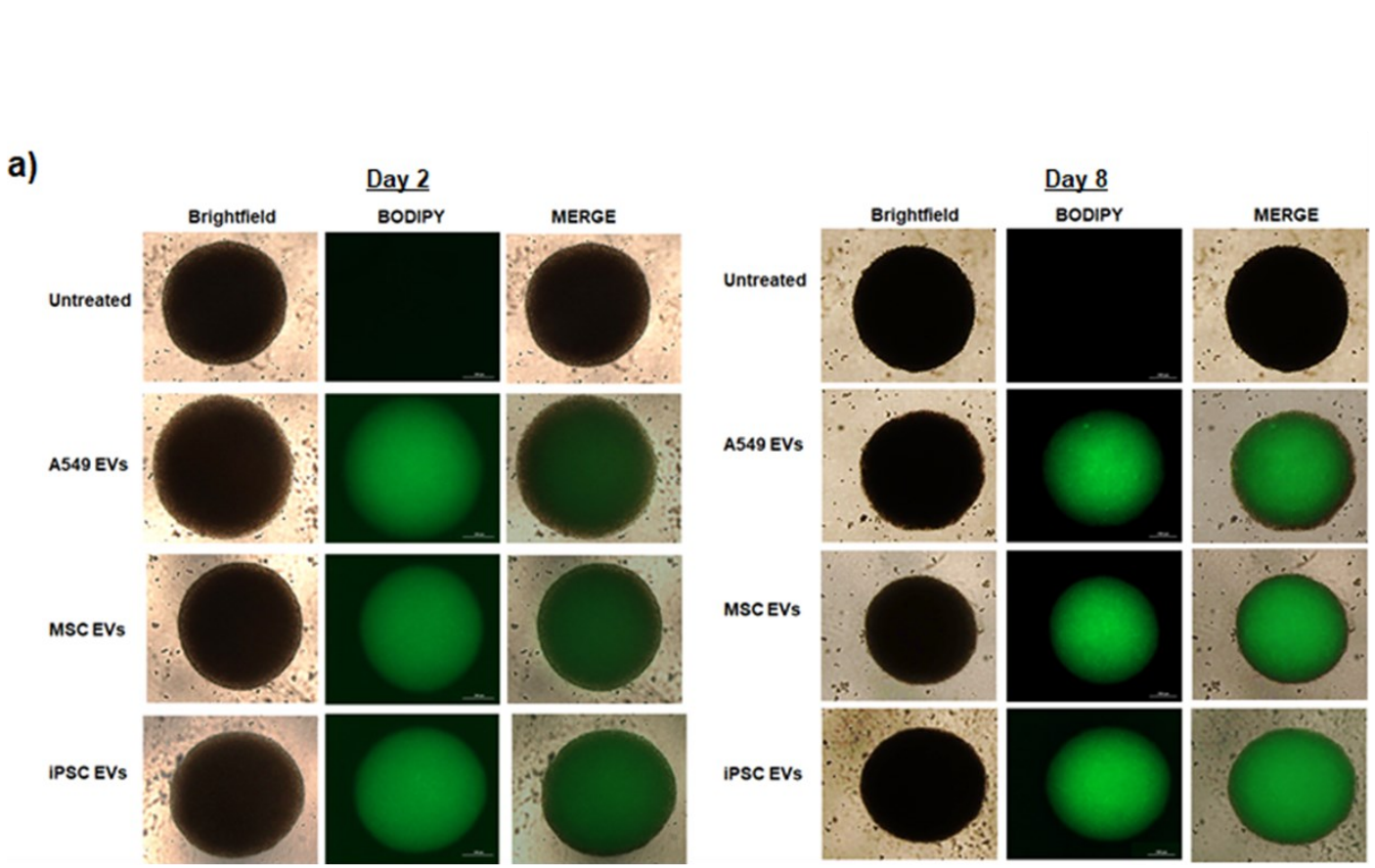


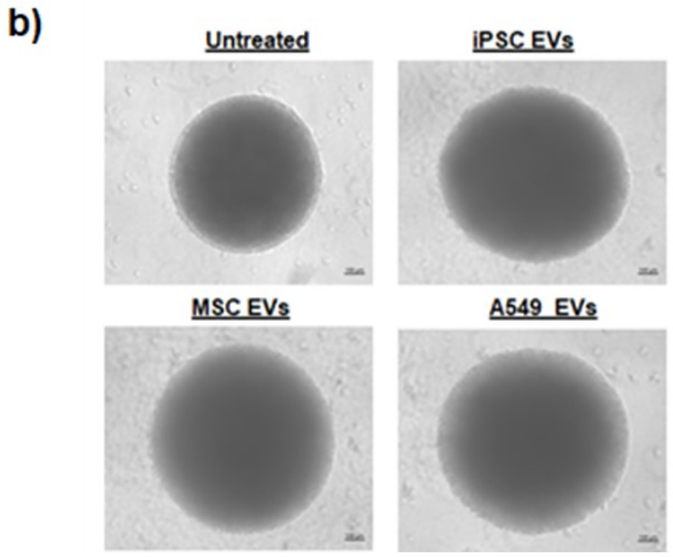


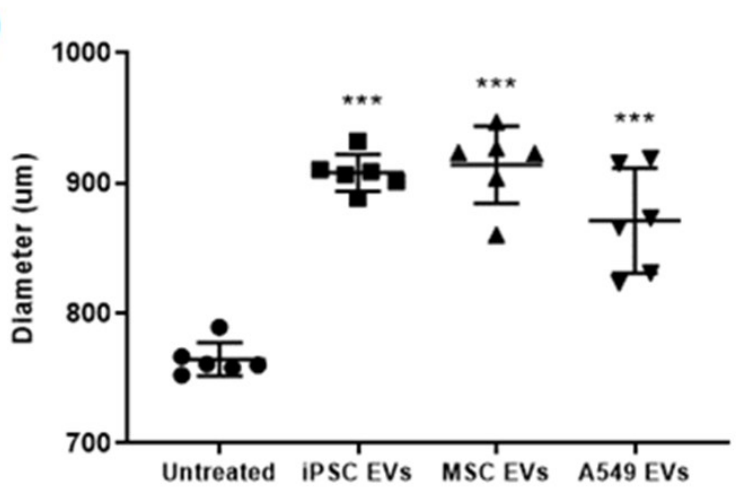


Branscome et al. 2022

EV Uptake

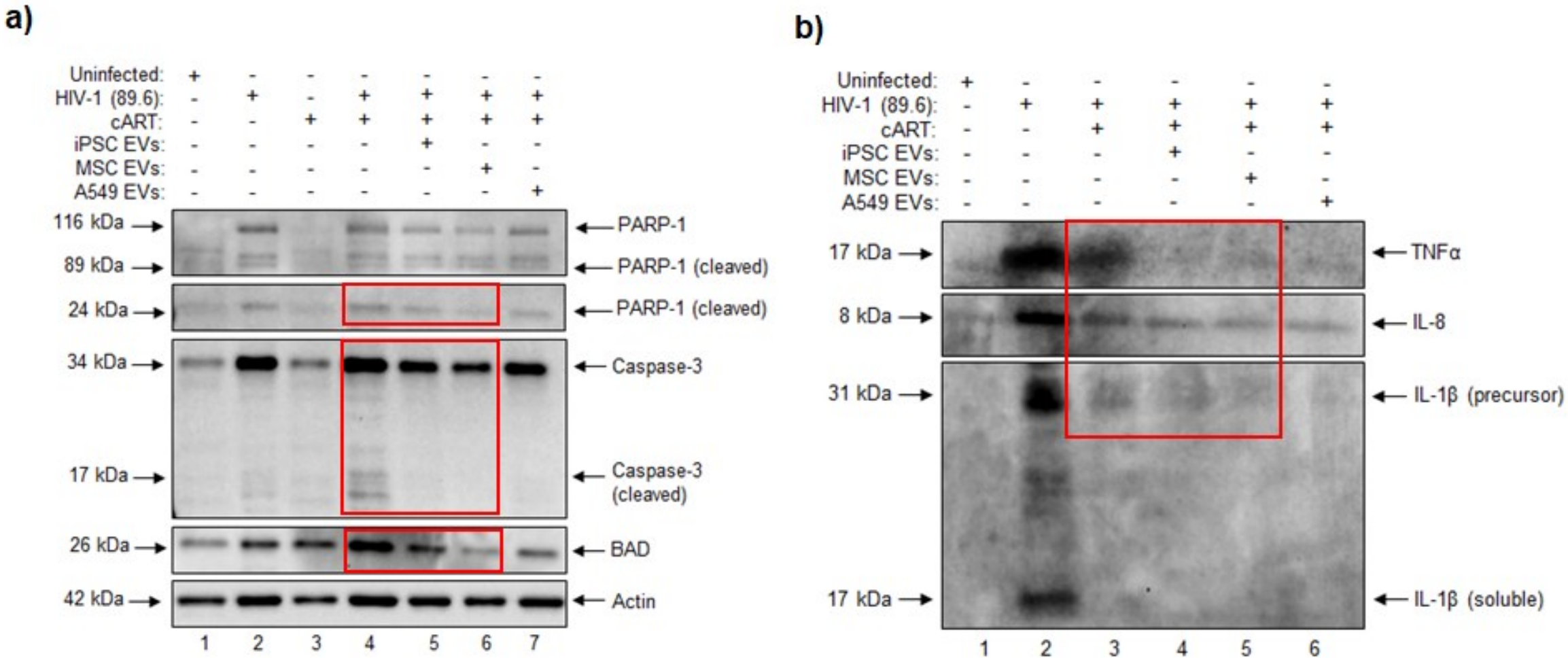






Branscome et al. 2022

