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# Mutation Generated the Mankind

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## Abstract:

On the basis of the mutational theory the process of Homo sapiens birth is investigated. The dependence of intellectual abilities of the man on features of a brain neuron structure in the early period of the man development is investigated. It is shown that Homo sapiens has appeared in result self-supported a temporary mutation of the brain neurons. The mutation has led to occurrence of a plenty of the brain free neurodendrites at early age which are quickly filled by the synaptic communications. This mutation is kept temporarily only in the early period of human life and is supported due to its training by human community. At absence of this mutation support the man does not leave an animal status. On the basis of Hardy - Weinberg law it is shown that at mutational influence on a population there is a disappearance of a mutational influence result for 4 - 5 generations.

**Keywords:** mutational influence, self-supported mutation, brain, neuron, neurodendrites, synaptic communications, anthropogenesis.

## 1. Introduction

Now there are two theoretical directions which explain occurrence of new species. It is the Ch. Darwin's evolutionary theory and the mutational theory. The Darwin's evolutionary theory assumes a principal cause of a biological variety occurrence the natural selection. The mutational theory assumes that new species are formed as a result of dot mutations [1, 2] due to action on species of the mutagen factors.

If to remain within the framework of the mutational theory there is an important problem. How the mutational theory explains the occurrence of Homo sapiens?

From the point of view of a mutational theory the Homo sapiens has taken place from apes as result of some mutation. This process refers to anthropogenesis. The mutational reasons of an anthropogenesis can be various. The most probable reason is the raised radiating background [3, 4] in area of the central Africa where has arisen Homo sapiens.

It is supposed that the modern man has arisen more 40 thousand years ago though the mutation has taken place apparently more 100 thousand years ago. There are following attributes which distinguish the modern man from other primates. It is a large brain also progressive differentiation of the brain areas, feature of the voice-formation device, relative increase in a brain department of a skull, a reduction of a hair, etc. Undoubtedly, many of these distinctive features are result of natural selection [5, 6].

## 2. Mutation resulted to anthropogenesis

The man is a separate species different, for example, from a pan or gorilla. Really, any attempts of the man and these monkeys mating do not result in birth of the offspring.

Distinctive feature of a man as species is self-consciousness, ability to abstract thinking and articulate speech. It is obvious that articulate speech has arisen as a result of natural selection after there was a self-consciousness and ability to an abstract thinking. It specifies that the mutation which has transformed the ape in the man has taken place in a brain [7].

There is a question what mutation in a brain has led to arise of a self-consciousness and ability to an abstract thinking? Whether directly these features of a man distinguish him, how a species, from other primates?

There were cases when the human child appeared in the environment of the wild animals and by them was up-brought (Homo ferus). After he came back in the environment of people it was visible that he has for ever lost ability to become the person of full value. All attempts to bring up the person of full value were ineffectual. He practically completely lost a self-consciousness and, especially, abstract thinking. Actually he remained an advanced primate but did not become the person of full value.

However, at reproductive contact to usual people there was quite viable offspring which with the years became people of full value. It specifies that specific distinction of the man-animal and usual man is not present. Thus, the self-consciousness and ability to abstract thinking is not the specific attribute distinguishing the man, as a species, from other primates. Various species by definition cannot give fertile offspring or this offspring is not capable to a reproduction. For example, the mulus is result of a donkey and a mare mating does not give fertile offspring. In it is essence of the species preservation law.

The level of the man intellectual abilities is defined by average number of the synaptic communications falling one neuron of a brain [8] In norm this size makes 3 - 4 thousand (up to 10 thousand) [9]. These synaptic communications are formed on the free neurodendrites of a brain which at the child early age there are especially much.

Recent researches the evolutionary history of gene GTPase activating protein 2 SRGAP2 [10, 11] has been established. This gene supervises the duration of dendritic spines growth, fig. 1. The dendritic spine it is a peak on a dendritic surface, capable to form synaptic communication. The control consists in development of the neuron spines, and thereof, dendrites development. Thus, it is possible to assume proved that quantity of dendrites on the brain neurons is a genetically set parameter.

