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REJUVENATION OF A BODY: DISCOVERY LEADING TO THE DRASTIC CHANGES OF GERONTOLOGY OPPORTUNITIES (REVIEW OF PERSONAL RESEARCHES)

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Only the one who clearly defines the meaning of words
can discover the truth

Автор відкрив тромбін-плазмінову систему (ТПС) та два, виконувані її підсистемами, фундаментальні взаємопротилежні фізіологічні процеси – біокоагуляцію (цито-гісто-гемокоагуляцію) та біорегенерацію (цито-гісто-геморегенерацію). Він виявив, що біокоагуляція функціонує як коагуляційно-гіпотрофічний механізм зі зниженням усіх механізмів трофіки, тому її кінцевим результатом (в нормі та при патології) є дегенеративно-дистрофічні пошкодження клітин і органів, зменшення кількості їхніх структур. А біорегенерація – функціонує як регенераційно-нормотрофічний механізм, тому її результатом є усунення цих пошкоджень, відновлення всіх механізмів трофіки, посилення клітинної та внутрішньоклітинної регенерації, збільшення кількості структур. Водночас з'ясував, що саме за допомогою цих двох процесів ТПС реалізує генетичну програму вікового розвитку, включно з прикінцевим його етапом – фізіологічним старінням організму. Крім того, автор довів, що біорегенерація є саме тим фізіологічним процесом, який, за певних умов, може омолодити структуру та функції всіх органів і систем старого організму до рівня їхнього стану в юності і показав, за яких умов це можливо, як у похилому і старечому віці можна було б досягти потрібних умов. Правдивість цих даних підтверджена практикою – на їхній підставі створено спосіб системного омолодження старого організму, який в експерименті на тваринах виявився дуже ефективним.

Ключові слова: *віковий розвиток, старіння, тромбін, плазмін, коагуляція, регенерація.*

The author has discovered thrombin-plasmin system (TPS) and two processes performed by its subsystems being fundamentally opposed, internally contradictory physiological processes – biological coagulation (cyto-histo-hemocoagulation) functioning as coagulation-hypotrophic mechanism (with a reduction of all the mechanisms of trophism), therefore, its final result (both in normal state and in the event of pathology) is a degenerative and dystrophic damage to cells and organs with a reduction in the number of their structures, and bioregeneration (cyto-histo-hemoregeneration) functioning as a regenerative-normotrophic mechanism, which, therefore, results in elimination of these damages, recovery of all trophic mechanisms, enhancement of cellular and intracellular regeneration with increase in the number of structures (the discovery has been registered). With the help of these two processes, TPS performs many vital functions of regulatory nature in the human body. However, the most important thing is that owing to these two processes, TPS implements a genetic program of all three stages of lifespan development of human body. This provided the author with an opportunity to substantiate two fundamentally new gerontological theories – coagulation-regenerative theory of lifespan development and coagulation- hypotrophic theory of physiological ageing of the human body. At the same time, the author has provided rationalization for regenerative-normotrophic theory of rejuvenation of the human body, since he has determined that bioregeneration is a fundamental physiological process which under certain conditions can rejuvenate the structure and functions of all organs and systems of the old human body to the level of its state at the young age, and has shown under what conditions it is possible and in what way the desired conditions could be achieved in old and senile age. The faithfulness of these gerontological theories has been confirmed in practice – on their basis the method of consistent rejuvenation of the old human body has been established, which appeared to be very effective in animal experiments.

Key words: *lifespan development, ageing, thrombin, plasmin, coagulation, regeneration.*

The search for rejuvenation methods of old body has probably begun in ancient times, apparently, immediately after people realized that their body tended to age. However, until now, no one managed to find it.

Moreover, gerontologists believe that it is generally impossible to rejuvenate the old human body to the level of its state at a young age. This belief is based on data that ageing of the human body is the final stage of lifespan development, and it is a genetically programmed and determined process that goes in one direction following the scheme: youth → mature age → old age, and it will never be possible to reverse this process in the opposite direction.

But based on this fact only, it is impossible to state that the nature has no real possibility to rejuvenate old human body to the level of its state at the young age, since other options may exist that do not require the reverse process of human body development.

Review if these possibilities is the basic issue this article dwells upon. The search for answers to the following three questions have been conducted: *1. Is there a real process in the human body able to rejuvenate the old human body to its state at the young age? 2. If such process exists, under what conditions is it able to perform such rejuvenation? 3. How can the desired condition be achieved in old and senile age?*

It is clear that a convincing answer to these questions can be found only by investigating the essence of three processes – lifespan development, ageing and its rejuvenation.

