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Учреждение образования  
«Гомельский государственный медицинский университет»

Кафедра патологической физиологии  
Обсуждено на заседании кафедры  
Протокол №7 от 30.08.2017

**МЕТОДИЧЕСКАЯ РАЗРАБОТКА**  
Для проведения занятия со студентами  
3 курса ФПСЗС, обучающихся на английском языке  
по патологической физиологии

Тема: **Роль реактивности, конституции и возраста в развитии патологии**  
Theme: **The role of reactivity, constitution and age in the development of pathology**

Время 3 ак. часа

**Actuality of the theme.** Reactivity is the characteristic of the organism to react in a certain way on the influence of the environment. It is the same as growing up, feeding, metabolism.

Reactivity is formed in the process of evolution in phylogenesis and ontogenesis, reflects specific, group and individual peculiarities of reaction. Reactivity is one of the forms of relations and interactions of the organism as a united system with the environment, which is basically defensive, adaptive and adjustive nature. Notion of reactivity fell into practical medicine and gives more correct notion of the patient's condition.

Any pathological process in one or another degree changes the reactivity of the organism and in the time the changing reactivity which exceeds physiological of the organism can become a main development of the disease. That's why, the study of reactivity and its mechanism has an important value for understanding of pathogens of the diseases and their purposeful treatment.

**Learning goals of the lesson:** to study resistance and reactivity of organism, their interrelation, as well as forms and basic mechanisms of reactivity.

**Educational goals of the lesson:** formation of scientific outlook and theoretical basis of future specialists on the basis of fundamental knowledge and the latest achievements of pathological physiology.

**Objectives of the lesson:**

1. To know the definition of reactivity, form of reactivity, classification of reactivity, factors that determine reactivity, basic mechanisms of reactivity, definition of resistance, its types, relationship with reactivity, and principles of etiologic prophylaxis of resistance of the body.
2. Be able to distinguish concept of reactivity from resistance.

**To repeat the following questions from related disciplines to ensure absolute mastery of the material:**

1. Structure of the blood-brain barrier (histology disciplines).
2. Physiological reactivity indexes Features of physiological processes in central nervous system, which determine its functional condition (physiology discipline).

**Control questions of the lesson:**

1. Reactivity, types and indices. Interrelation of concepts reactivity and resistance.
2. Role of reactivity in development of infectious process. Specific and nonspecific protection factors.
3. Pathological reactivity, types and forms of manifestation.
4. Directed changes in individual and group reactivity as the most important means of disease prevention and therapy.
5. Factors that ensure reduction in nonspecific resistance. Ways and means to improve it.
6. A doctrine of constitution. Classification of constitutional types. Significance in pathology.
7. Theories and mechanisms of aging.

**Calculation of study time**

Total study time 3 ac.hours

№ п/п	Contents	Calculation of study time
1.	Introduction. Motivational characteristic of the theme	3 minutes
2.	Written control of students on the topic of the lesson	15 minutes
3.	Interviews with students about the topic of the lesson	60 minutes
4.	Self-managed student work	15 minutes
5.	Summing up the results of the lesson	5 minutes
6.	Decision of situational tasks	20 minutes
7.	Task for the next lesson	2 minutes

## Additional materials:

### Reactivity

Reactivity is an ability of whole organism possessing the nervous system to differentially react by the change of vital ability on the action.

#### Genesis of reactivity

The forming of reaction was due to the evolving of the main characteristics of active creatures:

- **Reaction** is a response of organism to determine the action of environmental and intrinsic factors
- **Sensitivity** is an ability to determine the character, force, localization and rate of the agent action on organism
- **Irritability** is an ability to achieve the action of environmental and intrinsic factors and response to it, as a rule, by generalized, low differentiated reaction, e.g. change in metabolism, shape, size and others
- **Resistance** is a stability of organism or its part to the action of specific environmental and intrinsic factors.

