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Commentary

Exosomics as New Perspective for Pulmonary Disorders and Ontogenetic Bioregulation

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Abstract

This short commentary aims at describing some recent advances of exosomics, as referred to pulmonary and respiratory medicine, and in more general perspective of ontogenetic bioregulation.

Keywords: *Exosomes; Lungs and Airways; Ontogeny*

Abbreviations

DOHaD: Developmental Origins of Health and Disease; ISOAD: International Society on Aging and Disease; LA-DOHaD: Latin-American Chapter of International Society for DOHaD; PhD: Philosophy Doctor

Introduction

Fifty years ago, in 1976 the author of this commentary was completing educational course on Biochemistry in the Department of Molecular Pharmacology and Radiobiology of Medico-Biological Faculty in 2nd Moscow State Medical Institute. Our first investigative experience was related to the use of artificial liposomes composed of synthetic phospholipids. It was impossible to preview at that time that half a century later our attention will be attracted to a similar object.

In fact, a new biomedical discipline of exosomics [1] studies exosomes, nanosized extracelular vesicles released from almost every cell type [2,3]. However, the difference, as compared to liposomes, is that this topic shows incredibly rapid scientific elaboration, similar to that of nanotechnology in the last several decades.

The presented commentary has two interconnected aims: to describe briefly new advances of exosomics, as applied to pulmonary disorders, and to give a much larger perspective of exosomes as vehicles of ontogenetic bioregulation.

Role of exosomes in pulmonary and respiratory medicine

Although at present exosomes are discussed for various disorders including cancer [4], their contrbution to pulmonary disorders is relatively underestimated till the present time. Nevertheless, significant evidence was already accumulated for the role of exosomes in bronchial asthma and chronic obstructive pulmonary disease [5,6], as well as Covid-19 [7].

The important fact is that natural exosomes contain several types of macromolecules, such as proteins, nucleic acids and lipids. Moreover, exosomes derived from immune cells possess MHC components, together with interleukins and therefore, should be considered in pathogeny of pulmonary infections and inflammation in general. Finally, exosomes may be the vehicles for viruses, suh as SARS-Cov2.

Role of exosomes in ontogenetic bioregulation

Just recently we proposed the necessity of broadeninig and expansion of endocrinology to the science of bioregulation and of gerontology to the science of ontogeny [8]. As a matter of fact, the concept of ontogenetic bioregulation is located exactly on the crossroad of these amplified versions of endocrinology and gerontology [9]. As applied to pulmonary and respiratory medicine, earlier we justified that it should consider more closely the non-respiratory functions of the lungs that may include the metabolism of hormones, as well as the presence of neuroendocrine cells and neuroepithelial bodies in pulmonary tissue [10]. Both for the lungs and in general the situation can be described in a simple mode: Donor cells →Exosomes → Recipient cells.

It means that donor cells are releasing by exocytosis the exosomes that with circulation of blood and other extracelular fluids reach recipient cells that may be in the vicinity (paracrine mode) and on the distance (endocrine mode).

It is important that due to their small size (30-150 nm), exosomes appear to pass through all the known barriers including placenta, that's why they should be considered as potential mediators of programming/imprinting phenomena, probably interacting with glucocorticoids and other hormones in DOHaD paradigm, as referred to perinatal medicine.

On the other hand, exosomes may participate in mechanisms of aging [11,12], as was clearly shown also by Irina M. Conboy and her colleagues in experiments on heterochronic parabiosis (see discussion in [13]).

Final Remarks

Of course, exosomics is only at the onset of decisive scientific advances, but already at present it can be surely previewed that exosomes will be increasingly utilized in biomedical research and practice as biologicals, i.e. biotechnology products that together with conventional pharmaceutical agents are capable to revolutionize the diagnosis, treatment and prevention of pulmonary and other disorders.

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