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Extracellular Vesicles (EVs) and Viruses

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Abstract

Extracellular vesicles (EVs) were first discovered in the early 1940s, when Erwin Chargaff and Randolph West discovered that platelet-free plasma contains coagulation components that pellet when centrifuged at high speeds (31,000 g). Other researchers followed suit, including Peter Wolf's 1967 paper on "platelet dust" and Webber and Johnson's 1970 discovery that platelet alpha granules are connected with vesicles. These and other groundbreaking experiments lay the groundwork for the electric vehicle industry. EV is a generic designation for a heterogeneous collection of primarily circulating membranous vesicles, according to definition.

Although the term EV encompasses subgroups including ectosomes, exosomes, microvesicles, microparticles, oncosomes, and prostasomes, it is frequently used interchangeably in the area. All cell types from the three domains of life—Archaea, Bacteria, and Eukarya—release EVs. As a result, EVs play an important role in life, regulating biological processes such as intercellular communication, lateral/horizontal gene transfer, and response to stimuli and infectious agents like bacteria, fungus, parasites, and viruses.

Keywords: Vesicles; Virus; Extracellular vesicles

Introduction

The similarities between viruses and EVs are intriguing. EVs are produced by virus-infected cells, which may make uninfected cells susceptible to infection. EVs isolated from some bodily fluids, on the other hand, have antiviral properties or act as decoys to destroy viruses and inhibit their proliferation. We organised this Special Issue (SI) "Viruses and Extracellular Vesicles" to deliver both high-impact review and primary research articles to national and international EV researchers, given the similarities between viruses and EVs, as well as the tremendous research effort in the EV and virology fields. This SI informs scholars about advances in EV biology and how it intersects with virology. Kaddour et al. employed bodily fluid EVs extracted from the blood

and sperm of HIV-positive and HIV-negative males to offer biophysical and biological information on the role of surface electrostatic characteristics of EVs in their study. The research reveals the impact of HIV infection on EVs in the blood and sperm, as well as tissue-specific changes in EV surface electrostatic characteristics. The research also highlights the importance of sialic acid-associated EVs in EV surface charge and internalization by target cells. Barclay et al. looked into the connection between HIV and EVs in more depth. The researchers used HIV-1 latently infected cell lines to investigate a possible mechanism for EV-mediated latent HIV-1 activation. Grabowska et al. looked studied EV cargo and found that the EV-associated envelope glycoprotein B (gB) homologs of several Alpha herpesviruses change MHC Class II molecules differently and may act as a potential immunoregulatory mechanism for viral gB proteins. Ia et al. offered a more detailed look at the relationship between EVs and viruses, concluding that rotavirus particles are connected with EVs and that this interaction may enhance rotavirus infection. From a basic virology standpoint, the Okeoma, Kashanchi, Lipiska, and Arias groups used clinical samples or cultured cell lines to investigate the interplay between EV-associated viral and host proteins. The EV-mediated activation of latent HIV-1 has an important mechanism. Ishikawa et al. used transcriptome analysis to uncover the mRNA profile of milk-derived EVs isolated from BLV-infected cattle in their investigation [9]. McGowan et al. looked at the enrichment profile of EV-associated miRNAs in the blood of HEV- and HCV-infected patients in a pilot investigation. The Inoshima and Petrik groups' transcriptome investigations are valuable resources for the EV community since they provide information on the RNA biotypes associated with EVs in various mammalian body fluids under various illness situations. In addition to the core research publications listed above, good evaluations written by various investigators cover a wide range of studies on the functional impacts of EVs as well as mechanistic insights into how EV-mediated activities are regulated. The Daniel group's review by Alqatawni et al. focused on the role of EVs in HIV infection and wound healing. The researchers compiled data indicating EVs are involved in coagulation, inflammation, proliferation, and extracellular matrix remodelling, all of which are processes involved in wound healing and may be applicable to HIV and other viruses. Simone Giannecchini also detailed published research on how polyomaviruses (PyVs) utilise the EV delivery system during infection. The interaction of PyV miRNAs with EVs in bodily fluids, according to the researcher, could indicate PyV persistence. Giannessi et al. addressed the current status of research on the association between EVs and numerous viruses such as HIV, HCV, and SARS in their review. The putative role of EVs in the pathogenesis of SARS viruses was placed in a historical context with the knowledge of well-known EV–HIV and EV–HCV interactions in this review from the Affabris group. When all of the research in this SI edition are combined, a theme emerges that echoes the role of EVs in the pathogenesis of many viruses. The value of EVs in the creation of diagnostics and therapeutic techniques against numerous viruses is also clear.

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