#### Categories of reactivity

According to the type of reaction there are distinguished following form of reactivity:

- **Normergia** – it is a norm adequate reactions.
- **Hyperergia** (from Greek. hiper – more, ergon – action) – the processes of excitation are dominated. Inflammation is fulminant, with intense symptoms of the disease, acute changes in the organs and systems. F.e. Such as pneumonia, tuberculosis, dysentery occur intensive, rapidly, with strong symptoms, with high fever, a sharp acceleration of ESR, high leukocytosis.
- **Hypoergia** (low reactivity) – processes of inhibition are dominated. Hypoergic inflammation is stale, unexpressed symptoms erased, not very noticeable. Distinguish positive (anergy) and negative hypoergia.
  - ✓ **Positive hypoergia** (anergy) – symptoms reactions decreased (or absent), but this is due to the development of active defense responses (for example, the development of antimicrobial immunity).
  - ✓ **Negative hypoergia** – symptoms reactions also reduced, but this is due to the fact that the mechanisms that regulate the reactivity of the organism, inhibited, depressed, exhausted, damaged (for example, slow the wound process with flaccid pale granulation, epithelization weak after a long and severe infection) .
- **Dysergia** – is atypical (inadequate) response of the patient to a medicine, the effect of cold (vasodilation and increased sweating).

#### Factors determining reactivity

Reactivity is determined by many factors and manifests by different changes in vital ability of individual. So, there are several categories of reactivity. Criteria of reactivity forms results from the main biological properties of organism, the character of reaction on action.

#### Biological properties of organism

There are specific, group, individual types of reactivity according to the main biological properties of organism.

**Biological reactivity** (specific) – is determined by the specific properties of species (e.g. atherosclerosis is often observed in people, but it is observed in rabbits. The same is for syphilis. The specific properties of organism reactivity results from the change ability (due to mutation), hereditary fixation of the main specific properties of species.

**Group reactivity** – it includes age, gender and the body constitution reactivity. E.g. age reactivity – children are more subjected to infection disease, than adult because of immature immune system. Gender reactivity– women are more stable to blood loss, than man. The body constitution. It is known that asthenics are more stable to the prolonged physical and psychological overloads.

**Individual reactivity** – is determined by **hereditary information, individual change ability** (mutability). Unlike specific and body constitutional, individual reactivity of organism can be physiologic and pathologic. E.g.: the occurrence of allergic reactions to the factors in single individuals.

According to the level of specificity and organism differentiation there are specific and non-specific reactivity.

**Specific reactivity** – is an occurrence of **immune response** on antigen action.

**Non-specific reactivity** – reactivity reveals itself by the reaction of different factors of the external of the organism, and it's realized with the help of different mechanisms like **parabiosis stress, changes of functional condition of the nervous system, the biological barriers, phagocytes** (e.g. the activation of phagocytosis of leucocytes in response to contact with foreign cells, non-organic particles, bacteria, viruses and parasites) and others.

Specific and non-specific reactivity can be physiological and pathologic.

**Physiological reactivity** (primary) the **reactions of the healthy organism** in normal circumstance of existence, for example, immunity (specific reactivity), and also reactions of the organism on the action of the different factors of the external environment, which do not change homeostasis (non-specific reactivity).

**Pathologic reactivity** (secondary) reveals itself **in the action of the pathogenic factors on the organism**. Examples of specific pathologic reactivity are: allergy, immune deficit condition. Example of non-specific pathologic reactivity can be change of reactivity under traumatic shock, narcosis (phagocytosis, sensitivity to medicines).

### **Immunological reactivity**

In ancient Rome, "immune» (immunitas) meant "freed from the payment of taxes".

Also immune become to name people who recover from some contagious disease and stay a resistant to its recurrence.

Immune reactivity is an important expression of reactivity at all. This concept brings together a number of interrelated phenomena:

1. Human and animal resistance to infectious (infectious) disease, or immunity in the true sense of the word;
2. Reaction of biological tissue incompatibility:
  - Heterogeneous or phylogeny – in contact tissue of animals of one species into the body of another (for example, injection of horse serum to rabbit);
  - Isogenic – in contact with animal tissues of one immune group to animal of other immune groups within this species. For example, a transfusion of blood another groups to human, organ transplants);
  - Individual – transplantation a tissues from one animal to another within one and the same type of immunological groups, when this tissue are abnormal (tumor, exudates, etc.);
  - Reaction of interaction embryonic tissues with adult tissues, or with each other.

By origin immunity can be specific and acquired.

**Specific immunity** — is an **inherited feature of this species**. For example, cattle are not sick with syphilis, gonorrhea, malaria and many other diseases transmissible to humans.

For long-lived specific immunity is divided into absolute and relative.

**Absolute specific immunity** – called **immunity**, which occurs in animals from birth and is **so strong that any action of environment can not weaken it or destroy**.

