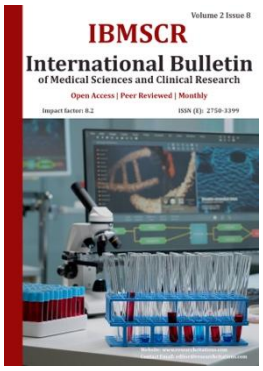

DEPENDENCE OF THE DEVELOPMENT OF CONGENITAL INSUFFICIENCY IN HUMANS ON ONTOPHYLLOGENESIS

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https://doi.org/10.5281/zenodo.18032930

Abstract. This article provides a scientific and theoretical analysis of the relationship between the origin and development of congenital malformations in humans and the processes of ontophylogenesis. Based on the laws of ontogenesis and phylogenesis, the influence of morphological and functional changes occurring at the stages of embryonic development on the formation of congenital defects is highlighted. Also, the causes of congenital malformations are revealed based on the integration of critical periods of embryonic development, genetic and epigenetic factors, and environmental influences into the ontogenetic process. The article analyzes the phylogenetic roots of some congenital defects from the point of view of evolutionary development and substantiates their theoretical and practical significance for medical and biological sciences.

Keywords: congenital insufficiency, ontogenesis, phylogenesis, ontophylogenesis, embryonic development, critical periods, genetic factors, epigenetic influence, evolutionary development, morphogenesis

Introduction

The concept of ontophilogenesis expresses the inextricable link between the individual development of living organisms (ontogenesis) and their historical-evolutionary development (phylogenesis). This approach allows for a deeper understanding of the formation of the structure and functions of the organism in biology and medicine. The human body, in the process of embryonic development, represents certain stages of phylogenetic experience, formed over millions of years, in a shortened and modified form. Therefore, the analysis of disorders of embryonic development and congenital malformations not only within the framework of ontogenetic processes, but also in connection with phylogenetic factors, is of great scientific importance.

Congenital malformations usually arise at certain stages of embryonic development as a result of the influence of genetic, epigenetic, or exogenous factors. According to the World Health Organization, congenital malformations are one of the leading causes of infant mortality and disability, most of which are formed in the first trimester of pregnancy. It is this period that is the most delicate and critical stage of ontogenesis, during which phylogenetically complex structures - the central nervous system, cardiovascular system, and maxillofacial apparatus - are formed.

From the point of view of ontophilogenesis, some congenital defects manifest themselves in connection with relatively late-forming or phylogenetically unstable structures in the evolutionary process. For example, the lack of closure of the neural tube, defects in the septa of the heart, or anomalies in the skeletal system, along with disruptions in ontogenetic development, are also interpreted as a result of phylogenetic limitations. This situation is widely discussed in modern developmental biology and evo-devo concepts.

The main goal of this article is to analyze the origin and development of congenital malformations in humans based on the concept of ontophilogenesis, to scientifically and theoretically substantiate the relationship between critical periods in ontogenesis and phylogenetic factors. Also, the research results are aimed at revealing the significance of the evolutionary approach in the prevention, early diagnosis, and explanation of congenital anomalies.

Literature review and methods

Literature review. The problem of ontophilogenesis and congenital malformations has a long history in biology and medicine, and the scientific views formed on this issue are closely related to evolutionary development. The biogenetic law, proposed by E. Haeckel in the 19th century, was one of the first attempts to explain the connection between ontogenesis and phylogenesis. Although this law was not fully accepted by modern science, it gave an important impetus to the formation of developmental biology and embryology.

The expansion of the possibilities of studying embryonic development processes at the molecular level in the 20th-21st centuries allowed for a deeper understanding of the origin of congenital malformations. In the studies of such scientists as S.F. Gilbert, T.W. Sadler, B.M. Carlson, K. Moore, and T. Persaud, the main causes of congenital defects are the disruption of gene-regulatory networks, signaling pathways, and cell differentiation in embryonic development.

The modern evo-devo (evolutionary developmental biology) approach pays special attention to the analysis of ontogenetic processes in a phylogenetic context. According to this concept, certain limitations and weak points in embryonic development are the result of the developmental program formed in the evolutionary process. As a result, phylogenetically complex or late-forming organs may be more susceptible to congenital malformations.

In domestic scientific sources, congenital anomalies are also widely covered within the framework of embryology, medical genetics, and anatomy. Textbooks and teaching aids created for higher educational institutions of Uzbekistan systematically describe the stages of ontogenesis and pathologies arising as a result of their disruption. However, in these works, it is noted that the approach to ontophilogenesis has not been sufficiently comprehensively applied.

