

Extracellular Vesicles – A New Frontier In Medical Research. Researchers Can Tap On This Area For Opportunities To Further Improve Clinical Care

K Tan, S Lim

Citation

K Tan, S Lim. *Extracellular Vesicles – A New Frontier In Medical Research. Researchers Can Tap On This Area For Opportunities To Further Improve Clinical Care*. The Internet Journal of Gynecology and Obstetrics. 2012 Volume 16 Number 2.

Abstract

The human genome, proteome and microbiome have been extensively studied for the last two decades. One area which was less studied and perhaps neglected by scientists has been in an area related to cell secretions.

Extracellular vesicles (EV) have now become the next focus of intensive scientific research. They comprise an assortment of extracellular structures, separately or variously known as exosomes, lipid membrane vesicles, microvesicles, microparticles, nanoparticles, ectosomes and apoptotic bodies. This emerging field pertains to nano & microparticles that carry proteins and RNA, both of which serve important cellular functions, and is likely to be an important player in the fast evolving field of nanomedicine.

EVs are secreted by many cell types and are present in many bodily fluids (plasma, saliva, urine, tear, milk, semen etc). Their levels and composition are altered in various diseases and hence are potential biomarkers.¹ They are an ideal source for biomarker discovery in plasma. Being encapsulated in lipid vesicles and easily extractable, this reduce the susceptibility of putative biomarkers to degradation during transport and storage, and enable biomarkers to be discovered without the confounding presence of high abundance plasma proteins e.g. albumin and immunoglobulins.² They are intimately involved in cell signalling and therefore are fundamental to our understanding of biology and pathology.^{3,4} They were demonstrated to be the active component of mesenchymal stem cell therapy and thus have wide potential therapeutic uses.^{5,6}

In 2011, researchers around the world interested in EV joined forces and founded the International Society for

Extracellular Vesicles (ISEV). Membership grew to about 750 in eight months, and the Society's first meeting took place in Gothenburg, Sweden, on 18-21 April 2012. More than 500 participants attended this event. The Journal of Extracellular Vesicles (JEV) was also conceived at that meeting and the journal is open access.⁷

There were many areas of work in EV which urgently need to be done. These include isolation, quantification & characterization of EV and their RNA and protein cargoes; studying the biological functions of EV in health and disease; understanding intracellular molecular mechanisms of EV production and release, elucidating the processes of membrane trafficking and protein sorting; unravelling the mechanisms of signal transduction, uptake and propagation of EV; studying stem cell biology with EV; use of EV in diseases' biomarker discovery and validation; setting up of informational databases and resources relating to EV and the therapeutic development for EV.

Global research in the field of EV which involves all disciplines of medicine, is rapidly expanding. The emergence of EV research is likely to be a disruptive and a strategic scientific development that deserves strategic research investment. Readers of this journal who are researchers in the fields of obstetrics, gynaecology, reproductive, maternal fetal medicine and related areas, need to be aware of the vast potential in EV research and should tap on this area for opportunities to further improve clinical care. At the same time, research funding agencies/institutes need to be cognisant of the likely disruptive and huge impact of EV research. Funding bodies can also formulate a strategic position to competitively encourage and attract EV

research.

References

1. Tan KH, Tan SS, Xu Y, Sze N, and Lim SK. Plasma membrane vesicles are a rich source of potential biomarkers for pre-eclampsia. *Journal of Extracellular Vesicles* 2012, 1: 18172 - <http://dx.doi.org/10.3402/jev.v1i0.18172> . Vol 1 (2012) Supplement Pg 40.
2. Tan KH, Tan SS, Sze N, Richards M, Chan M and Lim SK. Rapid isolation of two distinct plasma membrane microparticle populations for biomarker discovery and assay. *Diagnostic Applications of Exosomes & Molecular Diagnostics Europe 2012*. May 10-11 2012 London.
3. Aliotta JM, Pereira M, Li M, Amaral A, Sorokina A, Dooner MS et al. Stable cell fate changes in marrow cells induced by lung-derived microvesicles. *Journal of Extracellular Vesicles* 2012;1: doi:10.3402/jev.v1i0.18163.
4. Ekström K, Valadi H, Sjöstrand M, Malmhäll C, Bossios A, Eldh M et al. Characterization of mRNA and microRNA in human mast cell-derived exosomes and their transfer to other mast cells and blood CD34 progenitor cells. *Journal of Extracellular Vesicles*. 2012;1: doi:10.3402/jev.v1i0.18389.
5. Lai RC, Arslan F, Lee MM, Sze NS, Choo A, Chen TS, Salto-Tellez M, Timmers L, Lee CN, El Oakley RM, Pasterkamp G, de Kleijn DP, Lim SK. Exosome secreted by MSC reduces myocardial ischemia/reperfusion injury. *Stem Cell Res*. 2010;4:214-222.
6. Lai RC, Arslan F, Tan SS, Tan B, Choo A, Lee MM, Chen TS, Teh BJ, Eng JK, Sidik H, Tanavde V, Hwang WS, Lee CN, El Oakley RM, Pasterkamp G, de Kleijn DP, Tan KH, Lim SK. Derivation and characterization of human fetal MSCs: An alternative cell source for large-scale production of cardioprotective microparticles. *J Mol Cell Cardiol*. 2010;48:1215-1224.
7. Lötvall J, Rajendran L, Gho YS, Théry C, Wauben M, Raposo G, Sjöstrand M, Taylor D, Telemo E, Breakefield XO. The launch of *Journal of Extracellular Vesicles (JEV)*, the official journal of the International Society for Extracellular Vesicles - about microvesicles, exosomes, ectosomes and other extracellular vesicles. *Journal of Extracellular Vesicles* 2012, 1: 18514 - <http://dx.doi.org/10.3402/jev.v1i0.18514>

Author Information

Kok Hian Tan

Division of Obstetrics & Gynecology, KK Women's and Children's Hospital

Sai Kiang Lim

Institute of Medical Biology, Agency for Science Technology and Research (A*STAR)