For example, any additional effects (hunger, fatigue, chilling injury of the nervous system, etc.) can not cause the disease of poliomyelitis during the infection by the virus of dogs and rabbits.

**Relative specific immunity** – is less strong, **depending on the impact of the environment** on each animal.

For example, birds (chickens and pigeons) in normal conditions are immune to anthrax. But you need only weaken the body of these birds by cooled, starvation or injury of central nervous system (removal of cerebral hemispheres, etc.) as they become ill with anthrax.

**Acquired immunity** — is divided into naturally acquired and artificially acquired. By origin each of them is divided into active and passive.

### **Naturally acquired**

**Naturally acquired active immunity** – occurs **after** relevant infectious **disease**.

**Naturally acquired passive immunity** (or congenital, or placental immunity) – due to the transition of **protective antibodies from the mother's bloodstream through the placenta** into the fetal blood. The fetus gets protective antibodies produced by the mother (measles, scarlet fever, diphtheria and other infections). By passive immunity can be transferred with milk.

**Artificial acquired** immunity is made by man in order to prevent contagious diseases.

**Active artificial immunity** – is called immunity, achieved by **vaccination** healthy people and animals by killed or attenuated pathogens microorganisms, attenuated bacterial toxins (anatoxins) or viruses. First artificial active immunization reproduced Jenner by given cowpox vaccine to children. This procedure was called vaccination, and vaccination product - vaccines (lat. vaeca – cow).

**Passive artificial immunity** – is reproduced by **injection** artificial **human serum containing antibodies** against the bacteria and their toxins. Especially effective antitoxic serum against diphtheria, tetanus, botulism, gas gangrene. Also used serum against snake venom (cobra, viper, and others). Sera were obtained mainly from the blood of horses ("producers"), which is immunized appropriately toxin.

Antitoxic — immunity is directed to neutralize bacterial toxins in toxic infections (diphtheria, tetanus, botulism, gas gangrene, etc.)

Antibacterial — this immunity, directed to destruction of microbial cells. It manifested by a number of defense mechanisms (antibodies, phagocytosis, tissue reactivity). The antibodies cause the dissolution or agglutination of bacteria or in their presence, the virulent forms of bacteria is transition in avirulent. In various infections antibacterial immunity mechanism is different.

Antiviral immunity. In the mechanism of immunity against viral infections is significant:

1. Development of antibodies
2. Phagocytosis of viral particles and other absorbing objects. According to modern concepts, phagocytosis is not a major mechanism of immunity to viral infections.-viral antibodies.
3. Intracellular factors that suppress viral replication of infected cells. Nature and mechanism of action is not yet sufficiently studied.
4. Interferon. Viral infections cause the formation in lymphoid cells special protein – interferon. It inhibits the reproduction of the virus. Effect of interferon is nonspecific.

### **Immunologic tolerance**

Mechanism of immune tolerance:

- 1) Clonal deletion (or «clonal abortion») – it is a death of immunocompetent cell in case of negative selection in thymus or marrow. Arrive at apoptosis of T- and B- lymphocytes, that have high specific antigen determination receptors to autoantigens
- 2) Clonal anergy – areactivity of lymphocytes, that have B-cells receptors to solute autoantigens in low concentrations. After contact with antigen lymphocytes save vitality, but this cells not response to signal from antigen specific receptors – this cells functional inactive.
- 3) T-cells mediated immunosuppression. For saving tolerance peripheral autoreactive T lymphocytes must be destroyed by apoptosis or stay anergic by effect of cytokines Th2 suppression

### **Reactivity and biological barriers.**

Biological barriers – they are special tissue structures, which protect the organism or its separate part from pathogenic influence of the environment and preserve homeostasis. There are two types of the barriers: external and internal.

External barriers: include the skin, the mucous layer which protect the organism from pathogenic influence of the environment, the respiratory organs which hold back harmful materials pressure in atmosphere, the digestive organs (antibacterial action of gastric juice, deprivation of nutrients of antigenic properties), the liver has desintoxicating function, the spleen and the lymphatic nodes, as well as other organs, also have the same function; including mononuclear cells of phagocytes.

Internal barriers the necessary energetic material and prevent the penetration of the foreign and poisonous material arriving from the blood to the organs and tissues.