Methodology. This study was of a theoretical and analytical nature, and experimental methods were not used. The research was conducted on the basis of the following methodological approaches:

- systematic and critical analysis of scientific literature;
- comparative study of ontogenetic and phylogenetic processes;
- description of the stages of embryonic development in a logical sequence;
- theoretical modeling of the evolutionary basis of congenital malformations;
- generalization and drawing scientific conclusions.

In the selection of literature, priority was given to foreign monographs, textbooks, and reports of international organizations (WHO) published in recent years. The research results were aimed at highlighting the relationship between ontogenesis and phylogenesis, as well as explaining the mechanisms of development of congenital malformations.

Results and discussion.

Relationship between stages of ontogenesis and congenital malformations

The conducted theoretical analysis shows that most congenital malformations occur at specific ontogenetic stages of embryonic development. Especially 3-8 weeks of pregnancy is considered the most important and critical period of ontogenesis. During this period, gastrulation and initial organogenesis processes occur, and the main morphological structures of the embryo are formed. Therefore, any genetic or environmental disorders occurring at this stage can manifest as severe congenital defects.

For example, pathologies associated with the non-closure of the neural tube (anencephaly, spina bifida) arise as a result of disorders in the gastrulation process. Heart septal defects are explained by the incomplete implementation of successive stages in the embryonic development of the heart. These facts indicate the connection of ontogenesis processes with phylogenetically complex mechanisms.

Frequency of phylogenetically complex organs and defects

Analysis of the results shows that organs with a relatively late phylogenetic development and a complex structure are more prone to congenital malformations. These include the central nervous system, cardiovascular system, and maxillofacial apparatus. In the evolutionary process, these systems were formed under the influence of multi-stage adaptation and complex gene-regulatory control.

For example, congenital heart defects constitute the largest share among congenital pathologies. This is explained by the fact that the structure of the heart has been reorganized several times during the evolutionary process and requires a high level of coordination during embryonic development.

Discussion based on the ontophyllogenesis approach

Discussion from the point of view of ontophilogenesis shows that some congenital malformations are closely related to phylogenetic features that temporarily manifest during embryonic development. For example, excessive development of the coccyx in the embryo or anomalies of the gill arches are assessed as incorrect regression of phylogenetic inheritance in ontogenesis.

Also, deficiencies in the development of structures (appendix, coccyx) that have undergone regression or partially lost their functional significance in the evolutionary process occur when the phylogenetic program is not fully implemented in the ontogenetic process. These facts once again confirm the importance of the concept of ontophylogenesis in explaining congenital anomalies.

Discussing genetic and epigenetic factors

The results show that not only genetic mutations, but also epigenetic mechanisms play an important role in the development of congenital malformations. DNA methylation, histone modification, and temporary changes in gene expression can lead to disruption of the phylogenetic development program during ontogenesis.

Environmental factors, including radiation, chemical toxins, certain medications, and nutritional deficiencies, influence embryonic development through epigenetic mechanisms. These factors are especially dangerous for phylogenetically unstable structures in ontogenetic processes. Therefore, the ontophyllogenesis approach serves as an important theoretical basis for the prevention and early detection of congenital malformations.

In this article, the origin and development of congenital malformations in humans were analyzed based on the concept of ontophyllogenesis - an integral connection between ontogenesis and phylogenesis. The conducted theoretical analysis showed that congenital defects most often arise at the critical stages of embryonic development, in which, along with the genetic program, evolutionarily formed developmental mechanisms play an important role.

The research results confirmed that disorders occurring in the early stages of embryonic ontogenesis, in particular during gastrulation and early organogenesis, lead to severe and often irreversible congenital malformations. It has been established that organs and systems that have formed relatively late in a phylogenetically complex and evolutionary process - the central nervous system, the cardiovascular system, and the maxillofacial apparatus - are especially prone to such defects.

Discussions conducted on the basis of the ontophyllogenesis approach showed that some congenital malformations are associated with evolutionary inheritance. The temporary manifestation of phylogenetic traits during embryonic development and their incomplete regression create the basis for the formation of certain anatomical and functional anomalies. This situation indicates that not only clinical or genetic approaches are insufficient in explaining congenital defects, but evolutionary-biological views are also necessary.

It was also established that, along with genetic factors, epigenetic mechanisms and environmental factors play an important role in the development of congenital malformations. The influence of these factors on phylogenetically unstable structures during ontogenesis increases the risk of congenital defects. In this regard, the need to strengthen preventive measures and develop methods of early diagnosis during pregnancy was once again confirmed. In conclusion, the concept of ontophylogenesis is an effective theoretical model that allows for a deeper understanding of the origin and development of congenital malformations. This approach will serve as an important methodological basis for further research in the fields of medicine, biology, and developmental genetics, and will contribute to the improvement of strategies for the prevention and early detection of congenital malformations..

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