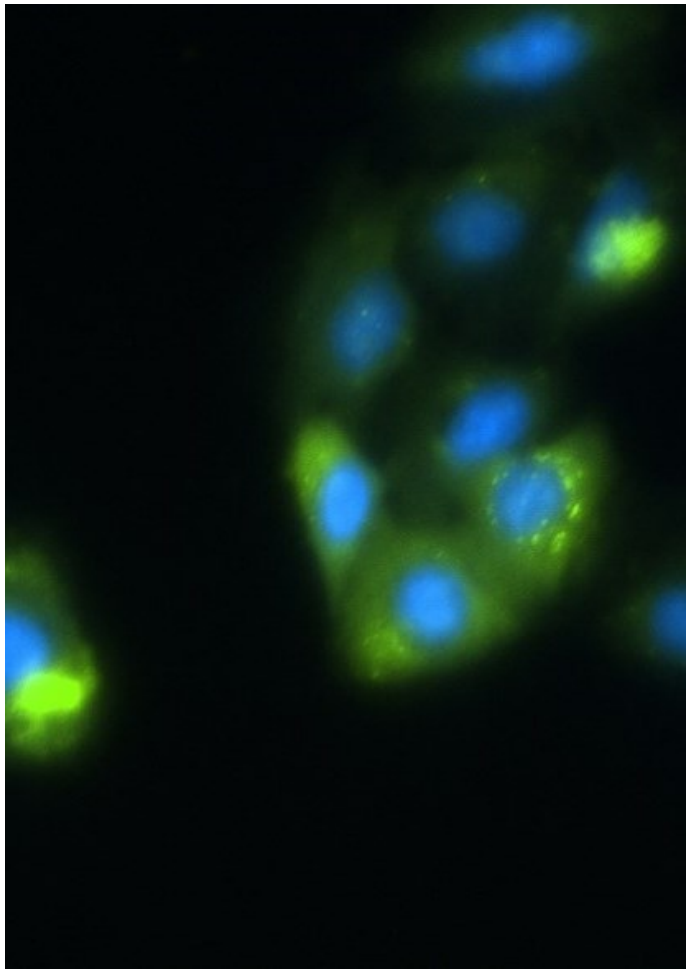
EV Function



Branscome et al. 2022

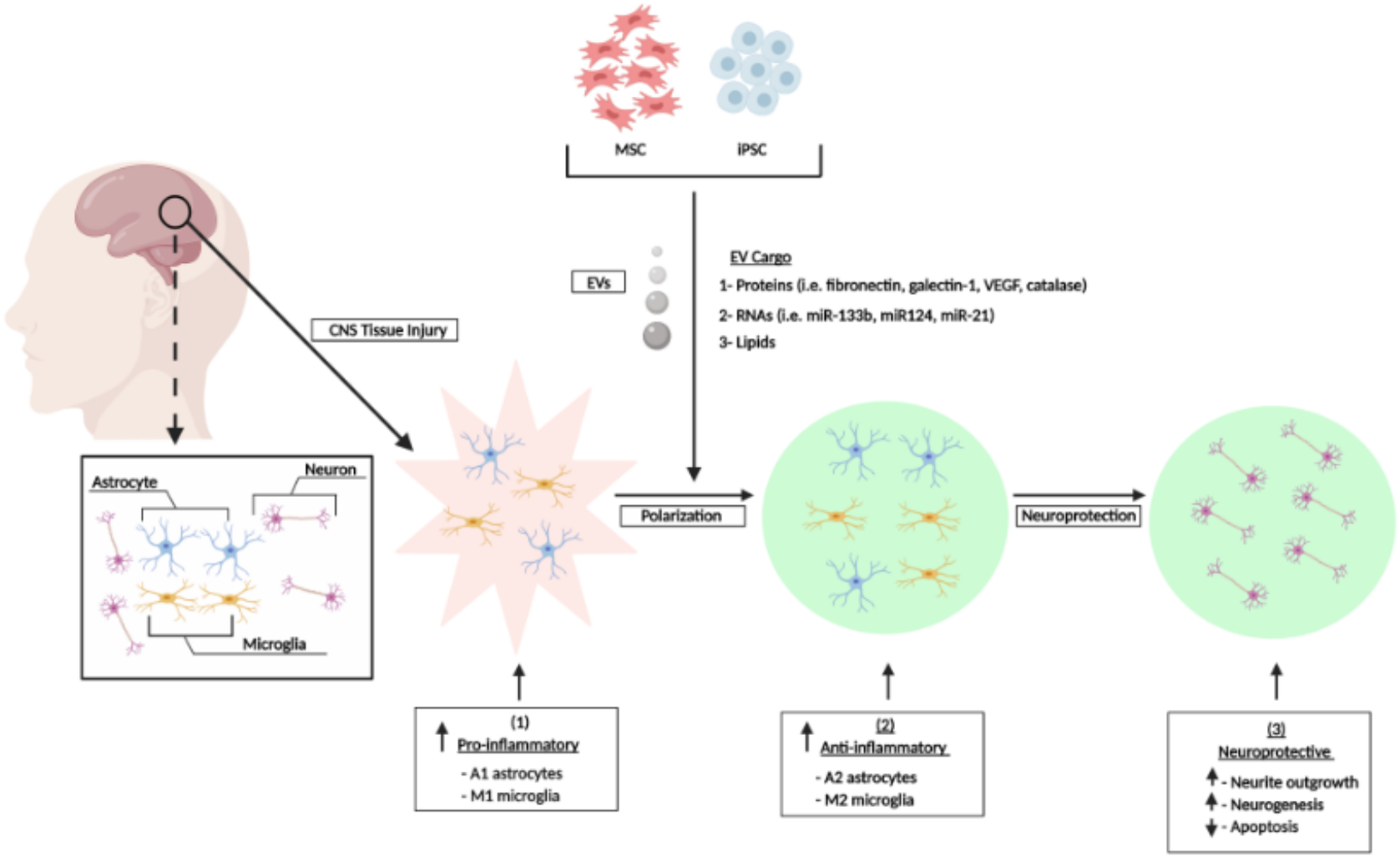
Summary

- High yields of EVs were isolated from well characterized and authenticated ATCC cell lines using TFF
- ATCC EV isolation protocols are robust, reproducible, and demonstrate low lot-to-lot variability
- ATCC EVs meet high quality standards and may serve as reliable reference material to the research community
- EVs can be stored for up to 3 years without a significant reduction in NTA profile
- Phenotypic and biochemical properties of EVs are cell-type specific
- Stem cell EVs are functional in multiple different in vitro and in vivo assays and this highlights their reparative properties



