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## Reduction in Mortality at All Stages of Animal Life and the Ways to Achieve Productive Longevity Using Aurol (*p*-Tyrosol)

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### Abstract

A complex of medical and biological studies of the effect of 4-(hydroxyethyl)phenol (*p*-tyrosol, aurol) on all life stages for the groups of different animals is considered. A substantial decrease in the level of mortality was revealed for each experimental group and at each life stage. The efficient action of aurol at the early life stages and during subsequent development of organisms was demonstrated. Aurol exhibits antioxidant properties, affects vascularization and neoangiogenesis and thus restores the nitroxidergic system of the brain, improves blood composition, strengthens the structures of the most essential systems of the organism, and decreases bird mortality at the early stage of life. The use of aurol in poultry breeding leads to early ovicell maturation in hen organisms, which causes an increase in egg-laying ability. In the cases of vaccination or diseases of birds, an increase in bird survival rate (90 %) is observed in the case of the treatment with known antibiotics in combination with aurol, compared to the reference group without aurol treatment (80 %). Neuroprotective action of aurol is exhibited as a sharp decrease in miscarriage rate during shearing pregnant goats. A positive effect of aurol application in cattle breeding causes the growth of more vigorous young individuals advancing in live weight by 5–7 % in comparison with the reference group. The long-term result of aurol action manifests itself in the animals of the experimental group during 25–30 days after injections and is explained by an increase in hemoglobin concentration and the high biological activity of blood serum. A substantial economic effect achieved during industrial tests of the maintenance of animals with the help of aurol at all stages of their life is the first example of an increase in productive longevity.

**Keywords:** aurol, *p*-tyrosol, pregnancy and progeny maintenance, reduction in mortality, egg production, increase in animal mass

### INTRODUCTION

The problems connected with the protection and welfare of the population belong to the most important key state programs of Russia for the nearest decades. The modern problem is in the fact that half of the male population in Russia does not live till the age of 60, so the related eco-

nomic damage of the state is measured by a ten trillion roubles every year. [1].

The state accumulates the scientific and practical experience of increasing the longevity of the population and implements the corresponding projects [2]. The first experiment was carried out since 2004 till 2015 in the Sverdlovsk Region under the supervision of the scientists of the Ural

Branch of RAS [3]. At present, the Novosibirsk Region is participating in the national project named Demography, one of the goals of which is an increase in the expected lifetime of the population to 80 years by 2030 [4].

However, it should be noted that the experiment in the Sverdlovsk Region had practically no results on an increase in the longevity of the population: by 2015 the parameters for the Sverdlovsk Region and for the country, in general, turned out to be identical. Possible reasons were discussed in [1, 3]. It was indicated that in Russia it is impossible to hope for self-preservation of the population under the conditions of increasing mortality and morbidity during the recent decade, and for concordance of the joint financial actions of the government and the capital (complicated economic situation interfered with the realization of the programme in the region in full). Hopes were set on the development of a chemical product for longevity [3], which would promote a decrease in the mortality of living beings at all stress stages of life starting from prenatal till the old age preventing cardiac arrest.

The development of a panacea (for animals at the initial stage) is the major goal of the present paper.

It is known that the development of pharmaceuticals involves at first pre-clinical trials with animals, and then, after obtaining reliable results, a multistage clinical trial is carried out in many medical establishments, now with people. The longevity product is a special one. It should be a reliable agent to rescue a living being at each stage of stress. According to preliminary calculations [1], several ten clinical trials of one compound are necessary, which would require additional financing in the amount of several ten milliard roubles (the amount comparable with the expenses for the construction of a modern synchrotron).

It is known that the success of treatment at an early stage of life is dependent by 15–20 % on the application of a complex of antioxidants with the compounds possessing antimicrobial activity [5]. However, an integrated preparation of vitamins E and C was determined to exhibit low activity. An assumption concerning the possibility of the use of preparations with polyfunctional properties was formulated.

Aurol (4-(hydroxyethyl)phenol, *p*-tyrosol) is the only efficient adaptogen that may be manufactured, unlike ginseng, by the industry in sufficient amount with high purity (99.7 %) [6]. This

low-toxic product of plant origin causes an increase in the resistance of an organism to the action of unfavourable environmental factors [7]. It is present in grapes, olives, blackcurrant, lavender, rhodiola rosea, the plants that are in use by humans for several thousand years [8]. A positive effect of aurol derivatives 2-dihydroxytyrosol and oleuropein is known [9].

