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Toronto, May 2013

Pioneer Anomaly predictions confirmed

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The STOE explains many mysterious phenomena from diverse observational disciplines. Some predictions of the STOE in 2006 concerning the Pioneer Anomaly (PA) that no other model predicted have been published in 2009 and 2011.

Hodge (2006a) suggested that photons traveling between galaxies could loose energy caused by a ρ field. Hodge (2006b) applied the galaxy redshift equation to the PA. The PA is a well established unexplained blueshift in the radio signal from the Pioneer 10 (P10) and Pioneer 11 (P11) spacecrafts (Anderson et al. 2002; Toth and Turyshev 2006).

The predicted observations made are: (1) The data before the flyby encounters were insufficient to detect the PA (Turyshev and Toth 2009). The STOE requires this rather than there was no PA before the encounters as suggested by several other models.

(2) "Although the Earth direction is marginally preferred by the solution (see Table III), the Sun, the Earth, and the spin axis directions cannot be distinguished." (Turyshev et al. 2011). An Earth directed PA suggests a signal related cause that the STOE calculates rather than acceleration of the spacecraft that all other models calculate. Anderson et al. (2002) examined commonly accepted models of the impact of various phenomena on the signal and conclude the commonly accepted models do not account for a signal blueshift effect. The STOE model is a model of a signal effect and, therefore, is Earth directed. Because the vast majority of PA papers considers the PA to be sun directed, that the Earth direction is "marginally preferred" is remarkable.

(3) "The data favor a temporally decaying anomalous acceleration with an over 10% improvement in the residuals compared to a constant acceleration model." (Turyshev et al. 2011). Equation (2) and Section 3.4 of Hodge (2006b) suggest the decline is exponential except when the signal passes near large mass such as during flyby maneuvers. Calculating the 10 day intervals of the Saturn encounter may show variability over the 50 day period rather than the large uncertainty.

The STOE is a self-consistent model that was devised based on observations including galaxy redshift. Other models leave unanswered or poorly answered many characteristics of the PA such as the cosmological cH_o connection, the Saturn encounter decrease, etc. The STOE made predictions for a different observable characteristic of the PA that are being confirmed.

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Natural low energy nuclear fusion reaction

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Abstract

Hypothesis is put forward explaining a superpower flash, a shock wave and instant evaporation of the most part of Chelyabinsk meteor by the emergence of conditions for a low energy fusion exothermic reaction between Mg and Si nuclei contained in olivine and pyroxene, which were found in the meteorite. The possible initiators of that reaction are considered. They are supposed as common for the known experiments of similar type.

Keywords: fireball; explosion; olivine; pyroxene; isotopes; silicon; magnesium; iron; nickel; chromium; nuclear fusion; LENR

The most mysterious feature of an airborne meteor is its sudden burst in atmosphere accompanied by a dazzling continuous flash and a power shock wave with estimated energy reaching several megatonnes of TNT equivalent. These events happened in the history of mankind several times [1]. Maximum values have Tunguska phenomenon (10-15 Mt) and Chelyabinsk bolide (0.44 Mt) [2]. The actual data famine in the first case gave rise to assumption about a natural nuclear fusion reaction in a nucleus of a comet [3,4], which is, however, inconsistent with our knowledge of the chemical composition of comets and of the temperature and pressure conditions necessary for initiating this reaction [5]. But the second case shows that the idea of a natural nuclear reaction is not devoid of sense by itself and deserves attention.

Meteorite fragments were a persuasive proof that on 02.15.2013 at an altitude of 23.3 km it was just a meteor of mass about 11,000 tonnes that has exploded, which was traveling at the moment of its burst at a velocity of 18.6 km/s [2]. It is unlikely that the meteor lost 9/10 of its initial mass due to ablation in traveling time of 13 s in atmosphere [6], but even so, about 1000 tonnes of meteor's substance, to say the least, instantly evaporated leaving a dense smoky trace in the air, which was absent before the burst. The assertion that 1000 tonnes of fragments fell down [6] looks rather doubtful and is obviously based on simple arithmetic.

Thus not for the first time Nature demonstrates us the experiment in which there happens a powerful burst and instant evaporation of a stone block containing no explosives. Among all known means only a nuclear explosion is capable to provide the energy required for that. There is ample evidence for that conclusion. Just the main features of a nuclear explosion characterize the behavior of Chelyabinsk meteor.