Future Work

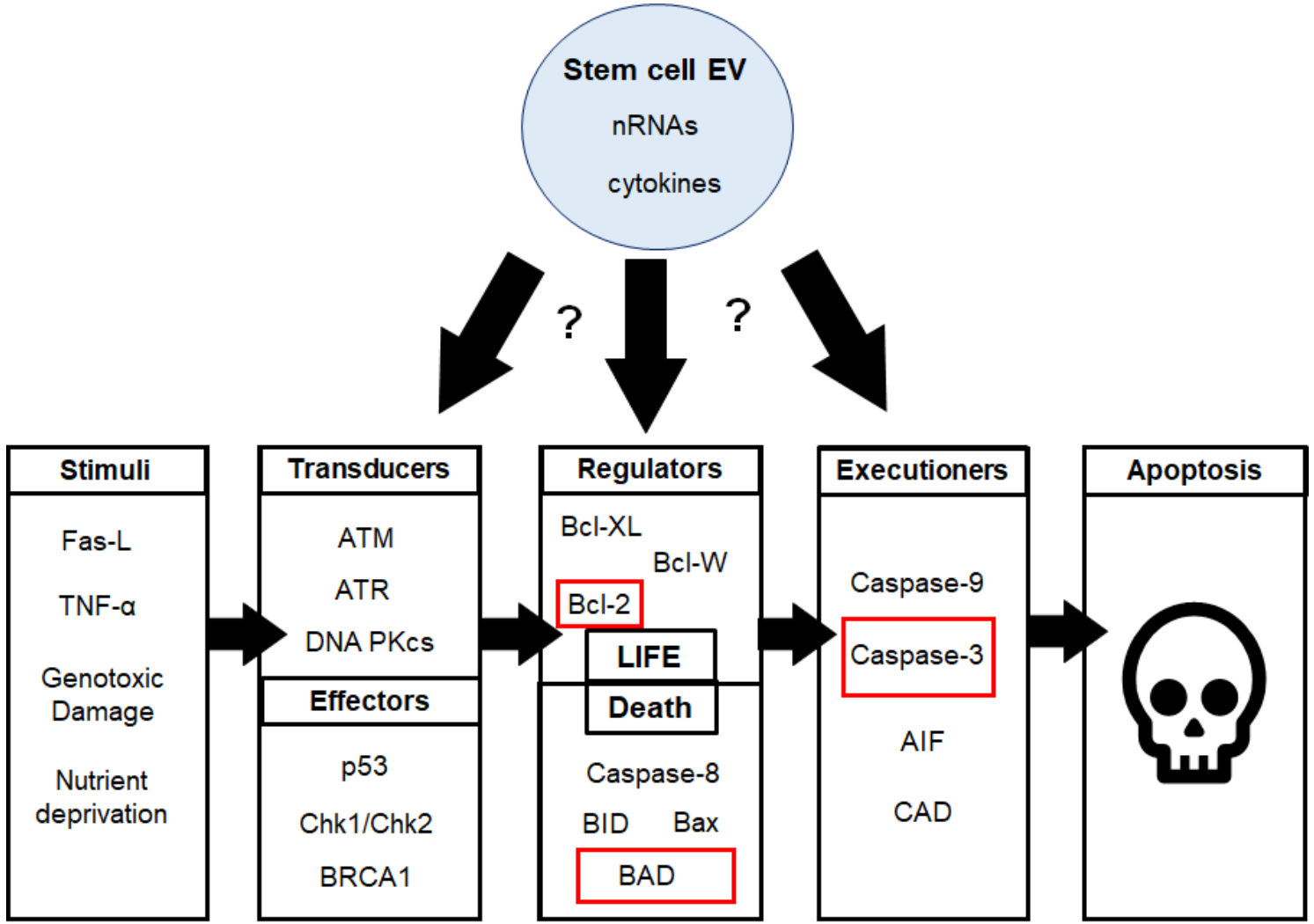
- Further study of cell-specific EV repair in 3D cultures



Branscome et al. 2021

Future Work

- Better definitions of death and EV-mediated mechanisms of repair



Acknowledgements

ATCC

- Dr. Dezhong Yin
- Dr. Siddhartha Paul
- Dr. Sheela Jacob
- Dr. James Kramer
- Dr. Mindy Goldsborough
- Dr. Ruth Cheng
- Dr. Brian Shapiro
- Dr. Nilay Chakraborty
- Quinn Osgood
- James Fantuzzo
- Tiffany Cato
- Dong Kim
- Steven Budd
- Debra Adams-Fish
- Conor McMahon

GMU

- Dr. Fatah Kashanchi
- Dr. Lance Liotta
- Dr. Pooja Khatkar
- Dr. Weidong Zhou
- Dr. Robert Barclay
- Yuriy Kim
- James Erickson
- Maria Cowen
- Dr. Sarah Al Sharif
- Gwen Cox

NIST

- Dr. Lily Wang
- Dr. Elzafir Elsheikh
- Dr. Wyatt Vreeland
- Dr. Thomas Cleveland

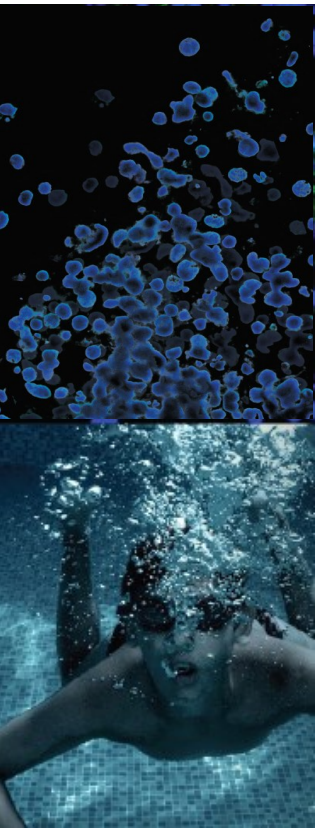
MSD

- Dr. David Routenberg

ATCC

ATCC®

THANK YOU



Credible Leads to Incredible™