Aurol regulates neurochemical processes: in low doses, it stimulates the nervous system preventing people from falling asleep, while in high doses it possesses a strong somniferous effect, which is necessary in some cases when treating acute diseases [8]. The feature which is its most valuable property in the opinion of Academician L. F. Panchenko is its ability to affect the nitroxidergic system of the brain activating and normalizing its functions [10]. This feature is depicted in the commercial name of *p*-tyrosol: aurol, a preparation recovering the aura, which characterizes the degree of the physiological activity of the brain.

The ability of aurol to activate the development of a new vascular system, its effect on neo-angiogenesis were demonstrated in [11]. The elasticity of not only the vessels but also the membranes of erythrocytes increases, which allows them to penetrate into thin vessels without destruction and to supply oxygen to inaccessible regions of an organism [12]. Thus the support is provided for various biological systems and functions of the organism at the early stages of development, when the adaptation possibilities are not completely formed and employed. It is childhood when the risk of radical processes causing pathological changes is high because of the insufficiency of the vascular system [13].

In our experiments with animals, we established the reduction of mortality for the treatment of cardiovascular diseases with aurol in comparison with the action of other preparations [14].

In the present work, we carried out a test of the indicated properties of aurol at the initial stages of animal life for the purpose of studying the positive therapeutic co-action on the functions of an organism under stress conditions of their formation [15].

#### EFFECT OF AUROL AT DIFFERENT STAGES OF DEVELOPMENT OF ANIMALS

An important effect on the development of an organism at the **initial period** of life, which is most strongly affected by stress, is caused by the

support provided during the intrauterine stage. The period that begins after birth (or after hatching, as termed in poultry keeping) is not less difficult because it is connected with the development of organism functions under the conditions of weak antioxidant status [13].

Initially, we studied the effect of auro on chick embryos [16]. It was established that the introduction of auro at a level of 0.01–0.001 % of the semi-lethal dose ( $LD_{50}$ ) into the yolk (which is 2.5 mg per 1 kg of the live weight) causes an increase in the mass of the internals of hatched chickens. Chickens born from embryos with the dosed action of auro were more active, consumed more food than the chickens of the reference group. No behavior pathologies or disturbances of the organs and egg-laying ability were revealed in laying hens grown from the embryos treated with the low doses of auro. Auro was completely metabolized in the organism within 24 hours after injection, which excluded its presence in the blood and in the body after a day [14], because auro is functionally similar to ethanol.

During one year, multiple injections of auro in the dose of 1 mg/kg of body mass was performed starting from a one day age of chickens hatched from untreated eggs [17]. This caused a decrease in the effect of stress factors, stimulated the development of young individuals, caused an increase in the vitality of hatching hens. During the whole period under investigation, the survival rate in the experimental group was 95 %, while the percentage of birds that died in the reference group was 22 % during one year. These experiments point to the fact that the action of auro resulted in a reliable increase in bird vitality and stability against stress unfavourable environment effects.

It was established that an essential feature of the organism is the timely mobilization of different protective mechanisms preventing the propagation (at the first stage) of negative signs. Auro acts as this tool of the mobilization of organisms at the period of life with the maximal stress.

The response of an organism to stress, first of all, the response of adrenal glands, is acute and often inadequate to the action. This reaction is moderated by the timely involvement of the hormones of the thyroid gland to neutralize the negative products of stress with the participation of antioxidants [17].

Other adaptogens may also act as the substituents of hormones [18]. For instance, the authors of that investigation developed a biologically ac-

tive complex composed of *Serratula coronata*, leuzea (*Rhaponticum carthamoides*) belonging to adaptogens, cocoa husks and fir boughs. This complex promotes normalization of the reproductive functions of sows by increasing their fertilization rate by 15 %. The parameters of sperm production in breeding boars increased by 33 %. Expectations for enhancement of the biochemical effect of this and other plant complexes containing adaptogens are connected with the mechanochemical activation of plant raw materials. Indeed, a plant complex composed of rice husks and green tea, sodium humate and silicon compounds, subjected to mechanochemical action, when used in bird poultry keeping, causes an increase in the mass of quails by 7 %, egg production by 9.5 %, with a decrease in total expenses for breeding.

