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SHORT COMMUNICATION

Environmental Pollution: Considerations from the Onto and Phylopathogenic Models

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ABSTRACT

This short communication describes possible implications of environmental pollution for the onto- and phylopathogenic models that describe etiopathogenic processes along the whole ontogeny and in transgenerational mode respectively.

Abbreviations

DOHaD: Developmental Origins of Health and Disease; ISOAD: International Society on Aging and Disease; PCB: Polychlorinated Biphenyls; PhD: Philosophy Doctor

Introduction

At present there exist two principal types of etiopathogenic factors: genetic and environmental ones. In this article we shall focus on the latter, focusing mainly on endocrine disruptors in relation to the phenomena of biological programming / imprinting. Our work presented here is not the first one in this important area, but the attempt will be made to reunite some different pieces of our previous publications, adding new and essential details.

Methodology

As earlier, we shall discuss bibliographic data gathered in various commercial databases and in public Internet domain, according to indicated key words.

Results and Discussion

We shall begin with endocrine disruptors, the polluting agents capable to disrupt hormonal regulation in extremely low doses. In previous articles we have already described persistent organic pesticides, like atrazine and PCBs affecting mainly reproduction and the action of thyroid hormones respectively [1,2]. The new question that will be treated here for the first time is: how endocrine disruptors can contribute to onto- and phylopathogenic models?.

Here we should explain that ontopathogeny describes pathogenic

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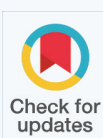
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mechanisms acting along the most part, or even the whole ontogeny, beginning from pre- and postnatal development and continuing till adult state, middle age and senescence, whereas phylopathogeny treats the phenomena of inter, multi- and transgenerational transfer of the risk of diseases, probably by means of epigenetic mechanisms.

Previously we have described the contribution of some endocrine disruptors to the pathogeny of endocrine-related tumors, especially of the breast and prostate, i.e. the leading types of cancer in modern society [3]. Interestingly enough, only at present it became clear that certain endocrine disruptors like bisphenol A are capable to provoke the phenomena of programming / imprinting, when the action of some environmental pollutants in early life results in considerable alterations of morpho-functional properties of estrogen-sensitive tissues, with long-term consequences of elevated risk of several cancer types during the subsequent years of life.

Another class of ubiquitous polluting agents in modern great cities is ultrafine particulate matter, resulting from incomplete combustion of fossil fuels, especially in diesel engines of autobus and trucks. The size of these ultrafine particles (100 nm) is comparable with the sizes of man-made nanoparticles that allow them to penetrate through various barriers, beginning from gas-blood interface in alveoles of the lungs and continuing to blood-brain barrier and placenta. What for the latter ones, it means that the action of ultrafine and nanoparticles is not limited to respiratory system, but extends to pathogenic action in neuropsychiatric area and even to the impact on fetal organs and tissues [4]. It is important to mention here that socially deprived persons and families tend to live near highways with great degree of pollution by ultrafine particulate matter from diesel exhaust, what can explain, at least partially, the well-known relationship between socioeconomic status and epidemiologic indices of morbidity and mortality [5].

Of course, man-made nanoparticles are only initiating their way to environment, but it is already known that carbon nanotubes have some properties similar to asbestos microfibers and therefore, their utilization should be strictly monitored also, and already now. This is important because the latent period from exposure to asbestos microfibers till

emergence of malignant mesothelioma in the lung pleura can extent to several decades [6].

Another example of long-acting environmental pollutants is cadmium in ionized form (Cd^{2+}). Although there exist effective tools of biochemical neutralization of Cd^{2+} in the body by means of complexing with metallothioneins pertaining to so called stress proteins, the reserve of such neutralization is quite small and moreover, the half-life of Cd^{2+} elimination from the body is extremely prolonged, reaching also several decades [6].

This peculiarity of long-term persistence is also characteristic of the aforementioned organic pesticides, due to their high liposolubility and hence, long-term conservation in adipose tissue, with subsequent low liberation and therefore, prolonged action, especially in the brain and other parts of central nervous system with high lipid content [7].

What for phylopathogenic model, here the data are relatively scarce. Although there exist already some indications of transgenerational action of several polluting agents like vinclozolin, bisphenol A, phthalates and PCB [8] (but not ultrafine particles), the principal problem of experimental studies in such modeling is logistic one, since these studies need the years and sometimes, decades of experimentation, even in short-lived mammals like rats and mice. On the other hand, it is not possible to study the action of, e.g. endocrine disruptors in the invertebrate species like nematodes, since they do not possess receptors and biosynthetic enzymes for steroid hormones (estrogens etc.) of vertebrate species, including those of mammals and humans [9].

Final Comments

In conclusion, the research in the framework of Developmental Origins of Health and Disease (DOHaD) should be supported by organization of regional DOHaD centers, due to their extremely important role also for environmental area and agriculture [10]. In these centers health professionals could interact with other specialists inside the great paradigm of Public and Collective Health.

Because of important contribution of stress, including ecologic one, and its mediators (first of all, glucocorticoids) to the mechanisms of programming

/ imprinting phenomena [11,12], especially the interactions of biomedical researchers with psychologists are particularly welcome.

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