LIFESPAN DEVELOPMENT. It is well known that starting with ovum fertilization and until the end of individual life of the human body, successive changes denoted by the term «development of the human body» occur. The nature clearly divided this process into two periods – *prenatal*, or *embryogenesis period*, and *postnatal,* or the period of *lifespan development* of the human body.

Thus, ***lifespan development*** is *the period of the human body development from birth and until the end of its individual life.* Though less distinctly, nature, in its turn, divided it into three stages – *stage of progressive development* (growth of the human body), *stage of stable development* (mature age) and *stage of regressive development* (ageing of the human body).

The described natural division of the human body's development can be represented in the form of the following biological formula. **Development of the human body** = ***embryogenesis***+ ***lifespan development***: *growth of the human body + mature age + ageing of the human body.*

Now that the meaning of the term «lifespan development» has been defined, it is necessary to find out what is being developed: *structure* or *function*?

At the first sight, this question seems odd, since it is well known that there is no structure without function as well as there is no function without a respective structure. Therefore, development of the human body is always the development of both its structure and functions simultaneously. However, this issue deserves attention for two reasons: first, because when the human body develops the primary thing is still the formation of its structures, and second, because gerontologists somehow do not properly consider the fact of structures' precedence. Thus, *lifespan development of the human body* is the development of its structures primarily. This fact makes it possible to clearly answer the crucial question, which is essential for the establishment of real mechanism of lifespan development, particularly: *What is the main result of lifespan development?*

Now there is no doubt that the result of lifespan development is the ***change*** during every stage of its mass of living matter (the number of structures of pre-organ level of organ organization) following the scheme: ***increase → relative stability → reduction***.

Thus, during the first and the third stages of lifespan development the amount of living matter changes in the opposite direction (increases ↔ decreases). This fact proves convincingly that lifespan development of the human body performs ***not one*** but ***two processes***. Since lifespan development is a fundamental physiological process, those two processes that perform it, must also be fundamental physiological processes, and are

sure to be opposed, internally contradictory – one of them must cause increase in the number of human body structures, and the second, on the contrary – causes their reduction.

Unity and struggle of these two processes is able to implement the genetic program of lifespan development of the human body and perform all its three stages. This means that for disclosure of lifespan development mechanism of the human body, it was first necessary to ***discover*** these two processes. Thus, the question arises: *Have these processes been discovered already*?

In this respect, it should be noted that gerontologists have long argued that lifespan development occurs by two processes, not one. They even created a study on them authored by Academician V.V. Frolkis. He believed that in the early stages of evolution, two processes appeared – «ageing» and «anti-ageing» (vitauct) and stated that these two internally contradictory processes ensure all stages of lifespan development, including its final stage – ageing of the human body. Based on this study, he created an adaptive-and-regulatory theory of lifespan development, the constituent of which he believed to be the genetic and regulatory hypothesis of human body's ageing [13].

However, now there is every reason to state that **there is no** special separate ageing and anti-ageing process in nature, they were formed neither at an early stage nor at any other stage of evolution. Therefore, the study above and, thus, theory created on the basis thereof, are wrong and ones that determined the development of gerontology in the wrong direction. [8]

Along with this, it has appeared that those two processes performing lifespan development of the human body have already been discovered. Moreover, that complex enzyme (thrombin-plasmin) system that performs them has also been discovered. These, however, were not gerontologists who discovered them but coagulologists [5, 14, 15].