First of all, there is superpower light radiation lasting 5 seconds as an extraordinarily increasing fireball. The radiation did not increase gradually but appeared suddenly and considerably exceeded heat radiation of burning gases attending the meteor flight. Approximate total radiated energy of the fireball was $3.75 \cdot 10^{14}$ J [7]. The flash brightness was so awful that a lot of eyewitnesses got a

tan on their faces even the man who was sitting in the back of his car. It is well known that light duration of nuclear explosion in seconds is equal to the cube root of its energy in kilotonnes [8]. From this correlation it is possible to make the rough estimate of energy as 125 kt that is of the same order of value with estimated in [2].

The second sign is penetrating radiation. Indirect but quite essential its evidence is represented by many eyewitnesses who felt the smell of spent gunpowder just after the flash. As is generally known such the smell is a distinctive feature of nitrogen oxides which could be formed in the air only under powerful gamma radiation at the moment of the burst. There are no data about neutrons in this penetrating radiation. Also there are no valid data about electromagnetic pulse besides short-time disappearance of mobile communication which could be caused by overloading of cellular networks.

The third sign is three shock waves, the first of which came to Chelyabinsk after 177 s, i.e. the explosion occurred at a distance (measured along an inclined straight line) about 60 km. If the explosion had happened at a lower height the shock wave force would have been much greater. There has not been any radioactive contamination, possibly, not only due to the high-altitude burst, but mainly because of total absence of unstable reaction products.

So the subject under consideration may appear as follows: at the input: a stone meteor (chondrite) of an estimated initial mass of 11,000 tonnes traveling at a velocity of 18.6 km/s; at the output: "pure" nuclear explosion. What kind of effects and processes during the object moving could bring to this result? First of all, of course, there are huge aerodynamic loads due to strongly compressed and heated atmospheric air. For example, pressure difference between front and back sides of a body moving at 20 km/s varies from 10⁷Pa at a height of 30 km to 10⁸Pa at a height of 15 km [9]. This air disrupts and heats body surface up to melting and even to evaporation whereas its interiors have no time to acquire heat, so that an effect of an overheated pressure cooker does not work hear.

Thus, the first two actions are high surface pressure and temperature. The third action which is not usually taken into account in meteors' behavior consideration is an acquirement of a negative charge by a cosmic body. This can cause the body's potential to rise up to 10kV or more [10]. Similar potentials create high values of the electric field strength and of the current density on sharpened parts of the body's surface. In other words, we are dealing with an electromagnetic action.

Just listed three actions, the main of which is the third one, are used in low energy nuclear reaction (LENR) experiments where mutual conversions of chemical elements are obtained at concentrations in excess of a possible error. Under these conditions an excess energy release and an absence of radioactivity were observed [11, 12, 13, 14]. A common feature of all these experiments is high values of current density, i.e. the high electron concentration on some parts researched samples.

A new hypothesis have been proposed in [15] that two electrons with opposing spin magnetic moments are capable of direct pairing by tunneling through the Coulomb barrier to the region of the dominant values of their negative spin-spin interaction energy. The most favorable conditions for this pairing are obtained at high surface densities of the negative charge, particularly on metallic points at high negative potentials. The pair dimensions are determined by geometry of the potential well in electron-electron interaction energy and are about classical electron radius, i.e. $2.8 \cdot 10^{-15}$ m.

The response of the pair to an external permanent electric field is that the pair executes rotation in the plane which is orthogonal to the vector of the electric field strength. The factor of proportionality ("giroelectric ratio") between the pair rotation frequency and the electric field strength is estimated theoretically in [15]. The rotation of the electron spin magnetic moments brings into existence the additional internal electric field, which completely compensates the external field and causes the translational movement of the centre-of-mass of the pair at right angles to the external electric field, so that the pair tends to be pushed out from this field along the equipotential surface. Such movement is an electrical analogy Meissner – Ochsenfeld effect and its indirect evidence was first observed by Prof. N.P. Myshkin in 1899 [16].

The strong evidence of the concept of directly paired electrons is the phenomenon of resonance absorption of alternating electric field energy by structural products of the corona discharge on the negative point [17, 18]. It occurs at the frequency connected with the permanent electric field strength (at its low values) by the linear dependence. The factor of proportionality in this linear dependence was found to be almost equal to theoretical one. Consequently, experimentally measured frequency of the resonance absorption of the alternating electric field energy is very close to the theoretical frequency of the electron pair rotation in the applied permanent electric field.