In 1929 L.S.Stern made a supposition: that there were protective device between the blood and the liquid of the tissue, which she named histo-hematic barriers. Each organ has its own medium because the

blood does not contact with the cells of the organs. The functional characteristics of the barriers depend on the morphological and physiological peculiarities, corresponding to the organs and tissues. The peculiarity of each barrier is its selective permeability.

Special barriers a particular group which defend certain organs which are in need of its own strictly constant media. They are hematoencephalic, hematoophthalmic, hematotesticular, hemotoplacental barriers.

The structural elements of the barriers are capillaries, whose endothelium in different organs possesses their own distinctive peculiarities, and that is the principal morphological selective permeability.

In different organs in respect of different materials the barrier function may not be alike. In the study of the penetration of serum proteins into the organs, several types of barriers were shown. Hematoencephalic barrier is mainly present in the vascular walls, the barrier of the thyroid gland has an organisation on the tissue level and with the help of the paranchymatous cells divides the organs into zones where protein does not penetrate. The sarcolemma acts as a barrier in the muscles.

Hematoencephalic barrier has the most difficult organization. Besides having the endothelium and basal membrane it also has argiophil material, the brain layers and glia with astrocytes.

It is known that microorganisms, toxins, medicines, antigens, antibodies do not penetrate into the brain. As to metabolites, hormones, biologically active materials, the brain acts selectively with respect to them, regulating the penetration of these materials, these barrier acts selectively, with respect to them regulating the penetration of these materials into the cells of the brain.

The main function of the barrier is the mechanism of dialysis, ultra-filtration, osmosis, as well as the metabolic function of the cells, which are included in the structure of the barrier.

Biological barriers, executing protective and adjusting function, support an optimum composition of medium for the organ and promote a conservation homeostasis to maximum.

Intensive transport through the barrier depends on the functional needs of the organ, hemodynamic, hormonal and nervous effect and also presence and absence of morphological and functional disturbances.

The function of the barrier may change depending on the age, the sex, nervous and hormonal effects and many influences of external and internal media. The functional state of the barrier may change when in sleep and staying awake, tiredness, trauma irradiation with infrared, ultraviolet and X-rays, influence of ultra short and high-frequency waves, ultrasound.

Introduction of alcohol, acetylcholine, histamine, kinines, hialuronidase, agitating the central nervous system, increases the permeability of the barrier in the organism. Materials, with opposite effect, at is lowering permeability, include: catecholamines, salts, calcium, vitamin PP, sleeping medicines.

Permeability of barriers is changed under different pathologic processes, such as trauma, inflammation, alcoholic intoxication, virus infection and others.

Increase of permeability makes the organ more sensitive to poisons, intoxications, intensify tumor growth. In impairment of permeability of the barriers there is possibility of autoimmune damage of the organs (for instance the thyroid gland, the brain). Particular value for developing fetus has the hemotoplacental barrier, which defends the fetus in the period of pregnancy. Impairment of permeability of this barrier (virus infection, alcoholic intoxication) can be harmfully reflected in the embryonal development of the fetus, which result in the development of different types of postnatal pathology.

## THE ROLE OF THE CONSTITUTION IN PATHOLOGY

Among the factors that play a role in the etiology of diseases, a certain value has the constitution of man (from the Latin constitutio – structure).

**Constitution** is a set of relatively stable structural and functional characteristics that influence on the reactivity of the organism and its resistance to the action of pathogenic factors.

The founder of the doctrine of the constitution and its connection with the development of disease – Hippocrates, who distinguish people with dry and wet; strengths and weaknesses; sluggish and resilient types of constitution. In addition, he divided people on the temperament to sanguine, choleric, melancholic and phlegmatic.

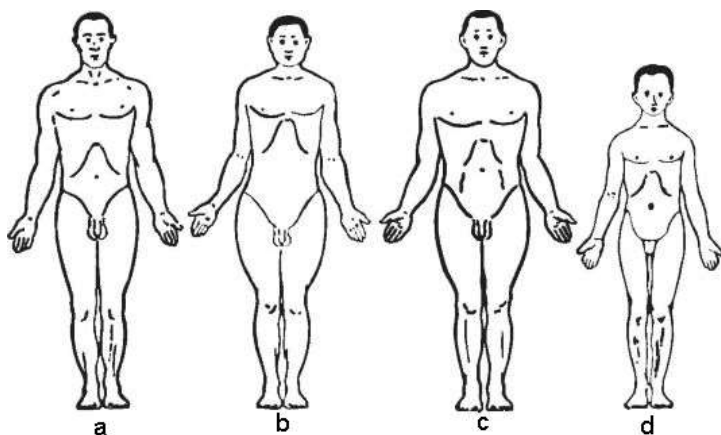
The main development of the doctrine of the constitution received in the twentieth century.