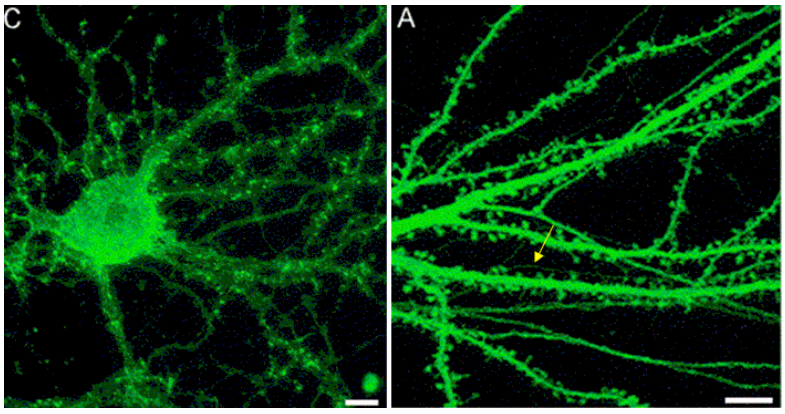


**Figure 1. A - The dendritic spines of a man brain neuron, C – a neuron, according to [12]**

At development of a fetus in mother and in the first 3-4 months after a birth in a brain of the child it is formed approximately 1 - 4 million synaptic communications in a second. If to accept number of a brain neuron after a birth equal approximately 50 - 100 billion [9] on the one neuron during this period it is formed $(2-4)\cdot 10^{-5}$ synaptic communications in a second or 0.86 – 1.73 synaptic communications in day. For 12 months (including the intrauterine period) on the neuron arises 300 - 600 synaptic communications. This time is the most important since during this period a level of the man intellectual abilities is established. If in this time the child is placed in any language environment at him the base thinking in this language starts to be formed.

On fig. 2 the variation of number synaptic communications on a brain neuron during a life is conditionally shown.

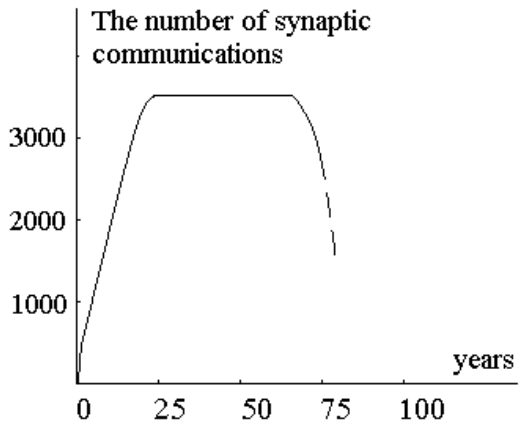


**Figure 2. Dynamics of synaptic communications number on a brain neuron**

For normal velocity of the synaptic communications occurrence in the brain neurons on the child after a birth (apparently and before) the powerful information stream (multi-colored visual sensation, various acoustical sensation, tactile parent influence, etc.) should be directed. If the information stream is reduced or limited the necessary number of synaptic communications is not formed. The child has discomfort - so-called “information hunger”, he shouts, cries. Frequently in this case a mother tries to feed only the child, to rock to sleep him that does not reduce a level of his discomfort.

If the child is brought up in the environment of animals the information stream to him is very small. The necessary number of the synaptic communications in the brain neurodendrites is not formed. Free from the synaptic communications neurodendrites, or neurodendrites with insufficient number of the synaptic communications (less ~ 300) have the important feature.

They start to be pulled into the neuron soma and to disappear [9] therefore the situation to become irreversible. The effect of the neurodendrites retraction in a brain neuron soma of animals also is observed but at them much less free neurodendrites in early age is formed.

Even if the child Homo ferus then gets in the human environment a place for formation of the synaptic communications at him (on a brain neurodendrites) is very much limited, and he for ever remains underdeveloped, actually in an animal status.

The number of the synaptic communications on the brain neurons determining the level of the man intellectual abilities is proportional to dendrites number remained on the neurons after the end of process of the part dendrites disappearance. It is supposed that due to lack of information loading of the man brain in early age back pull into the neuron body on the average up to 50% dendrites. Apparently due to it the mankind has big cognitive reserve for the development. In early stages of development of species Homo the percent of the pulled into the neuron of the dendrites was obviously higher.