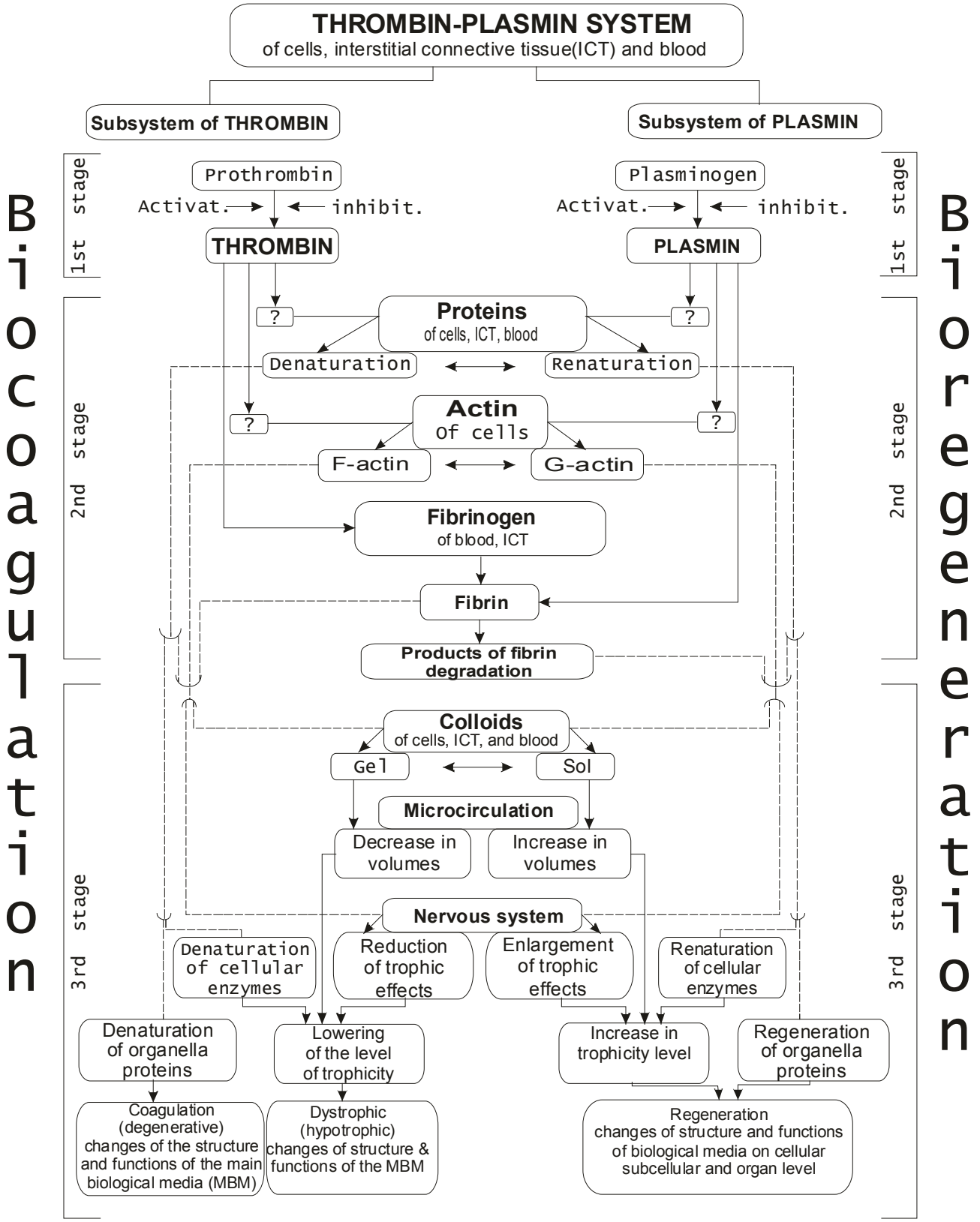
That is why it is necessary to highlight the current understanding of thrombin-plasmin system in order to outline brief history of its discovery, and the study of biocoagulation and bioregeneration.

Thrombin-plasmin system (TPS). The results of multi-year research in animal experiments enabled me to establish (discover) the following: *first*, TPS is a very complex structural enzyme system that has two subsystems of equal value – subsystem of thrombin and subsystem of plasmin (Fig.); *second*, TPS subsystems operate constantly in all the major biological media (MBM) – in the cytoplasm of various cells of the human body, in the interstitial connective tissue (ICT) and in blood, and *third,* TPS in all these media performs two fundamentally opposed and internally contradictory physiological processes – *biocoagulation* (*cyto-histo-hemocoagulation*), which is conducted by the subsystem of thrombin and *bioregeneration* (*cyto-histo-hemoregeneration*), performed by the subsystem of plasmin [4, 14, 15].

With the help of these two processes in the human body, TPS performs many vital functions of regulatory nature, which provides grounds to believe that there is another – ***fifth main regulatory system of the human body***, on equal terms with genetic, immune, endocrine and nervous systems [4].

Schematic representation of the structure of thrombin-plasmin system and the processes of biocoagulation and bioregeneration performed by it *solid lines* – denote the influence, transformation and other modifications; *stipple lines* – indicate, in which organs, structures, or media the aforementioned modifications of proteins are taken into consideration

The history of TPS discovery. The discovery of TPS and the two processes – biocoagulation and bioregeneration, performed by it, *lasted almost 150 years*. Its history can be divided into two main periods: ***the first*** period which lasted almost 100 years, and during which many researchers around the world made a large number of so-called intermediate coagulation findings that laid the foundation for the discovery of two coagulation systems – *coagulation (system of thrombin*) and *fibrinolytic (system of plasmin),* and the ***second*** period that lasted nearly 50 years, during which I made another series of intermediate discoveries that led to the discovery of *actual TPS* as one of the major regulatory systems of the human body. [5].