Metabolism, growth, differentiation, reproduction, neurochemical homeostasis and adaptation are the most important functional stages of the **second phase** of organism development, which are regulated by the hormones of endocrine glands, connected with the normal functioning of adrenal glands, thyroid gland and genital glands of the organism. At this stage, an important role is allotted to auro as a regulator of cell functions through the action on the activity of enzymes in blood plasma and favourable influence on blood composition [8].

The application of adaptogens involves an increase in the adaptive possibilities of the organism by switching on the compensatory mechanisms till the moment when the favourable state for the development is recovered [19]. This phenomenon, termed neurochemical homeostasis, is the most reasonable interaction of an organism with the environment as the most important feature of the living matter, providing its formation, preservation, productive characteristics and maximal possible lifetime, which allowed including adaptogens in the list of vitally important means.

In the **third phase** of life, polyfunctional nature of auro manifests itself. The most important regulators of the protective and adaptive system of the organism are glucocorticoids, the hormones of the adrenal gland. Their decreased or increased activity determines the degree of organism protection. An increased activity is moderated by the hormones of the thyroid gland preventing lethal situations [16]. Adaptogens (for example, auro) recover the functions of the organism, rise the stability of its antioxidant system, which generally causes an increase in *lifetime*, first of all, due to a decrease in probable dangers from free radicals that cause pathological processes [13].

It follows from [20] that aurocl and its derivatives that are present in olive oil may act as antioxidant hormones for stress reduction. Experiments were carried out with the participation of 12 thousand volunteers – women with different manifestations of climax. A positive result of the experiment which involved the intake of olive oil instead of hormones was beyond dispute.

Adaptation wave causes an increase in the mass of cell cultures. It manifests itself as an urgent and long-term rearrangement of an organism to environmental factors – a feature of normally functioning organism during simultaneous adaptation to the new stage of active life [16]. Under the action of aurocl, a substantial increase in the mass of muscles was obtained for all living objects with which large-scale experiments were carried out, in particular for calves, piglets, geese, meat hens. This is one of the factors of their rehabilitation and viability in comparison with the reference groups of animals and birds [21].

Now the *response of genital glands to the stress* is to be considered [17]. In the majority of works, the suppressing action of the stress is pointed out; it causes disturbance of the synthesis of reproduction hormones, which may last for several days to several weeks.

Long-term action of the stress causes negative events connected with various physiological and morphological changes suppressing immunity. For pregnant females, this may be expressed as fetal death, or the birth of weakened progeny [22]. It was established that females are most sensitive to the stress at the initial stage of intrauterine fetation, when the stress causes spontaneous abortions, and increases the rate of embryonic deaths. During this stage, a transition from urgent adaptation to long-term one is necessary, along with the achievement of stable resistance of the organism to stress factors and their carriers, which requires stabilization of the nervous system through the intake of medicinal agents and by carrying out physiological and other arrangements.

In this connection, a pronounced favourable effect of aurocl on the procreation of laying hens should be stressed [17]; it leads to an increase in egg production and may be connected with an increase in the functional activity of ovaries.

An increase in viability is also observed in male individuals after aurocl intake *in vivo*. This is manifested physiologically as an increase in the activity of spermatozoa. It was established that aurocl, similarly to dihydroquercetin, causes an increase in antioxidant status and thus decreases the num-

ber of DNA damages in generative cells and the degree of pathospermia manifestation [23].

The neuroprotective effect of aurocl was reported. It is able to recover the nervous system even in the cases of the most serious pathological states (narcomania and schizophrenia) [8].

At the **final stage** of life, aurocl causes an increase in the stability of the organism by enhancing antitumour activity and weakening the toxicity of cytostatics [7].

With the model of 45 min long myocardial ischemia in rats after reperfusion, carried out as a surgical operation, 1 % aqueous solution of aurocl was injected intravenously in the animals. This caused a substantial *decrease in mortality* in the experimental group, in which only one animal of 13 died of acute myocardial infarction (6 %), while the number of animals that died in the reference group was 7, out of 18 (39 %) [14].

Experimental results point to the positive role of aurocl in the reduction of death risk at all stressful stages of life since the birth till the old age, and in the enhancement of viability during the operation period.

#### RESULTS OF AUROCL APPLICATION IN POULTRY KEEPING

In the common practice of poultry keeping and animal breeding, the problems related to breeding are solved by full-value enrichment of food with antioxidants, plant extracts and microelements which are deficient in the natural ration.