In norm the man reaches a maximum of intellectual abilities (not experience) approximately in age 25 years. By this time practically there is no opportunity of occurrence new synaptic communications in a brain [13]. Filling of neuron by the synaptic communications up to 3 - 4 thousand goes with average velocity 0.33 – 0.44 synaptic communications in day that twice less than initial velocity. And to age 25 years the velocity of the synaptic communications formation falls from 0.86 – 1.73 synaptic communications in day up to zero.

What the role of training process of the child at early age?

Let's consider genetic essence of the man training process in early age. A mutation distinguishing the man from an animal, for example, monkeys is a plenty of the free neurodendrites in a brain at early age.

To define type of this mutation we shall track the general mechanism of an evolution process. How there can be an evolution of a population, i.e. to be observed change of a species?

The mutations in individuals of a population originate continuously and in a plenty. But these mutations do not result in change of a species. If the mutational individual can be crossed to not mutational individual, calculations show (see **Appendix**) through 4 - 5 generations a genome of a population comes back to an initial level which existed before the mutational influence. Due to mating the mutations as are soluble in a population. This fact is well-known to selectors. The cultural plants are given themselves quickly become natural.

## 3. Conditions of the species change

Two conditions are necessary for change of the species.

The first condition: mutational influence should generate, at least, two individuals, male and female which contain to another but to the same species. At different mothers even for one family tree it is practically impossible since mutations usually occur incidentally and in different locus of genome. However mother can give birth to two different sex individuals in which the mutation of the same gene in X-chromosomes has taken place identically. Naturally the mutation should be rational and useful to vital activity of an organism.

The second condition: mutations of genome born different sex individuals should not allow to these individuals to have successful reproductive contact to other individuals of the family tree and the more so populations. Or result of this contact should be offspring not capable to the further reproduction. Naturally, reproductive contact between mutant individuals should be obligatory and successful. Thus the new offspring should be more competitive in comparison with other individuals of a population.

Realization at once two conditions extremely rare case therefore evolutionary process is very slow.

Thus, the new species appear jump inside a former family tree and its founders are only two different sex individuals. The further development of a new species in the beginning is carried out inbred method that does not lead out the individuals from frameworks of this species (see **Appendix**).

## 4. Type of the mutation generated the man

Some mutations can be divided on supported and self-supported.

For example, dogs have taken place from wolves owing to the artificial selection which has been carried out by the man. Useful mutations (obedience, ability to training etc.) the man kept, and dogs with harmful mutations the man destroyed. The man did not allow dogs to be crossed to wolves, supporting mutational changes.

But the new species has not arisen. The sheep-dog can be crossed to wolves and have the fertile offspring. This offspring can already live in the wolf pack. Domestic dogs it is an example of a supported mutation.

Intellect of the man it is a self-supported mutation. Though Homo sapiens usually concerns to a separate species which is determined by him intellect it is not absolutely so. The intellect of the man does not determine his species.

The certain species of primates had mutation (anthropogenesis) consist in originate of a plenty free neurodendrites in a brain at early age. At other primates it is not present otherwise they would be same clever as the man.

The arisen mutation is self-supported and temporary. It is realized due to training the child in early age. If the child not train (for example, Homo ferus) this mutation will not work. But it does not mean that the given individual will concern to other species than the trained man. Therefore more correct name of our species - the Man trained (Homo doctus).

There is a question why at an early stage of the man evolution, right after occurrences of the first mutant individuals this mutation was not dissolved in a population due to crossing mutant and not mutant individuals? In fact at first sight any obstacles for such crossing in a tribe where there was a mutation, was not.

Apparently, at once after occurrence in the foremother of mutant individuals, i.e. first people - men and women, they could realize themselves people that could become an obstacle for their crossing with surrounding not mutant individuals though, apparently, sometimes there was a similar crossing. As, sexual contacts to animals though those and are possible are not comfortable for the man (but not for an animal who does not realize unnaturalness of these contacts).