Discovery of TPS and thorough study of its structure and functions enabled me to actually create a new science – **biological coagulolo-gy**, *which is the science of two fundamentally opposed and internally contradictory physio-logical processes –* ***biocoagulation*** *(cyto-his-*

to-hemocoagulation) and ***bioregeneration*** *(cyto-histo-hemoregeneration), the science that studies physiological, pathogenetic, and sanogenetic role of this very complex enzyme system* [4, 8].

Study on biocoagulation and bioregeneration. Since TPS is a system, which has two equal-worth subsystems – ***subsystem of thrombin*** and ***subsystem of plasmin,*** functioning constantly in all MBM, this is in these media where it performs two processes – *biocoagulation* (cyto-histo-hemocoagulation) and *bioregeneration* (cyto-histo-hemoregeneration) [4, 14, 15].

Reasons, development mechanisms, results and outcomes of biocoagulation and bioregeneration processes have been already investigated thoroughly, and the respective findings were outlined sufficiently in my previous publications [4, 8, 10], thus, I would like to provide only brief review of them here.

Biological coagulation *(cyto-histo-hemocoagulation)* is a very complex multi-link thrombin-dependent physiological process, which can be divided into three main stages of development.

The first stage is the stage of ***thrombogenesis***. In other words, the stage of generating thrombin in all MBM – in the cytoplasm of various cells of the human body, in the interstitial connective tissue (stroma of organs) and in the blood.

This stage of biocoagulation in itself is a very complex process, which involves: prothrombin – *zymogen* that can convert into an active enzyme – ***thrombin*** as well as significant amounts of *activators* – substances of protein nature that cause conversion of prothrombin to thrombin and *inhibitors* counteracting this transformation.

The severity of thrombogenesis depends on the prevalence of activators or inhibitors, thus, it can be ***compensated, subcompensated,*** or ***decompensated.*** Depending on the degree of decompensation, larger or smaller number of thrombin is formed, which in turn, determines the severity of the process in general.

The stage of thrombogenesis is the ***main link*** of the mechanism of biocoagulation development process, without which all its subsequent, secondary links and stages do not develop, thus, the development of this process is generally impossible without it.

The second stage is the stage of the ***change in the structure of different proteins of MBM.*** During this phase, thrombin formed in the first stage entails the following three types of changes in the structure of proteins: 1*) in the cells* – actin polymerization, i.e. transition of G-actin to F-actin; 2) *in the blood and ICT* – conversion of fibrinogen to fibrin; 3) *in all MBM* – denaturation, i.e. changing the spatial three-dimensional structure of all other proteins.

The third is the stage of ***damaging cells and organs***. It has been found that during this stage of change in the structure and functions of different proteins, which are preconditioned in the second stage by the action of thrombin, cause, on the one hand, development of so-called *primary direct coagulation* (inherently *degenerative*) *damages,* and on the other hand, decrease of all four mechanisms of trophism – cellular (enzymatic), circulatory, endocrine and nervous, leading to the development of *secondary indirect coagulation*, inherently *degenerative* damages. The development mechanism of all links of this biocoagulation stage as well as the previous two has already been deciphered in details and outlined in my previous publications [4, 8, 10].

Thus, it has been determined that biocoagulation is a very complex fundamental thrombin-dependent physiological process that functions as the ***coagulation-hypotrophic mechanism*** with a reduction of all four mechanisms of trophism, therefore, *under normal conditions* its final result is ***physiological*** degenerative and dystrophic damages to various structures of the human body (molecules of proteins, subcellular structures, cells, tissues and organs), and *under conditions of pathology* – ***pathological*** degenerative and dystrophic damages. The damages I have described under the term of «***coagulation dystrophies***» [6].

Biological regeneration (cyto-histo-hemoregeneration**)** is also a very complex multi-link, but plasmin-dependent process, which can also be divided into three main stages of development.

The first is the stage of ***plasminogenesis,*** i.e. the stage of forming plasmin in all MBM – in the cytoplasm of various cells, ICT (stroma of organs) in the blood.

This stage of bioregeneraton is also a very complex process in itself, which involves *plasminogen* – zymogen that can convert into an active enzyme – ***plasmin***, and a significant number of activators – substances of protein nature that cause conversion of plasminogen to plasmin and *inhibitors* counteracting this transformation.

The severity of plasminogenesis depends on prevalence of its activators or inhibitors, so it can be ***compensated***, ***subcompensated,*** or ***decompensated.*** In addition, depending on the degree of its decompensation, larger or smaller number of *plasmin* is formed, which in turn, *determines the essence and severity* of the process in general.

The stage of plasminogenesis is ***the main link*** of the mechanism of bioregeneration development process, without which all its subsequent (secondary) links and stages do not develop, thus, the development of this process is generally impossible without it.