### Classification of the body constitution



The basis of classification in most cases taken different physical characteristics, such as the ratio between height and weight, the length of the trunk and limbs, as well as the size and shape of the chest, the degree of muscle development, etc.. Much less classification of constitutional types is based on the functional features of the nervous system.

C. Sigaud (1914) proposed to allocate 4 type of constitution - respiratory, digestive, cerebral and muscle, depending on the priority of a particular system. Respiratory type is characterized by a long chest with a sharp epigastric angle and moderate development of the abdominal viscera. The digestive type has chest short, obtuse epigastric angle, however, increased the size of the stomach, strongly developed masticatory apparatus, there is a tendency to obesity. People of cerebral type are characterized by a large skull with well developed frontal lobes in combination with delicate thin physique and short limbs. Muscular type of constitution has increased muscle development, proportionate physique, broad chest. According to the Sigaud ideas, formation of the constitution type occurs mainly in children, depending on the training organs and body systems.



**Figure 9** – Types of constitution by C. Sigaud: a - respiratory; b - the digestive; c - muscular; d – cerebral

German psychiatrist E. Kretchmer (1921) identified three type of constitution - pyknic, shallow (asthenic) and athletics. Picnic is characterized by high body weight due to excess fat deposits, short rib cage, a large protruding belly, long body and relatively short limbs. Asthenic – tall and thin, with long limbs and relatively short trunk, narrow chest. Athlete – people with well-developed muscles, a broad chest and shoulders, narrow hips.

W. Sheldon (1940) based his classification of the degree of development of germ layers derivatives – ectoderm, endoderm and mesoderm, and allocated, respectively, three constitutional types: endomorphic, ectomorphic and mesomorphic. Characteristics of these types resemble the constitutional types, distinguished E. Kretchmer: endomorphic type similar to picnic, ectomorphic – with asthenic and mesomorphic – the athlete.

In our country the most popular classification of M.V. Chernorutskii (1928), which is allocated on the basis of body features two extreme types – asthenic and hypersthenic and one intermediate - normosthenic.

Asthenic type of constitution is characterized by relatively short body and long limbs, narrow, flat and relatively long chest with a sharp epigastric angle, narrow shoulders, thin, long neck, a small volume of the stomach; the overall longitudinal dimensions substantially prevail over transverse.

In people with type hypersthenic constitution there is an inverse ratio of body size compared to asthenic: relatively long torso and short legs, a short neck, short wide thorax with increased anteroposterior size, large, often protruding belly; in general there is increase the transverse dimensions of the body.

Normosthenic characterized proportionate physique, broad shoulders and convex chest, well muscled.

Chernorutski study features of metabolism and condition of some of the internal organs from their assigned constitutional types.

Table 3. Features of metabolism and predisposition to disease in individuals with different types of constitution (by M.V. Chernorutski)

Type of constitution	Features of metabolism	Predisposition to diseases
<b>Asthenics</b>	The predominance of dissimilation processes on assimilation; tendency to increase the basal metabolic rate and alkalosis; accelerated	Tendency to ptosis of the abdominal organs, peptic ulcer, severe course of pulmonary tuberculosis, hypotension,

	utilization of glucose at the sugar load; cholesterol and lipid levels within normal limits or reduced	pathological amenorrhea
<b>Hypersthenics</b>	The predominance of assimilation, the tendency to a decrease in basal metabolic rate and acidosis; impaired glucose tolerance at sugar load; elevated blood lipid and cholesterol	Predisposition to diseases of the cardiovascular system (atherosclerosis, myocardial infarction, hypertension), diabetes mellitus type 2, obesity, gallstones
<b>Normosthenics</b>	Balance of processes of assimilation and dissimulation; parameters of metabolism and physiological processes are close to the average rate	Predisposition to diseases of upper respiratory tract and locomotor system

I.P. Pavlov (1925) identified people with different types of higher nervous activity by taking into account strength, mobility and balance basic nervous processes – excitation and inhibition. He used proposed by Hippocrates classification of temperament – sanguine, choleric, phlegmatic and melancholic. Sanguine is characterized by a strong balanced mobile type of higher nervous activity; choleric – strong unbalanced mobile; phlegmatic – strong, balanced and inert melancholy – a weak type of higher nervous activity.