Reproductive crossing between the first mutant heterosexual people for them was more comfortable that could be connected to occurrence of a love feeling. Apparently, the love feeling was the basic motive limiting crossing of mutant and not mutant individuals. The offspring of these people possessed large advantages before surrounding apes. Intensity of environment knowledge by the first people was much more than at other individuals of a tribe. Apparently, it frequently resulted in conflict as people did not believe surrounding apes equal to, and the tribe of apes has expelled people from the tribe. People have been compelled to take the food themselves. About it the genetic memory at mankind was remained.

In the final period of a human life return process - detachment of the synaptic communications begins.

On fig. 3 it is shown, as the synaptic communications density in sections of a brain cortex with the age decreases. On the data [14] in the man brain cortex to age 90 years 20% synapses disappear.

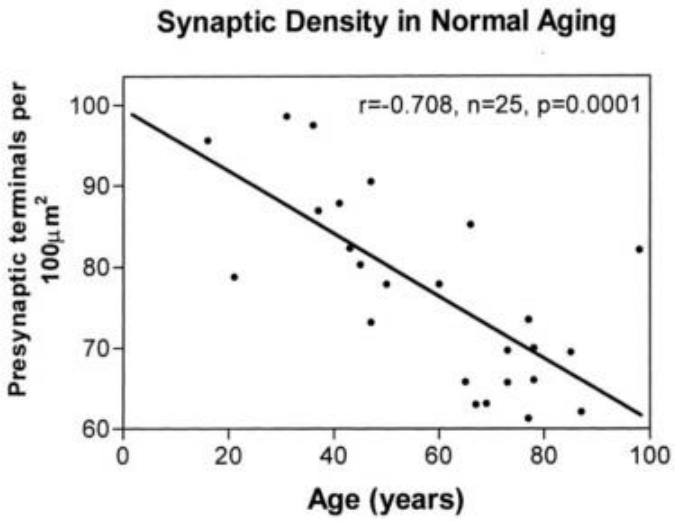


**Figure 3. Reduction of the synaptic communications density with the man age, measured with the help con-focal microscopy in the brain cortex [15]**

Velocity of this detachment defines the velocity of falling of the man intellectual abilities. This process apparently is irreversible but it can be slowed down. The delay of this process is determined by functional activity [9] of the synaptic communications. In turn the functional activity of the synaptic communications is defined by intensity of creative activity of the man. We shall notice that preservation of the synaptic communications promotes preservation of the certain level of the man organs regulation, and it results in his longevity. For a long time it is noticed that scientists on the average live longer than workers of low qualified physical work.

## 5. Conclusions

The mutational changes in a population usually disappear during 4 - 5 generations after occurrence of mutations, and the population comes back in initial on distribution of genotypes a condition.

Homo sapiens originated in result of a self-supported and temporary mutation.

This mutation consists in a plenty free neurodendrites of a brain at early age. At absence the synaptic communications on these neurodendrites or their lack they start to be pulled into the

neuron soma and to disappear that determine temporariness of a mutation existence. Formation of the synaptic communications enough quantity it is possible only at the big information stream on the man in early age. Training of the child there is essence of a mutation self-supported. The man with the help of parents and environments should is greatest possible at early age to realize the self-supported and temporary mutation - a plenty free neurodendrites of a brain. The problem of parents consists in creation in the postnatal period of the greatest possible information stream on the child with the purpose of the free neurodendrites fast filling by the synaptic communications. During the final period of a life it is necessary to slow down as much as possible process of the synaptic communications detachment, first of all, intensive brainwork. Process of the synaptic communications detachment in any measure represents return of the man to initial before mutational state.

## Appendix

### 1A. Preservation of species and Hardy - Weinberg law

To understand, why and how there are evolutionary changes, we shall consider laws of the species preservation.

Preservation of the species is defined by the Hardy – Weinberg law [16].

The Hardy – Weinberg law says that in panmictic (ideal) population the allele frequencies are kept constant from generation to generation. The full panmixia it is characteristic for indefinitely big populations where there is no selection, mutations, migrations, etc. In the mathematical form the Hardy – Weinberg law in the elementary case of the two alleles of a gene establishes that relative frequencies of genotypes in generations meet to terms of a binomial expansion $(p+q)^2$ so $p+q=1$, where $p$ and $q$ there are allele frequencies in a population.