The second is the stage of pre-regenerative and reconstructive processes, during which the following processes occur: elimination of degenerative and dystrophic damages of organs, reconstruction of the structure and functions of inversely damaged and hydrolysis of irreversibly damaged proteins in all MBM, restoration of all four mechanisms of trophism and enhancement of the new proteins synthesis.

The third is the stage of ***actual regenerative and restorative processes,*** i.e. the stage of restoration of structure and functions of human body organs and systems by increasing intracellular and cellular regeneration. The development mechanism of all links of this bioregeneration stage as well as the previous two, have been also deciphered in detail and outlined in my previous publications [4, 8, 10].

Thus, it has been established that bioregeneration is a very complex fundamental plasmin-dependent physiological process that functions as a ***regenerative and normotrophic mechanism*** and, therefore, its final result is elimination of all forms of degenerative damages, restoration of all the mechanisms of trophism and full restoration of the structure and functions of damaged organs.

However, the following should be particularly emphasized: subsystem of plasmin performs bioregeneration process primarily *under normal conditions* when the process of plasminogenesis is always compensated, and *in case of pathology,* the final result of this process depends on the degree of its compensation: in case of *compensated* and *subcompensated* plasminogenesis – bioregeneration process develops, and in case of ***decompensated*** plasminogenesis, ***completely different process evolves*** – ***the process of pathological proteolysis*** with severe, often fatal organ damages [8, 10].

Biocoagulation and bioregeneration function *simultaneously and continuously throughout the human body life* – starting with ovum fertilization and until the end of individual life, and noted before they facilitate performance by TPS system of many vital functions of regulatory nature [4]. The most important thing, however, is that *biocoagulation* and *bioregeneration* are two fundamentally opposed and internally contradictory physiological processes *able to perform all three stages of lifespan development.* Therefore, one may state that ***these are processes used by TPS to implement the genetic program of human body lifespan development*** [3, 8, 10].

However, one needs to remember that all processes occurring in the human body, including processes of biocoagulation and bioregeneration, have two levels of activity – «basic» and «trans-basic» [8, 10].

Basic activity level of all processes *is a genetically programmed determined level,* i.e. the level determined by genetic programs; it is stable for a long period and changes only when transferring from one stage of lifespan development to another.

These basic activity levels of biocoagulation and bioregeneration processes during lifespan development ensure a basic level of structural and functional *homeostasis*, i.e. provide dynamic sustainability of the structure and functions of all human body organs and systems [11]. At that, the level of this sustainability

during the first stage of lifespan development is the *highest*, and during the third stage, it is *the lowest*.

Trans-basic level of process activity is a level *determined by various factors of external and internal media of the human body*. By influencing correspondingly various regulatory systems, they change (increase or decrease) this level of processes activity and that is why it changes quickly, depending on the needs of the human body at any given moment.

The doctrine of basic and trans-basic activity level of all human body processes enables to take another look at those two processes that ensure lifespan development of the human body, since it gives grounds to assume that only ***basic*** levels of activity of ***biocoagulation*** and ***bioregeneration*** processes play a ***crucial*** *role in the mechanism of human body lifespan development*, while ***trans-basic*** level of their activity is only the *conditions* of this process development.

At every stage, the genetic program of lifespan development determines the **change** in the ratio of *basic levels of biocoagulation and bioregeneration processes activity* by the following principle: *at the first stage* – the program determines the *prevalence* of basic activity level of *bioregeneration process* ensuring *progressive development* (growth of the human body), at the *second stage* – the prevalence of either of these two processes is *absent*, which is represented in the form of sustainable development (mature age), and *at the third stage* – the program determines the prevalence of basic activity level of *biocoagulation process,* which ensures *regressive development* (ageing).

The foregoing gives grounds to assert that basic activity level of **bioregeneraton** process *at the first stage* of lifespan development, due to its prevalence over basic activity level of biocoagulation process, ***plays the role of the human body growth mechanism***, whereas the basic activity level of **biocoagulation** process at the *third stage* of lifespan development, due to its prevalence over bioregeneration process, ***serves as the mechanism of ageing***.

In addition, and this should be particularly emphasized on, *at the third stage* of lifespan development both basic and trans-basic activity levels of **bioregeneration** process **under certain conditions** (*in case of its prevalence over the process of biocoagulation*) can serve as a mechanism for ***real systematic rejuvenation of the human body***.

Thus, the discovery of *biocoagulation* and *bioregeneration* process along with modern achievements of other natural sciences, particularly **genetics** – *the study of the 'program support' of the human body* [1, 10], **normal physiology** – *the study of homeostasis* [11] and *the study of basic and trans-basic activity levels of all processes* [10], and **pathological physiology** – *the study of aetiology and pathogenesis* [2] gave me an opportunity to prove the ***coagulation and regenerative theory of human body lifespan development*** [3, 8, 10], which defines its cause, direct cause and conditions of development, as well as development mechanisms, results, and outcomes. The following framework may represent the essence of this theory, which meets all criteria of truthfulness set forth in my monograph [10].

