

Ontogenesis: Diseases of Ontogenetic Development

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Received : December 10, 2024

Published : January 24, 2025

ABSTRACT

Nature is ruled by the second law of thermodynamics, or the law of increasing entropy. An organism is an integral open non-equilibrium biological system. The ecosystem seeks to destroy its integrity, subjugate it, and dictates its systemic arrangement through natural biological selection. Living organisms resist the general natural tendency to entropic death through the creation of complex biological systems with non-entropic properties. Phylogeny is adaptationogenesis. The source of evolution of living systems is the conflict between the entropic forces of nature and the non-entropic defenses of the organism. Countering the forces of entropic degradation is the essence of progressive biological development. Ontogenesis is an individual protective and adaptive process of organism's counteraction to the entropic pressure of the ecosystem. By its nature, it is not a straightforward, progressive and painless process, but an internally contradictory, multidimensional, leapfrogging process going through systemic recessions, crises and conflicts. The consequence of antagonistic contradictions and internal conflict of the organism with the ecosystem are the diseases of its ontogenetic development.

Keywords: Biological System, Developmental Periods, Entropy, Non-Entropy, Ontogenesis, Maturation, Evolution, Involution, Aging, Developmental Diseases

INTRODUCTION

To date, many problems of human ontogenetic development have not been solved. There is no unified view on stages and phases, biological crises and sensitive periods of development, processes of maturation, involution, aging, their causes and morph functional content. Involutionary processes are often considered only through the prism of sexual fading, the processes of involution and aging are separated. The aging of an organism is explained by separate nosological units, rather than as a consequence of its energetic regression associated with entropic degradation. Death is considered alien to life rather than its natural outcome [1].

From the position of synergetic, an organism is a holistic open non-equilibrium biological system that moves towards

systemic equilibrium, stability and entropic death at the point of the main attractor. The movement to entropic death goes through internal crises, catastrophes, passing bifurcation points, intermediate attractors leading the organism down the ladder of entropic degradation. Ontogenesis is an individual protective and adaptive process of organism's resistance to entropic pressure of the ecosystem [2-5].

The study of stages, phases and mechanisms of ontogenesis is extremely important for understanding the inner nature of man, the problems of his life, individual development.

It is of interest to study the influence of ontogenesis stages on the character of somatic and neuropsychiatric disorders and, vice versa, the influence of somatic and neuropsychiatric disorders on the character of human ontogenetic development. But this is a topic for a separate study.

The aim of the article is to find ways to solve the problems of ontogenesis using the methods of logic, scientific generalization, systemic evolutionary analysis and theoretical modeling.

The solution of these problems is of paramount importance.

DISCUSSION

The energy evolution of biological matter is part of the energy evolution of the universe [6]. Entropy is a measure of irreversible dissipation of energy. No entropy is a measure of morph functional organization of a living system against the increase of its entropy. The goal of evolution of biological systems is the preservation of life. The main content of phylogenies is adaptationogenesis driven by natural selection. The main content of ontogenesis is the preservation of progressive genotype, stabilization of adaptive phylogenetic changes. The energy model of ontogenetic development of the organism is relevant; it integrates holistically the processes of its maturation, involution and aging. Hereditary, accumulative, environmental factors influence the course of ontogenesis, but do not determine its basic character [7]. The notions of death as a group adaptation and possible human immortality are near-scientific.

The second law of thermodynamics, or the law of increasing entropy, reigns in nature. Phylogeny is adaptationogenesis, the change of progressive adaptive norms. Living organisms resist entropic degradation through the creation of complex biological systems with non-entropic properties. Countering the law of entropic degradation is the essence of progressive

biological evolution [2,3]. The development of an organism is a non-entropic process, the result of interaction between internal and external determinants, where the external determinant of the ecosystem is determinant. Systemic crises in development are a consequence of the internal conflict of these determinants; reflect the nodes, stages of development, change of progressive adaptive norms. The main strategies of organism development, restraining the entropic pressure of the ecosystem, are its structural growth, increasing the level of systemic energy, maturity, organization and complexity, adaptive reactivity, hierarchical integration and the power of homeostatic mechanisms.

All biological systems are reactive. An organism is an integral open reactive system capable of maintaining the constancy of its internal environment. Homeostasis is the moment of integrity and independence of the organism from the ecosystem, which dictates its internal structure through natural selection. The organism, as a whole, is formed through the reflection of the ecosystem requirements, formalized in its needs, and the reciprocal triggering of self-regulation processes aimed at their satisfaction. Satisfaction of the reflected needs leads to a balance of the organism's relations with the ecosystem, homeostasis. Violation of homeostasis leads to the destruction of the organism [2,4,8,9]. The integrative factor of the organism's vital activity as a biological system is the reflected need, and the system-forming reactive structure is the basal nuclei of the brain and emotions. Reflecting needs, the organism generates in phylogenies the development of soma as a superhomeostat, musculoskeletal system, higher forms of consciousness and intelligence, which is fixed in the hereditary program of organism maturation [10,11].