According to this law the genotypes *AA*, *Aa*, and *aa* by an autosomal inheritance have the following frequency ratio:

$$(AA)\,p^2:(Aa)\,2pq:(aa)\,q^2. \qquad (1)$$

The Hardy - Weinberg equilibrium state is indifferent. On the autosomal inheritance it is obvious. Really, using distribution of genotypes (1) it is possible to receive, for example, frequency of a recessive allele $a$ in the following $(n+1)$ generation. For this purpose it is

necessary for the previous generation *n* to do summation of the half of heterozygotes frequency *Aa*, and the homozygotes frequency *aa*:

$$q_{n+1} = \frac{1}{2} 2 p_n q_n + q_n^2 = q_n (p_n + q_n) = q_n . \qquad (2)$$

In the following $(n+1)$ generation the same frequency of a recessive allele *a* as in the previous *n* generation was received.

For the linked to a sex genome the analysis is necessary more complex.

Let's assume that alleles *A* and *a* are linked to the *X*-chromosome. The frequency of a dominant allele *A* in the men is $p_m$ and in the women $p_f$. For recessive allele *a* it is accordingly $q_m$ and $q_f$.

At mating in the first generation there is a ratio of genotypes in the women according to product $(p_f + q_f)(p_m + q_m)$:

$$(AA)\, p_f p_m : (Aa)\, (p_m q_f + p_f q_m) : (aa)\, q_m q_f . \qquad (3)$$

Using the distribution of genotypes (3) it is possible to find a frequency of allele *a* in the women for the following $(n+1)$ generation:

$$q_{f(n+1)} = \frac{1}{2} (p_{mn} q_{fn} + p_{fn} q_{mn}) + q_{mn} q_{fn} =$$
$$= \frac{1}{2} \left[ (1 - q_{mn}) q_{fn} + (1 - q_{fn}) q_{mn} \right] + q_{mn} q_{fn} = \frac{1}{2} \left[ q_{fn} + q_{mn} \right] . \qquad (4)$$

In the deduction (4) the following obvious ratios $p_{mn} = 1 - q_{mn}$ and $p_{fn} = 1 - q_{fn}$ are used.

Thus, the frequency of allele *a* in the women for the following generation is equal to a half-sum of the allele frequencies *a* in women and men of the previous generation between whom there was a reproductive contact.

For the analysis of evolutionary processes it is important to note that inbreeding (consanguineous mating) is not broken the preservation of the species. Usually consanguineous assume only mating up to the third generation inclusive [16]. Inbred processes are especially characteristic for a family tree therefore further we shall analyze a family tree. The population will usually consist of set of the family trees.

In the Hardy - Weinberg law (1) inbreeding it is taken into account with the help of an inbreeding factor in a family tree $F$ [16, 17]:

$$(AA)(p_n^2 + Fp_nq_n):(Aa)[2p_nq_n(1-F)]:(aa)\left(q_n^2 + Fp_nq_n\right). \qquad (5)$$

The ratio (5) for autosomal inheritance has been established by English geneticist Wright [18, 19] also is called Wright's ratio.

Wright's ratio shows that in the offspring autosomas of the inbred family tree at mating observes identical increase in frequencies dominant *AA* and recessive *aa* homozygotes. During too time the frequency of heterozygotes in $1-F$ time decreases.

The deduction of the ratio (5) can be found, for example, in the book [20].

In the following generation the Hardy - Weinberg equilibrium (5) for autosomal genome in inbred family tree is redressed:

$$q_{n+1} = \frac{1}{2}2p_nq_n(1-F) + \left(q_n^2 + Fp_nq_n\right) = q_n\,. \qquad (6)$$

For the genes linked to a sex the distribution of alleles has more complex kind:

$$(AA)\left[p_{fn}p_{mn} + (p_{mn}q_{fn} + p_{fn}q_{mn})\frac{F}{2}\right]:(Aa)[(p_{mn}q_{fn} + p_{fn}q_{mn})(1-F)]: \\ (aa)\left[q_{mn}q_{fn} + (p_{mn}q_{fn} + p_{fn}q_{mn})\frac{F}{2}\right] \qquad . \qquad (7)$$

The detailed deduction of a ratio (7) can be found, for example, in the book [21].