Coagulation and regenerative theory of human body lifespan development (framework)

Cause of lifespan development is post-natal fragment of human body genetic program.

Direct cause – the determined *prevalence* of basic activity level of one of the two processes at every stage of lifespan development – biocoagulation or bioregeneration, or the *absence of such prevalence,* has been programmed.

Development conditions are various factors of internal and external media, which can affect in a certain manner the result of the process***.***

Development mechanism is a coagulation and regeneration mechanism, which consists of two fundamental processes – ***biological coagulation*** (cyto-histo-hemocoagulation), based on *coagulation-hypotrophic mechanism* with a reduction of all trophism mechanisms leading to degenerative and dystrophic damage of cells and organs with a reduction in the number of their structures, and ***biological regeneration*** (cyto-histo-hemoregeneration), based on *regenera-*

tive-normotrophic mechanism that leads to elimination (liquidation) of degenerative and dystrophic damage, restoration of all trophic mechanisms and formation of new structures.

The result depends on the following: at *the first stage* (growth of the human body) – the programmed determined prevalence of *bioregeneration* process, at the *second* stage (mature age) – prevalence is absent; at the *third stage* (ageing of the human body) – the prevalence of *biocoagulation* process.

Result *is the change* during every stage of lifespan development in the ***amount of (mass) living matter*** following the scheme: ***increase → relative stability → decrease.***

Outcomes are the change in functions of organs and systems of the human body and their adaptive and compensatory abilities according to the change in the number and quality of their structures.

AGEING OF THE HUMAN BODY. Modern achievements of gerontology give grounds to differentiate three types of human body ageing: 1) physiological; 2) physiological, but intensified and accelerated; 3) pathological, though only *physiological ageing of the human body* will be reviewed in this article (short – «*ageing of the human body*»).

Ageing of the human body is the manifestation of consistent accumulation of age-related damage to the structure and functions of organs and systems of the human body with simultaneous decrease of their adaptive and compensatory abilities.

That is why determining the essence of ageing comes down to examining causes, development mechanisms, results and outcomes of this phenomenon. Thus, it has become possible to investigate all these data on ageing only after discovering TPS and two processes performed by its subsystems, since it has been found that the development mechanism of one of them – *biocoagulation process* – becomes a development mechanism of human body physiological ageing in old and senile age, due to its genetically determined prevalence over bioregeneration process [3, 8, 10].

This fact gave me ground to justify ***coagulation-hypotrophic theory of human body ageing*** [3, 9, 10], the essence of which can also be represented in the form of the following framework.

Coagulation and hypotrophic theory of physiological ageing of the human body (framework)

Cause of ageing *is* the final fragment of the genetic program of human body lifespan development.

Direct cause – the determined *prevalence* at the third stage of lifespan development of basic activity level of biocoagulation process over basic activity level of bioregeneration process has been programmed.

Development conditions are various factors of internal and external media capable of having noticeable effect on the result.

Development mechanism is a ***coagulation and hypotrophic mechanism***. It ensures the development of direct primary coagulative, inherently *degenerative* damages and secondary indirect coagulative, inherently dystrophic damage to cells and organs.

Result – very slow accumulation of age-related physiological degenerative and compensatory damage to organs.

Outcomes – reduction of functions of human body organs and systems with simultaneous decrease in their adaptive and compensatory abilities, the development of age-related pathology***.***

This theory of physiological ageing enables to provide the following three definitions – the most comprehensive one, slightly shorter and short [10].

Ageing of the human body *is the* ***manifestation*** *of gradual**,** very slow increase in degenerative and dystrophic damage to organs of coagulation and hypotrophic genesis in old and senile age with the decrease in their functions and adaptive-compensatory abilities due to genetically determined* ***predominance*** *in old and senile age of basic activity level of* ***biocoagulation process*** *over basic activity level of bioregeneration process.*

Ageing of the human body *is the* ***manifestation*** *of gradual, very slow increase in*

genetically determined ***age-related coagulation dystrophy of organs*** *in old and senile age with the decrease in their functions and adaptive-compensatory abilities.*

Ageing of the human body *is the* ***manifestation*** *of genetically determined* ***age-related coagulation dystrophy of organs development.***

Thus, ageing of the human body is not a destructive process as stated by V.V.Frolkis [12]; this is the process of ***age-related coagulation dystrophy development.***

HUMAN BODY REJUVENATION. Rejuvenation is normally referred to when it becomes possible to eliminate or at least reduce some signs of human body ageing. However, this article will not dwell upon this, but rather upon the possibility of ***systematic rejuvenation of an old human body***, that is, the ability *to restore the structure and functions of all organs and systems of the old human body to the level of its state at the young age*. Since yet no one has managed to provide a real systematic rejuvenation of the old human body to its state at the young age yet, the question arises: *Is there a real possibility to rejuvenate the old human body to its state at the young age?*

To answer this question properly, we first need to answer the first two questions raised in the beginning of this article.