Economic reasonableness of preliminary mechanochemical treatment of food was revealed [24]. After treatment, the products are assimilated by the organism with higher efficiency. However, experiments show that these measures do not replace the need to correct the nutrition of the animals by adding adaptogens, especially during stressful periods of life.

It is possible to reduce the negative consequences of stress action on young birds by applying medicinal agents possessing adaptogenic and stress-protective action. In the modern Chinese practice of poultry keeping, the groups of effective agents originating from plants are used for this purpose, in particular acanthopanax, membranous milk vetch, soapwort, angelica sinensis, absinth, caprifoli, licorice, plantain, motherwort, ginseng [25–27].

Results of the action of synthetic aurocl preparation with the content of the active component 99.7 % are presented below [6]. Its purity provides the temporal stability of its aqueous solutions used

either with forage or in the form of injections. In poultry keeping [17], *three courses of aurol administration* were implemented, which ensures the safety of young birds, stimulates their development, provides high egg-laying ability of laying hens and increases their viability.

*The first course of treatment with aurol for the safety of young birds* starts for one day old chickens after they are moved from the incubator into the department of growing, which is the strongest stress action for the young birds [17]. During this time, measures are taken to develop protective reactions of chickens against infections, to activate the mechanisms of the stability of their organisms to increasing unfavourable actions. The effect of the preparation involves a reduction of the stress-caused response arising during the initial period of life, which is biologically necessary state of the organism elaborated during long-term evolution [17, 21].

For the application of aurol at the first stage (till the age of 9 weeks), its 1 % aqueous solution is diluted per the daily need of chickens in water (0.15 l per one bird daily in the dose of 1 mg per 1 kg of body mass). Then, with an increase in the need of birds in water at an age of 10–22 weeks the amount of the aqueous solution of aurol is increased from 0.15 l to 0.23 l per one bird.

*The second course of aurol application* is carried out for 3 days not later than at the age of three months, before veterinary measures [17], which not only stimulates the development of young birds but also allows higher efficiency of these measures, thus the viability of laying hens increases from 80 to 90 %. This is likely to be connected with the high antibacterial and anti-inflammatory activity of aurol itself, enhancing as a result of the combined action with the preparations generally accepted for this purpose.

According to the data reported in [16], aurol accelerates the formation of erythrocytes in birds, which promotes an increase in bird viability [21].

According to the data of industrial tests at the PC Ptitsevod (the Republic of Khakasia), the **application of 50 g** of aurol in the experimental group of chickens incorporating 7488 birds helped to achieve a decrease in mortality, which allowed obtaining **1003 additional hens** in comparison with the reference group comprising the same number of birds.

*The third course* of aurol for the *stimulation of ovogenesis* should be carried out since the start of oviposition at an age of 160 days. During 3 days, the birds are given 1 % aurol solution to drink. At the age of 190 days, egg production in the ex-

perimental group reaches 100 %, while in the reference group it is 50 % by this time, reaching the maximum (80 %) at the age of 220 days and more. It was concluded in the test report that the effect of aurol on the substantial increase in egg production lasts for 30–45 days, but the positive effect of its action is conserved till the end of egg production.

In the experimental group of hens (7488 birds), 38 950 eggs were additionally obtained in comparison with the reference group. In general, egg production was 2 times higher in comparison with the reference group [17], which is due to the earlier start of egg-laying.

The mass of birds in the experimental group drinking the curative dose of aurol (1 mg per 1 kg of body mass) was higher by 26 g as average per day than the mass of birds from the reference group as a result of the proportional development of all organs: no reliable changes were detected in the organs of birds. Along with an increase in cell factors, an increase in the immune response was detected in the blood vascular system of hens.

An increase in egg production in the experimental group allowed a substantial increase in the time of the use of egg-laying hens for this purpose, thus the prime cost of eggs and meat.

*The data obtained in the experiments on the application of aurol are economically important for the practical implementation of the productive longevity of animals. However, not less important is also the theoretical part opening the way to solving the most important problem of a decrease in death rate, preservation and creation of the conditions for the sustainable development of progeny in general and for the stabilization of homeostasis during the whole life.*

The stimulation of egg formation in hens by aurol even before laying points to the intrauterine tonic action of aurol on egg-bearing ability not only in hens but also in ducks and geese [21]. Drinking aurol in the dose of 1 mg/kg allows enhancement of the natural resistance of birds by 20 % in comparison with the preparations generally accepted for this purpose, which were taken for comparison: succinic and ascorbic acids.