Two stages of ontogenetic development of an organism can be distinguished:

- A. The maturation stage.
- B. The stage of involution.
- C. The stage of maturation of the organism

Maturation is a stage of progressive evolution, a nodal line of measures, a change of adaptive norms, the realization of the hereditary program of development, and the unfolding of genotype into phenotype under the control of the ecosystem.

It is realized by two non-entropic processes [4,5,14]:

1. Structural growth, increase of systemic energy capacity, specialization and differentiation of tissues, power of homeostatic systems.
2. Creation of a specialized control center on the basis of brain development increases in the level of system organization and complexity, hierarchical integration, adaptive reactivity of the organism.

Human phylogeny is the progressive historical evolution of a species, adaptationogenesis, driven by natural biological selection, with a succession of progressive adaptive norms. The genotype contains the encoded information of phylogenies. Ontogenesis at the stage of maturation in a reduced form repeats developmental leaps, aromorphosis [15], and the change of progressive adaptive norms [5]. The maturation of an organism is rigidly buffered and canalized by genotype, and represents homeothesis, the unfolding of genotype into phenotype [2,4]. Phenotype is a morphological functional expression of genotype, reflection of the hereditary program of development, progressive adaptive norm.

At the stage of maturation, non-entropic processes dominate in the organism, directed against its entropic degradation as a general natural tendency in development. The physiological mechanism of maturation is an increase in hypothalamic sensitivity to peripheral hormones [7]. This is the period from the moment of conception to the peak of body development at 18 - 21 years of age.

Laws of maturation [1,2,5,16-18]

1. The maturation of an organism in a reduced form repeats the stages of phylogenies. Genotype contains coded information about the historical development of the species.
2. Unevenness and heterochrony of maturation.

The processes of maturation of an organism are wavelike and non-simultaneous. The intensity of maturation is determined by the age of the organism. The younger the organism, the greater the intensity and compression of the process.

3. Stages, stages of maturation.

Each stage, stage of development of the organism has its own content, pace and growth, its own progressive adaptive norm.

4. New properties of the organism in the process of its maturation are manifested through internal conflict. They do not negate the old properties, but transform, adapt and appropriate them to themselves.
5. Plasticity of development.

The source of maturation of an organism is the internal conflict of ecosystem and genotype, hereditary program of development, internal and external determinants of development.

6. Cumulatively of development.

The accumulation of quantitative changes in development leads to a new quality, a leap in development.

7. Combination of the processes of maturation, progressive evolution and involution. The maturation of an organism is the interaction of different potencies of development: progress and regression, evolution and involution, life and death.

8. Divergence of individual development - increase of fields, potencies, diversity of functions. It is observed at the stage of maturation of the organism.

Convergence of individual development is observed at the stage of involution of the organism.

9. Human maturation is a biosocial process, as his nature is biosocial. The biosocial structures of the brain neocortex are responsible for the development of human social functions.

Biosocial maturation of the neocortex.

The evolution of the neocortex is a biosocial process. Biological development goes simultaneously with the formation of its social functions through quantitative changes and qualitative leaps - metamorphoses, which reflect the stages of ontogenesis. Biological and Social are two sides of neocortex evolution [14,16].

Biological evolution of the neocortex is its structural growth, increase in the level of energy, specialization and differentiation of internal structures, and system integration. Social evolution of neocortex is the development of its social functions:

consciousness, speech, higher emotions, will, thinking, intelligence. Biological maturation of the neocortex realizes its innate social potential. The biological and social determinants of evolution are interrelated. The biological determinant is intense during biological crises; the social determinant is intense during sensitized periods of evolution. Sensitive periods of neocortex evolution are periods sensitive to profound internal biosocial changes.

Moral-ethical and Aesthetic are the highest forms of biosocial matter movement [11].