Now there is no doubt, that only the process that is opposed and internally contradictory to the process enabling its ageing can rejuvenate the old human body. In addition, since physiological ageing is performed by biocoagulation process (cyto-histo-hemocoagulation), opposed to which is the process of bioregeneration (cyto-histo-hemoregeneration), this fact gives grounds to assert that ***it is the process of bioregeneration that is a real process likely to be able to achieve systematic rejuvenation of the old human body to its state at the young age***.

Such ability of bioregeneration also shows that at the first stage of lifespan development, this process due to genetically determined prevalence over biocoagulation process ensures human body growth and its young age.

Since the development of bioregeneration process is based on *regenerative-normotrophic mechanism*, this fact has provided grounds to justify ***regenerative-normotrophic theory of systematic rejuvenation of the human body*** [8, 9, 10]. It appeared that its essence might also be represented in the form of the following framework.

Regenerative-normotrophic theory of human body rejuvenation (framework)

Direct cause of the systematic rejuvenation of the human body is the achievement of considerable and rather continuous *prevalence* of *bioregeneration* activity process over *biocoagulation* activity process at the old age.

Development conditions are various factors of internal and external media able to have noticeable effect on the result of this process.

Development mechanism is a ***regenerative–normotrophic mechanism***. During human body lifespan, it is a mechanism for development of physiological bioregeneration process and «on a part-time basis», it is the only real mechanism of anti-ageing, and in old or senile age, *under certain conditions, it can become a mechanism for real systematic rejuvenation of the human body*, i.e., it can convert the structure and functions of the old human body into its state at the young age.

Regenerative-normotrophic mechanism determines elimination of age-related degenerative and dystrophic damage to organs, fully restores normal levels of trophism, and leads to sufficient increase in intracellular and cellular regeneration. All these processes lead to full restoration of the structure and functions of damaged organs and systems of the human body, which is manifested in the form of its rejuvenation.

Result is full elimination of age-related degenerative and dystrophic damage, restoration of all mechanisms of trophism, and complete restoration of the structure of organs to their state at the young age.

Outcomes – restoration of functions of human body organs and systems, and their adaptive-and-compensatory abilities to their state at the young age.

Thus, we may provide a clear and unequivocal answer to *the first two questions* raised at the beginning of this article.

Answer to the first question: real plasmin-dependent fundamental physiological process – the ***process of biological regeneration –*** continuously functions in the human body, and *is able to ensure real systematic rejuvenation of the old human body, i.e. to restore the structure and functions of all organs and systems of the old human body to their state at the young age*.

Answer to the second question: Bioregeneration is capable to rejuvenating the old human body only **under condition** that *considerable and sufficiently continuous prevalence over biocoagulation process* is achieved*.*

Therefore, a need to answer the third question raised at the beginning of this article remains, namely: *How can the desired condition, i.e. prevalence of bioregeneration, particularly, genetically determined prevalence, be* achieved in old and senile age?

The correct answer to this question can be found only based on the above theory of basic and trans-basic activity levels and processes of biocoagulation and bioregeneration. This doctrine gives grounds to assume that ***there are two variants*** of opportunities that help achieve considerable and sufficiently continuous prevalence of bioregeneration process over biocoagulation process in old and senile age.

The first possible variant. It is based on the statement that rejuvenation of the old human body is happens by intensifying ***trans-basic*** activity level of bioregeneration. This variant is quite available now. We have found that in old and senile age, it is possible to intensify ***trans-basic*** activity level of bioregeneration in order to slow down ageing process and ensure rejuvenation of the old human body with the help of finished preparation of ***plasmin*** and activators of endogenous formation of ***plasmin*** [8. 10]. We have determined this based on experiments on animals.

By researching old white rats of both sexes aged over 30 months, we have found that all experimental animals experienced changes proving significant systematic rejuvenation of their body after the application of the course of both plasmin and plasmingenesis activator – streptokinase. The most convincing of these changes is restoration of reproductive function in old animals.

We received two invention patents for these rejuvenation methods, particularly, patent for the method of human body rejuvenation with the use of streptokinase [7].