Owing to unexpected peculiarities of their behavior in the external electric field paired electrons elude usual observation and remain in the shadow of researchers' attention. "Selfconcealment" of directly paired electrons impedes estimation of their possible importance in a lot of natural processes and phenomena. With regard to considered properties of paired electrons there has been proposed their ability to take part in "cold" nuclear reactions as a peculiar kind of a catalyst [15], inasmuch as they move orthogonally to a vector of an electric field strength and are capable to penetrate between a nucleus and an electron shell possibly causing its disturbance and making nuclei approach each other.

The research has shown that the main minerals of Chelyabinsk meteorite fragments are olivine (Fe, Mg)₂SiO₄ and pyroxene (Mg, Fe)₂Si₂O₆ [6]. There are also native iron, nickel and chromium in them. So that possible natural low energy nuclear fusion reactions can occur as follows:

$${}^{24}_{12}Mg + {}^{30}_{14}Si \Longrightarrow {}^{54}_{26}Fe + 17.886MeV$$

$${}^{26}_{12}Mg + {}^{28}_{14}Si \Longrightarrow {}^{54}_{26}Fe + 12.412MeV$$

$${}^{26}_{12}Mg + {}^{30}_{14}Si \Longrightarrow {}^{56}_{26}Fe + 13.825MeV$$

$${}^{29}_{14}Si \Longrightarrow {}^{58}_{28}Ni + 16.437MeV$$

$$2^{30}_{14}Si \Rightarrow {}^{60}_{28}Ni + 15.606MeV$$
$$2^{26}_{12}Mg \Rightarrow {}^{52}_{24}Cr + 10.772MeV$$

Mg and Si nuclei flow together forming a stable isotope Fe, or two Si nuclei turn into Ni nucleus, or two Mg nuclei turn into Cr nucleus. An oxygen nucleus does not take part in this process since it is double-magic and has a greater stability. All these reactions obey the conservation laws of charge, nucleon-number and isotopic spin. Energy yield of the reaction is calculated as the difference in rest energies of initial and ultimate products [19]. As mentioned above, paired electrons may act as an initiator of these reactions. As the heat release thereafter increases, the reaction may become self-sustained that seemingly has happened in Chelyabinsk. Reaction products have instantly evaporated and left a dense smoky trace in the air which has disappeared little by little and has not caused radioactive fallout since there have not been any radioactive materials. For 440 kt $(1.841 \cdot 10^{15} J)$ of explosion energy it is required $6.43 \cdot 10^{26}$ nuclear fusions in accordance with the first mentioned reaction, i.e. 32 kg of silicon and 25.6 kg of magnesium, the amount of which in that meteor was excessive.

Process history must depend on aggregative state, temperature, pressure and density of initial components as well as on characteristic of the electrical action on them. It is not inconceivable and even more probable that within certain conditions these reactions can occur calmly, without burst, therefore their research is of specific interest for the purpose of obtaining cheap and pure nuclear energy.

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A New Model Without Dark Matter for the Rotation of Spiral Galaxies: The Connections among Shape, Kinematics and Evolution

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Abstract It is proposed that the arms of spiral galaxies are formed by the continuous outflow of matter from their centers. It is then shown that the ratio between the radial and tangential velocities of the outflow is the parameter responsible for the logarithmic spiral structure of spiral galaxies. The fitting of some spiral galaxies to the model allows the calculation of the expansion velocities of matter in these galaxies and such values completely agree with the observational data. An approximate universal equation is proposed for the description of the arms of spiral galaxies with or without bars. Some important consequences are discussed with respect to dark matter, galactic evolution, cosmology, and the Milky Way. It is, particularly, concluded that dark matter does not exist in spiral galaxies.

Keywords Spiral Galaxies, Spiral Structure of Galaxies, Dark Matter

1. Introduction

The current status quo for the formation of the spiral structure in spiral galaxies is still based on the density wave theory which states that the matter of the disk becomes distributed in spiral arms due to the action of a wave-like perturbation in the form of quasi-steady global modes of the disk[1-3]. These three references are just examples of a long list of proposals within the same general framework. In this framework, of course, there would exist spiral galaxies of one type only, but as it is widely known spiral galaxies can be barred and non barred.