Stages of organism maturation [19,20]:

1. Somatovegetative stage - age 0-3 years. Active development of somatovegetative sphere of vital activity is observed. It corresponds to the period of early childhood.
2. Psychomotor stage - age 4-7 years. Active development of psychomotor skills is observed. Corresponds to the period of the first childhood.
3. Affective stage - age 8-11 years. Active development of the affective sphere of life activity is observed. Corresponds to the period of the second childhood.
4. Affective -ideatorial stage - age 12-17 years. Sexual maturation of the organism, inclusion of its species reproductive function, active development of self-consciousness, higher emotions, intellect are observed. The system resists entropic degradation by reaching a higher level of internal organization, complexity, integration, power of homeostasis. Functional insufficiency of immature homeostatic systems leads to diseases of organism maturation. Corresponds to the pubertal period.
5. Acme, peak of development - species maturity, the peak of biosocial development, when entropic and non-entropic processes balance each other. Corresponds to the period of adolescence. Age of achievement: 18 - 21 years.
6. Plateau - the time when the organism is at the top of biosocial development, the state of its internal dynamic equilibrium at the point of evolutionary maturity. Maximum adaptation of the organism in the ecosystem is observed. Corresponds to the first period of maturity. Period of life: 22 - 35 years.

B. Stage of organism involution

There is a decrease in the level of system energy capacity, adaptive reactivity, integration, power of hemostats, increase in the entropy of the system as a general natural tendency in development. Entropic degradation leads to the extinction of reproductive function, regression of adaptive norms, teleomorphosis and specialization of organism development [5]. There is no hereditary program of involution due to the lack of biological expediency in it. The physiological reason for involution is the continuation of the mechanisms of organism maturation based on the pleiotropy of genes [7]. This is the period of life older than 35 years.

Stages of involution:

1. Middle age. The period of accumulation of regressive changes without transition of the organism to a new adaptive norm. Functional stress of homeostatic systems is observed. Corresponds to the second period of maturity [19]. Period of life: 36 - 60 years.
2. Older age. Regressive adaptive norm, pathological constants of the internal environment, pathological homeostasis, the state of sub compensation of the organism on the deficit energy level of vital activity are observed [10,13,19,21]. Diseases of involution are formed. Period of life: 61 - 75 years.
3. Old age. There is a further drop in systemic energy capacity; the organism enters the total atrophic process, dementia of the Alzheimer's type, multiorgan failure and cachexia. Partial variants of senile tissue atrophy reflect variants of unevenness and asynchrony of aging. The period of life older than 75 years [19].

Death is a victory of entropic forces of nature, the outcome of ontogenesis. The physiological cause of death is total atrophic process, involution diseases, multiorgan failure and cachexia.

Table. Comparative characterization of the stages of human ontogenetic development

Maturation stage	Involution stage
Extraversion, sociability	Introverted, withdrawn
Divergence, expansion	Convergence
Activity, mobility	Apathy, hypobulia
Optimism	Pessimism, anxiety
Curiosity, neophilia	Neophobia
Cognitive development	Cognitive impairment
Independence, freedom	Sociophobia
Altruism	Egocentrism
Progress, flexibility	Conservatism, stagnation, stampedes
Hyperthymia	Hypothymia, depression
High self-esteem	Reduced self-esteem
Vector to the future	Vector to the past
Self-actualization, personal growth	Self-realization, stagnation
High sensory acuity	Diminished sensory acuity
High libido	Decreased libido
High endurance	Reduced endurance
Low need for sleep, rest	High need for sleep, rest
Fast metabolism. HTG	Slow metabolism. LTG
Strong muscles	Muscle atrophy. Obesity.
Skeletal strength, teeth	Osteoporosis
Quickness of reflex reactions	Slowing reflex reactions.
Character building	Sharpening of character traits
Diseases of maturation	Diseases of involution

The conflict of internal and external determinants of organism development expresses itself through developmental diseases. The physiological cause of developmental diseases is energy degradation, functional insufficiency of homeostatic systems in response to the entropic pressure of the ecosystem.

Diseases of ontogenetic development of the organism are subdivided [1]:

A. Diseases of maturation.

B. Diseases of involution.

It is reasonable to distinguish two stages of the disease [21]:

1. Functional stage - the functional tone of homeostasis increases with compensation of disturbed functions, preservation of homeostasis.

2. Structural stage - there is decompensation in the work of homeostasis, there is

a specific structural defect of function with the formation of internal pathological constants, pathological homeostasis, the transition of the organism to an energetically lower, deficient, adaptive level of vital activity.

A. Diseases of maturation of the organism [1]

Diseases of maturation are transient dysfunctions, diseases of structural growth, and adaptation typical of childhood. In their extreme expression, maturation diseases can reach a state of pathology. These include neuropathy, childhood infections, sleep disorders, eating disorders, disorders of general and special development, urges, mixed disorders of behavior and emotions, somatoform and neurosis-like disorders, hormonal dysfunctions and others.

Diseases of organism maturation are characterized by connection with the age period, typical character, mildness and transitoriness of clinical manifestations, states of functional sub compensation of organs and systems, sub adaptation of the organism in the ecosystem.

Diseases of maturation of the organism lead it to the top of ontogenetic development.