Results of these investigations testify: *first, truthfulness of all three aforementioned gerontological theories* – lifespan development, physiological ageing of the human body and its systematic rejuvenation; *second,* the fact that *bioregeneration process* is the one real *fundamental physiological process* under certain conditions capable of causing *real systematic rejuvenation of old human body to its state at a young age*.

However, despite positive results, we should admit that only by intensifying *trans-basic* activity level of bioregeneration process, it might not be possible to achieve **lasting** rejuvenation of the old human body for the following reasons. Intensification of *trans-basic* activity level of bioregeneration process using plasminogenesis activators is a «substitution therapy» in its essence, which requires continuous injection of the medication. In this case, continuous injection of the necessary drug is very dangerous for at least three reasons: *first*, because there exists a threat of bleeding complications; *second*, because there exists a threat of allergic complications, including possible development of anaphylactic shock, and; *third*, due to the threat of aggravation of various chronic bacterial, viral or fungal inflammation processes. [8, 10].

The second possible variant. It is based on the statement that old human body rejuvenation is achieved via change of ***basic*** activity level of bioregeneration process, and therefore, in order to achieve it, certain manipulations with genomes are necessary. However, presently, it is not yet known, which manipulations with genomes to perform in order to rejuvenate the old human body. Therefore, the following assumptions can be made.

Literature has data showing that the human or animal body is a very complex biological system with program management located in the genome. The point is, that all genetic programs

are «written» at two levels – molecular (about 3%) and quantum (over 97%) [1, 2]. In this case, in order to implement the genetic program of lifespan development in the human body, a reading method should exist, since otherwise it is unlikely to be implemented.

If this is true, then there must be a principal opportunity to transfer *readout method* (or readout «device») from one place of the program to another, for example, from the 70th year back to the 10th or any other year of human body growth, i.e. its transfer to the place in the program where it determines the *prevalence of bioregeneration process over biocoagulation process*. This would lead to real rejuvenation of the human body, and later the body would pass all subsequent stages of its development, starting from the age to which the process was reverted.

Thus, by implementing this rejuvenation method, it would not need to *develop in the reverse direction*. Moreover, if the readout device of lifespan development program could be transferred not once, but multiple times, such body *being able to start its development from the young age repeatedly, could live hundreds of years.*

Although nowadays, such rejuvenation method of the human body is more like a fantasy, the likelihood of its implementation is high enough. My optimism is based on the enormous scientific achievements with regard to creation of man-made systems with program management, where the readout device for their programs is easily transferrable from one place to another, even using remote control. Quite recently, just a few decades ago, such a possibility was also considered a fantasy.

However, it should be noted that the program support of biological systems is obviously much more complicated than the program support of even the most complex man-made systems, and method of their programs readout may differ significantly from the method of man-made programs readout, thus it might not be worth expecting a quick solution for this problem.

Nevertheless, there are sufficient grounds for *geneticists,* obviously in cooperation with specialists in information technologies, to start a thorough study of *genetic programs implementation methods,* since investigation of this issue would make it possible to create an *effective and safe method* of ***real systematic rejuvenation of the old human body to its state at the young age***. As far as funding of such researches is concerned, many well-off people would certainly be interested in providing sufficient funds for implementation of such researches.

Conclusions

1. The discovery of **thrombin-plasmin system** (TPS) and two processes performed by its subsystems being fundamentally opposed and internally contradictory physiological processes – ***biological coagulology*** *(cyto-histo-hemocoagulation)* and ***biological regeneration*** *(cyto-histo-hemoregeneration)* has lead to drastic changes of gerontology opportunities, since it has been found that using these two processes, TPS implements genetic program of lifespan development of the human body.

2. It has been established, that at the first stage of lifespan development, the basic activity level of ***bioregeneration process*** *ensures growth of the human body* due to its genetically determined prevalence over basic activity level of ***biocoagulation process****.*

3. It has been determined that in old and senile age, basic activity level of ***biocoagulation process*** plays the role of *physiological ageing process of the human body.*

4. Basic activity level of ***bioregeneration process*** during all stages of lifespan development constantly counteracts the process of biocoagulation (and thus, the process of ageing); therefore, it is the only real process of anti-ageing.

5. ***Under certain conditions*** *(in the event of its prevalence over the biocoagulation process) and i*n old and senile age, the ***process of bioregeneration*** is capable of completing real systemic rejuvenation of the old human body, and the desired conditions can be achieved both by increasing *trans-basic activity* of this process (which may be done even nowadays), and by changing the correlation between *basic activity levels* of biocoagulation and bioregeneration towards the prevalence of the latter, which, obviously is generally possible. However, this method is not available in practice yet.

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