A positive effect of aurol application is manifested as an increase in the mass of meat hens and geese during growth. In the experimental group, weight increment goslings starts on the 3<sup>rd</sup> day after redistribution. At the 10<sup>th</sup> day, the daily increase in goose mass was 32 g in the group of 500 geese drinking aurol with water. In the reference group of 560 geese kept without aurol, the mass increment was 15 g per one bird [21]. This

had consequences on bird survival later on. In the experimental group, the death rate of geese was 1 %, while in the reference group it was 16 %.

At present, the nutritive additive named Tseaur has been patented for birds as the means for the prophylactics of stress-causing factors under the conditions of industrial production. This additive contains auroal adsorbed on natural zeolite, at the percentage of 0.05 : 99.04 (with respect to mass) [28]. It was demonstrated that the biological efficiency of auroal in Tseaur increased due to microelements in the zeolite, and the use of this additive turned out to be more economic. For instance, the daily average increment of birds in mass increased by 17 % in comparison with the reference group. This effect was conserved over time as the characteristic of productive longevity.

*The economic effect of the use of auroal calculated on the basis of industrial tests is the 12-fold profit per 1 rouble of expenses [17]. With the use of Tseaur, this profit increased two times more [28].*

#### **APPLICATION OF AUROL FOR PREVENTING STRESS OF PREGNANT FEMALE GOATS OF THE GORNO-ALTAYSKAYA WOOL-BREED STRAIN**

At first glance, goat hair combing presents no special problems. However, sometimes combing has even lethal consequences which make it close to the heaviest stress carrying lives away [29], thus it may be considered as a model of the heavy stress. For this reason, the combing process which causes acute stress in pregnant FEMALE goats requires thorough investigation and the development of urgent precautions to smooth down the situation.

Goat hair combing out is often accompanied by abortions in female goats of the Gorno-Altayskaya wool-breed strain. Prevention of abortion is the most important task for the efficient development of goat breeding [16]. Thus, the stress in animals is detected as unfavourable changes in blood composition, accompanied by an increase in the level of stress-indicating substances (thyroxin, cholesterol, catecholamines, cortisol, glucose) and in an increase in the number of leucocytes.

Adaptogens improving the state of animals under unfavourable living conditions are used in animal breeding [7]. Their stress-regulating action is detected: inhibition of the stage of anxiety in pregnant females. This may be the most reasonable way to search for a solution of the formulated problem [17].

During 5 days before hair combing off, peroral administration of 1 % auroal solution to female

goats was carried out. The daily amount of auroal for pregnant animals 3–6 years old with the average mass of 40 kg was 90 mg, while for young eugamic animals it was 100 mg of the preparation per one animal. The blood of the animals of both groups was analyzed. It was found that leucocytosis was less pronounced in goats treated with auroal [16].

After hair combing off, noticeable differences in blood composition were observed between the animals of the reference and experimental groups. The content of stress-indicating substances in the blood of goats treated with auroal was lower by 20–40 % than in the animals of the reference group. A day after hair combing off, the content of cortisol, thyroxin and the hormone of thyroid gland decreased in the blood of the animals from the experimental group, while the content of sex hormones was stable. It is known that the lower is cortisol concentration in blood, the less pronounced is the response of adrenal glands to the stress [16]. This is a good sign of animal viability.

Combing off caused the date close to the stress in all the animals. However, in the experimental group of animals it was lower than the critical value that caused spontaneous abortion in pregnant female goats in the animals from the reference group [29]. Thus, auroal preparation has a favourable effect on the organism of pregnant goats promoting normal course of pregnancy even under the conditions of stress and anxiety.

The treatment of goats with auroal before hair combing off helped to preserve their pregnancy to a substantial extent. This caused an additional increment of goat number due to the birth of healthy young goats and brought substantial economic effect to the farming facilities [16].

It may be assumed the considered experience on a decrease in the effect of stressful factors on goat pregnancy under the action of auroal can be used on a broader scale with other living objects. For instance, it was reported in [15] that due to stress states caused, for example, by difficult economic conditions or other negative reasons, many pregnant women in Russia are at high risk of miscarriage and the birth of immature infants.