In the following generation of inbreed family tree the frequency of a recessive allele *a* in the women is equal a half-sum of the allele frequencies *a* female and male individuals:

$$q_{f(n+1)} = \frac{1}{2}(p_{mn}q_{fn} + p_{fn}q_{mn})(1-F) + q_{mn}q_{fn} + (p_{mn}q_{fn} + p_{fn}q_{mn})\frac{F}{2} = \\ = \frac{1}{2}\left[(1-q_{mn})q_{fn} + (1-q_{fn})q_{mn}\right](1-F+F) + q_{mn}q_{fn} = \frac{1}{2}\left[q_{fn} + q_{mn}\right] \qquad . \qquad (8)$$

The carried out analysis shows that inbreeding does not lead out the individuals from frameworks of the given species.

In a reality the full panmixia it is impossible. There is a question, whether the genic modification in a population will be observed at a small divergence from panmixia, and what will occur to the given modification further?

The population will usually consist of set of the family trees. If for a family tree the Hardy - Weinberg law is written within the framework of discrete mathematics for a population as a whole this law is written as the differential equation [22, 23]. In a population of people during each moment of time there are set of descendants, therefore the processes of the people number change (and hence their genomes distribution) is proceed actually continuously and it is possible to use methods of the functional analysis.

We shall assume a researched population some system on which small mutational influence (the negative ecological factor, radioactive radiation, etc.) is carried out. We believe influence rather small, therefore interaction of a system and an influence has linear character.

**2A. Mutational influence on a population**

The characteristic of the system response on some influence generally is Green's function of this system [24]. Therefore, first of all we shall find Green's function for a weak non-panmictic population.

On a population can operate as the determined factor causing genic modification, for example, continuous radioactive radiation [3], and random factors, for example, various factors of a carcinogenesis. All these factors change an allele frequency in a population, i.e. cause genic modification.

Let's consider the differential equation reflecting the Hardy - Weinberg law for allele linked to the sex for a population on which some mutational factor operates [22, 23]:

$$\frac{d^2 q_f}{dn^2} + \ln 2 \frac{dq_f}{dn} = D(n), \qquad (9)$$

where $n = \frac{t}{T}$ - dimensionless time, $t$ – time, $T$ – an average time of the generations alternation (at the person approximately 25 years), $D(n)$ - function of time describing influence of the mutational factor on a population.

For the panmictic population is $D(n) = 0$. In this case the solution of the equation (9) is $q_f = const$ that reflects an invariance of an allele frequency according to the Hardy - Weinberg law.

We search the solution of the equation (9) as:

$$q_f(n) = q_{f0} + \int G(n, n') D(n') dn' , \qquad (10)$$

where $q_{f0}$ there is initial (before the beginning of influence on a population) frequency of recessive allele in the woman, $G(n,n^{/})$ - Green's function for a population, $n^{/}$ - the parameter of integration – time (moment) of influence the response on which is investigated in time (moment) $n$, so $n > n^{/}$.

Let's substitute the formula (10) in the equation (9):

$$\frac{d^2\left(q_{f0} + \int G(n,n^{/})D\left(n^{/}\right)dn^{/}\right)}{dn^2} + \ln 2 \frac{d\left(q_{f0} + \int G(n,n^{/})D\left(n^{/}\right)dn^{/}\right)}{dn} = D(n). \quad (11)$$

Let's accept the following initial conditions reflecting that initial frequency of a recessive allele does not depend on time:

$$\frac{d^2 q_{f0}}{dn^2} = \frac{dq_{f0}}{dn} = 0. \quad (12)$$

In this case the equation (11) will be transformed to a kind:

$$\int\left(\frac{d^2 G(n,n^{/})}{dn^2} + \ln 2 \frac{dG(n,n^{/})}{dn}\right)D\left(n^{/}\right)dn^{/} = \int \delta\left(n - n^{/}\right)D\left(n^{/}\right)dn^{/}, \quad (13)$$

where $\delta\left(n - n^{/}\right)$ there is Dirac's function.