### Causes and mechanisms of aging

#### *Etiology*

At the present time it is impossible to make definitive conclusions about the causes of aging.

*Wear and tear theory*: Posed by Dr. August Weismann (1882), the theory postulates that the daily grind of life, in particular abuse or overuse, literally wears the body out, leading to disease states. The degeneration of cartilage and eventual grinding of bone on bone is an example of the aging process on body joints, as wear and tear exceed the body's ability to repair.

*Waste accumulation theory*: This theory proposes that, as we age, our cells accumulate waste products as a consequence of normal metabolic processes in the cells. It is believed that this build-up of toxic "sludge" eventually compromises normal cell functions. Lipofuscin pigments or liver spots, common on aging skin, are an example of this waste material. The brownish pigments consist of oxidized (rancid) fats that accumulate in the skin, as well as in the internal organs of our body, as we age.

*Faulty reconstruction theory*: Throughout life the body is constantly re-building and repairing itself. The Faulty Reconstruction Theory argues that, as we age, the repair process begins to produce faulty reconstruction materials that compromise the repair job and weaken the cell - much like renovating a house with poor quality building supplies that diminish its final structure.

*Errors and repair theory*: According to this theory, the aging process is, in part, caused by damage to the genetic structure of the DNA, the genetic blueprint of our cells, life-long accumulation of molecular rubbish that, leads to errors in the manufacture of related proteins and helps accelerate the aging process.

*Mitochondrial damage theory*: The theory postulates that the oxidative processes occurring deep within the mitochondrial membranes eventually damage the organelle, leading to a loss of function. Once mitochondria are lost to the cell, they cannot be replaced, leading to a gradual but inexorable loss of energy and function in cells over time.

*The free radical theory* of aging was proposed in 1954 by Dr. D. Harman. Aging occurs when cells become permanently damaged from the life-long and unrelenting attack of charged molecular fragments, known as free radicals. The cellular damage inflicted by this uncontrolled oxidative stress inexorably spreads outward to the level of tissues and organs, where it eventually manifests itself as some form of degenerative disease.

Existing on the subject of numerous hypotheses can be divided into two main groups.

The first group of hypotheses suggests that aging is caused by the accumulation of non-renewable damages received by the body over a lifetime. As damaging factors may act radioactive radiation, free radicals and peroxides. It is assumed that the accumulation of certain errors lead eventually to the appearance of new, identifying avalanche increase a process ends with "catastrophic error".



According to the hypothesis of the second group, aging is a genetically programmed process developed in evolution as a tool for limiting the duration of an individual life. From this point of view, the rapid change of the endangered one by one generation contributes to a better adaptability to the conditions of existence and protect the species from extinction to a greater extent than the potential immortality of the individual.

### Pathogenesis

There are several variants of mechanisms of age-related changes.

The first variant assumes that the causes of aging, equally and simultaneously act on different elements of the body, leading them to a uniform violation. Accumulated to date experimental data do not support this mechanism of aging.

The second variant selects one link in the body, which by virtue of its weakness or excessive load on it the first down, in the future becoming a driver ("pacemaker") age-related changes and causing secondary changes in other, more stable links. On the role of the age driver could claim the hypothalamus, connective tissue, or immune system.

The third variant: aging occurs as a consequence of the activities of certain mechanisms for which generation of age-related changes in other tissues is their normal function ("clock") and not the result of any damage.