Variants of maturation of the organism:

1. Harmonious, proportional maturation.
2. Acceleration - accelerated maturation.
3. Disharmonious, asynchronous maturation.
4. Retardation - delayed maturation.
5. Regression - return to the passed stages of development of the organism.

Types of maturation of the organism:

1. Uncomplicated, benign, compensated development of the organism.
2. Complicated development of the organism - maturation diseases, states of transient functional sub compensation of organs and systems are observed.

The maturation of an organism is not a straightforward, progressive, painless process, but an internally contradictory, multidimensional, jump-shaped process through biological crises, conflicts, changes of progressive adaptive norms, and states of transient functional sub compensation associated with a new stage of evolution.

The reasons for the difference in the character of maturation of individuals lie in the difference of ecosystems and genotypes of individuals, in their internal conflict. Hereditary anomalies, pathology of the musculoskeletal system, organic brain damage, hormonal dysfunctions, exogeny, somatogeny, psychogenic, sensory deprivation distort and complement the clinical picture of pediatric pathology and lead to dysontogenesis.

Prevention of diseases of maturation of the organism is to carry out regime-protective measures.

B. Diseases of involution of the organism

Involution is regression, entropic degradation of the organism, associated with the action of the second law of thermodynamics, the principle of increasing entropy. The internal cause of involution is the continued action of maturation mechanisms after the passage of acme, based on the pleiotropy of genes, which lead to an increase in the threshold of adaptive reactivity of the hypothalamus, regressive adaptive norm, and pathological homeostasis. Hereditary, accumulation, environmental, factors influence the processes of involution of the organism, but do not determine the main character of its ontogenetic development.

As a result, diseases of involution of the organism are formed: menopause, general atherosclerosis, hypertension, type 2 diabetes, cancrophilia, hyperadaptosis, endogenous depression, immunodeficiency states, atrophic processes of tissues and organs, including early variants of Alzheimer's, Pick's, Parkinson's, and other diseases [7]. If maturation diseases lead the organism to the top of its ontogenetic development, involution diseases lead it to death.

Variants of involution course:

1. Harmonious, uniform, proportional course of involution.
2. Asynchrony - uneven, disproportionate course of involution.
3. Acceleration - accelerated course of involution.
4. Retardation - a slow course of involution.

Types of involution course:

1. Slow, compensated, uncomplicated course of involution.
2. Rapid, complicated course of involution. Diseases of involution, states of functional decompensation of organs and systems are observed.

The reasons for the different character of involution lie in the invariance of ecosystems and genotypes of individuals in their internal conflict. Hereditary anomalies, exogeny, somatogeny and psychogenic distort and supplement the picture of involution.

Prevention of rapid and complicated course of involution of the organism consists in the implementation of regime-protective measures, prevention of exacerbation of chronic pathology.

Old age

Old age is an extreme expression of involution, a natural outcome of the individual development of the organism with a decline in its energy capacity, and the transition to a total atrophic process, dementia of the Alzheimer's type, multiorgan failure and cachexia. Partial variants of senile atrophy reflect variants of unevenness and asynchrony of aging. The state of chronic depression, or adaptive inhibition of vital activity, complements the clinical picture of aging [10,11].

CONCLUSION

Ontogenesis is not a straightforward, progressive and painless process, but an internally contradictory, multidimensional, jump-shaped process going through internal recessions, crises and conflicts. It is based on the adaptation of the organism to the requirements of the ecosystem. The source of ontogenesis is the conflict between the entropic forces of nature and the non-entropic defense of the organism. Countering the forces of entropic degradation is the essence of biological development. The ecosystem dictates the internal organization of living systems through natural biological selection.

Maturation of an organism is a stage of progressive evolution, realization of the genetic program of development. At the stage of maturation, non-entropic processes dominate in the organism, directed against the entropic pressure of the ecosystem. Involution of an organism is a stage of entropic degradation, regression, associated with the action of the second law of thermodynamics, increasing entropy of the system. The physiological cause of organism involution is the continued action of maturation mechanisms based on the pleiotropy of genes. Hereditary, accumulation, and environmental factors influence the processes of ontogenesis, but do not determine the main character of the organism's ontogenetic development.

The consequence of antagonistic relations and internal struggle of the organism with the ecosystem are diseases of its ontogenetic development. The internal cause of diseases of the organism's ontogenetic development is energy degradation, functional insufficiency of homeostatic systems in response to the entropic pressure of the ecosystem.

Death is a natural outcome of ontogenesis, a victory of entropic forces of nature. Physiological causes of death are diseases of involution, total atrophic process, multi-organ failure and cachexia.

CONFLICT OF INTEREST

There is no conflict of interest.

The article was written without sponsorship.

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