#### **APPLICATION OF AUROL FOR ENHANCEMENT OF THE PRODUCTIVITY OF THE MEAT BREEDS OF DOMESTIC ANIMALS**

The favourable action of auroal was demonstrated for growing and keeping animals: cows, goats, and pigs. This was manifested as the improvement of blood parameters: an increase in

the number of erythrocytes, hemoglobin concentration, improvement of lysozyme and bactericidal activity of blood serum [21], which unambiguously points to the successful overcoming of stress events by animal organisms.

Biological activity was exhibited by aurol in experiments with animals as enhancement of the functional activity of lymphocytes, phagocytic activity of neutrophils and natural killers in blood [21]. The application of aurol in the form of 1 % aqueous solution in the dose of 10 mL/day per one animal with food or in parallel experiments through the subcutaneous introduction of 5 mL of this solution 7 and 14 days before regrouping caused an increase in the parameters of non-specific stability of pigs and young cattle.

A positive effect of aurol application was observed at all stages of animal keeping: during taking the piglets away from sows, during their transfer into growing groups, during vaccination, as well as during additional introduction of aurol with food or subcutaneously. This caused a reliable increase in animal survival in the experimental group in comparison with the reference group.

The daily increment of piglet mass in the experimental groups in the experiments carried out during one month was 270 g (aurol introduction with food) and 275 g (subcutaneous introduction) per one piglet in comparison with the increment in the reference group (250 g). A positive effect of aurol on an increase in mass increment was conserved for 20–25 days after a three-day course of aurol intake by animals.

After experiments, the live mass of animals in the experimental group increased by 7 % in comparison with the animals of the reference group. It should be stressed that healthy producers were grown, with the mass exceeding the mass of reference animals of the same age by 50 kg. These are confident steps to the longevity of this generation and ongoing ones [16].

The steps to longevity are actual not only as a rescue during the terminal period of life but start from the early age and are made during the whole life using such agents as aurol. This provides *active* longevity.

Specialists of livestock business and farmers care for the *productive* longevity of agricultural animals and obtain substantial profits from the preservation of the population under stressful conditions. This is achieved through the application of scientific technologies allowing an increase in survival and productivity of animals.

#### MEASURES TAKEN TO DECREASE THE COST OF AUROL

The major parameters of aurol cost are determined by: 1) the presence of the home industrial production of the initial products for its synthesis; 2) total cost of the raw materials per 1 kg of the product; 3) complexity of technological operations; 4) the required purity of the product (more than 99 % of the major component).

All stages of aurol production in Russia are technologically accomplishable.

At present, efforts of technologists are aimed at a decrease in the price of aurol by diminishing the technological stages of production for the purpose of obtaining the product of suitable purity and cost.

#### CONCLUSION

It was established that the application of the aqueous solution of aurol in experiments with hen embryos (prenatal period) and with hatched chickens leads to a reliable decrease in their mortality during the early period of their development. Observation of the developing chickens revealed that chickens from the embryos treated previously with aurol left behind untreated ones.

Subsequent tests of aurol with birds demonstrated a decrease in mortality and an increase in egg production. The achieved positive effect of aurol application was confirmed in the industrial tests with the egg-laying strain of hens. The use of aurol in the experimental group of birds during growing leads to substantial preservation from death, an increase in egg production and the mass of every bird. These data were confirmed for geese breeding. A positive economic effect of aurol application in poultry keeping was obtained.

The application of aurol in cattle breeding caused a substantial increase in the live mass of goats, pigs and cows (up to 7 %).

The addition of aurol into the ration of pregnant female goats before shearing prevented subsequent cases of miscarriage and preterm delivery connected with the stress. The economic effect was expressed as the preservation and increase in the goat population.

The provision of long-term productive longevity of cattle is a modern problem. A task for the future is connected with the provision of reproduction of cattle population and requires an integrated (scientific and practical) approach,

and its solution is conjugated with substantial expenses.

Not less important problem is the preservation of the lives of agricultural animals. Scientific experiments on the preservation and an increase in longevity gave good results. This points to an actual possibility to model separate stages of animal ontogenesis, to increase productive longevity with sufficient care and support of life with the help of new chemical agents, in particular auroal, thus confirming the essential contribution from chemistry into the sustainable development of mankind.

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