In (13) we used known property of Dirac's $\delta$-function:

$$D(n) = \int \delta\left(n - n^{/}\right)D\left(n^{/}\right)dn^{/}. \quad (14)$$

Thus, from the equation (13) we find the equation for the Green's function of a population:

$$\frac{d^2 G(n,n^{/})}{dn^2} + \ln 2 \frac{dG(n,n^{/})}{dn} = \delta\left(n - n^{/}\right). \quad (15)$$

Dirac's function $\delta\left(n - n^{/}\right)$ has property: $\begin{cases} n = n^{/}, & \delta\left(n - n^{/}\right) = \infty \\ n \neq n^{/}, & \delta\left(n - n^{/}\right) = 0 \end{cases}$. The equation (15) reflects the variation of the population Green's function at influence on a population of a conditional dot mutational source as $\delta$-function in the initial moment of time $n = n^{/}$. We shall note that Green's function of a population does not depend on a kind of influence. The concrete kind of influence, in particular, determined or random is defined by function $D(n)$. Green's function of a population is a characteristic of a population but not the influence kind on it.

The received linear differential equation of the second order (15) easily is solved by introduction of a new variable $Z(n,n^{/}) = \frac{dG(n,n^{/})}{dn}$.

Further, assuming $Z = uv$ we find the function $v = e^{-n\ln 2}$. For function $u$ the differential equation looks like:

$$\frac{du}{dn} = \delta\left(n - n^{/}\right)e^{n\ln 2}, \qquad (16)$$

which solution is:

$$u = \int \delta\left(n - n^{/}\right)e^{n\ln 2}dn = \int \delta\left(n^{/} - n\right)e^{n\ln 2}dn = e^{n^{/}\ln 2}. \qquad (17)$$

In a finding (17) we are used the evenness of the $\delta$-function and property (14). Hence there is $Z = uv = e^{-\left(n-n^{/}\right)\ln 2}$. Green's function of a population find by a condition:

$$G(n,n^{/}) = \int Z\left(n,n^{/}\right)dn = \int e^{-\left(n-n^{/}\right)\ln 2}dn = -\frac{1}{\ln 2}e^{-\left(n-n^{/}\right)\ln 2}. \qquad (18)$$

Green's function of a population can be presented as:

$$G(\Delta n) = -\frac{1}{2^{\Delta n}\ln 2}, \qquad (19)$$

where $\Delta n = n - n^{/}$ there is time interval from the moment of influence or is more exact from the moment of the ending of influence.

The sign a minus specifies that the population always resists to the external influence.

On fig. 4 the change of Green's function of a population in case of the elementary two-allele system linked to a sex is shown. The minimal value of the Green's function at $\Delta n = 0$ it is equal $G(\Delta n) = -1.443$. On $\Delta n \to \infty$ the Green's function is to tend to zero. Thus the response of a population to influence it is gradual disappearance of an influence result. Actually, already in 4 - 5 generation a genome of a population comes back to an initial level which existed before the influence. Due to mating the mutations as are soluble in a population. This fact is well-known to selectors. The cultural plants are given themselves quickly become natural.

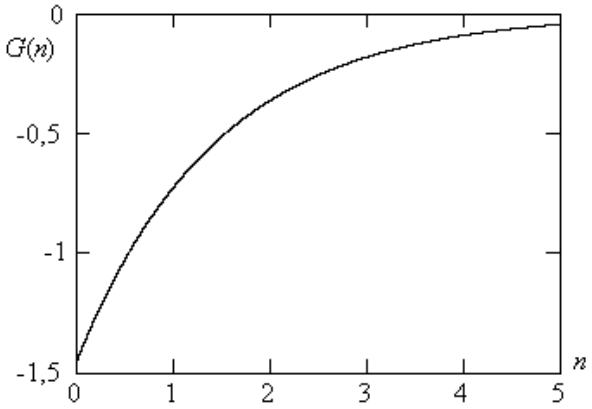


**Figure 4. Green's function for the two-allele genomic system linked to a sex**

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