### Progeria

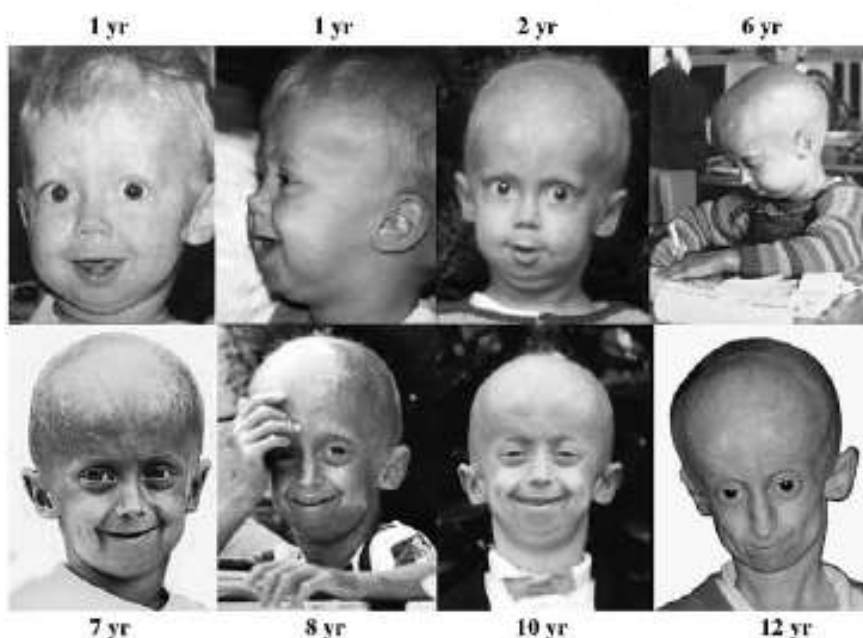
Progeria (Greek. progeros – prematurely aged) – is a rare, fatal genetic condition characterized by an appearance of accelerated aging.

There are progeria in children and adults.

#### *Progeria children is a Hutchinson–Gilford progeria syndrome (HGPS)*

The reported incidence of HGPS is 1 in 8 million. Hutchinson–Gilford progeria syndrome had been proposed to be a recessive disorder due to observations of affected individuals found in consanguineous families. However, many cases of progeria suggesting sporadic autosomal dominant inheritance, which has been confirmed with the discovery of the causative mutations. Others have reported the presence of various chromosomal abnormalities, such as an inverted insertion in the long arm of chromosome 1 and an interstitial deletion of chromosome 1q23 (11), as possible contributing factors to the disease.

Affected children typically look normal at birth and in early infancy, but then grow more slowly than other children and do not gain weight at the expected rate (failure to thrive). Main first symptoms were failure to thrive (55%), hair loss (40%), skin problems (28%), and lipodystrophy (20%). Typical facial features include micrognathia (small jaw), craniofacial disproportion, alopecia (loss of hair), and prominent eyes and scalp veins. Growth in weight was more disturbed than growth in height, and growth delay started already prenatally. Lipodystrophy is generalized, only intra-abdominal fat depositions remain present. Pathologic findings in coronaries and aorta resemble sometimes the findings in elderly persons, but can also be much more limited. Loss of smooth muscle cells seems the most important finding.



**Figure 10** – Dutch Patient with progeria at the age of 1, 2, 6, 7, 8, 10 and 12 years (Hennekam R.C.M., 2006)

Lifespan not exceed 7-27 years (average – 13 years). Patients die of starvation, myocardial infarction, intercurrent diseases.

#### *Progeria adults or Werner syndrome (WS)*

WS is an autosomal recessive disease with features

that are reminiscent of premature ageing. It manifested the disease in 20-30 years, more frequently in men. Clinical features of the syndrome: sharp-pointed "bird nose", prominent chin, a narrow mouth; high, hoarse voice, pale skin, thinning of the subcutaneous tissue and muscle atrophy of limbs, often – the appearance of venous ulcers, malignant tumors; stunting, early graying and balding, progressive cataracts, premature atherosclerosis, a violation of the cardiovascular system; generalized osteoporosis, hypogonadism; decrease of intelligence. Changes are progressive and are not the consequence of another systemic disease process or the result of a primary endocrine deficiency or dysfunction

Patients die at about 40 years age from disease of the cardiovascular system, development of tumors intercurrent diseases.

#### **Questions for self-control of knowledge:**

1. What are role of foreign and our country scientists in study of reactivity and resistance.
2. What are features of inflammatory process in hypoergic and hyperergic?
3. Give and describe an example of disergia.
4. Describe ways and methods to increase nonspecific resistance.
5. Describe factors that determine state of reactivity in newborn period.
6. What is a role of pathology in constitution?
7. Give a description of factors contributing to different types of reactivity.
8. Describe concept of "active" and "passive" resistance.
9. What are characteristics and manifestations of disease in elderly and old age?

#### **Tasks for self-managed student work:**

1. Methods for assessing specific reactivity.
2. Progeria.
3. Importance of age in the occurrence of diseases.

#### **Literature**

##### **Basis literature:**

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