Other approaches defend that the spiral structure is a short-lived, transient phenomenon triggered by gravitational instabilities. Two of many references in this line are[4] and[5].

A quite simple argumentation against the density wave theory is that according to this theory we would have to have many spirals with 3, 4, and even 5 arms. Observations, however, have shown that almost all spirals have only two arms. Also, according to this theory there would not exist asymmetric galaxies such as lopsided spirals.

A very recent study by Foyle *et al.*[6] based on observations of 12 spiral galaxies discard the density wave theory in its simplest form as being an "important aspect of

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explaining spirals in large disk galaxies", but the authors wrongly conclude that the spiral structure is not a long-livedphenomenon. This paper, actually, completely rules out the density wave theory. We present a new and alternative model for the description of spiral galaxies based on the outflow of matter from their cores and show that the spiral structure is inherent to the existence of the galaxy. Outflows

of matter from the centers of galaxies have been reported since a long time ago. Let us present some examples. Very recent data[7] of NGC 6240, which is considered a typical protogalaxy show that "approximately 70\% of the total radio power at 20cm originates from the nuclear region $(\leq 1.5 \text{ kpc})$, of which half is emitted by two unresolved $(R \le 30 \text{ pc})$ cores and half by a diffuse component. Nearly all of the other 30% of the total radio power comes from an arm-like region extending westward from the nuclear region". NGC 2992 presents a jet-like structure and a circum-nuclear ring[8]. Falcke and Biermann[9] report that there is a large scale emission-like jet going outward from the core of NGC 4258 with a mass of about 4×10^{35} kg and with a kinetic power of approximately 10^{42} ergs/s and expansion velocity of about 2000km/s. Brunthaler et al.[10] report the first superluminal jet with a velocity of about 1.25c in the Seyfert spiral galaxy III Zw 2. For superluminal as well as subluminal speeds within physical media one must see[11].

Balmaverde and Capetti[12] have reported in 2006 that "Considering the radio structure, several objects of our Core G sample have a radio-morphology with well developed jets and lobes: UGC 7360, UGC 7494 and UGC 7654 are FR

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I radio-galaxies part of the 3C sample (3C 270, 3C 272.1 and 3C 274), while in the Southern sample we have the well studied radio-galaxies NGC 1316 (Fornax A), a FR II source, NGC 5128 (Cen A) and IC 4296. A literature search shows that at least another 11 sources have extended radio-structures indicative of a collimated outflow, although in several cases this can only be seen in high resolution VLBI images, such as the mass scale double-lobes in UGC 7760 or the one-sided jet of UGC 7386". Sturm et al.[13] have just reported massive molecular outflows from the centers of ultraluminous infrared galaxies (ULIRGs). As the authors state the terminal velocities in some of these outflows exceed 1000 km/s "and their outflow rates (up to \sim 1200 solar masses per year) are several times larger than their star formation rates". Middleberg et al.[14] report radio observation of the Seyfert galaxies NGC 7674, NGC 5506, NGC 2110 and Mrk 1210, and conclude that "Our results confirm and extend earlier work showing that the outward motion of radio components in Seyfert galaxies is non-relativistic on pc scale. We briefly discuss whether this non-relativistic motion is intrinsic to the jet-formation process" Muñoz-Tuñon and Beckman[15] analyze the consequences of mass outflows in the circumnuclear zones of galaxies. They have found "in addition to a ring structure in the gas, there is often measurable expansion with higher radial velocities occurring near the nucleus" and also they show that "radially progressive bursts of star formation can account for a wide range of these observed phenomena and could be related to the presence of liners in the interstellar medium close to the nucleus." On April 2011 Alatalo et al.[16] have reported the discovery of an AGN-Driven Molecular Outflow in the early-type galaxy NGC 1266 which is classified as an S0 without arms. The molecular outflow has a molecular mass of 2.4×10^7 Msuns. As the authors observe "The star formation in NGC 1266 is insufficient to drive the outflow, and thus it is likely driven by the active galactic nucleus (AGN)". A very important work that shows the initial formation of spiral arms in a galaxy is the paper of Stark et al.[17] entitled The formation and assembly of a typical star-forming galaxy at redshift $z \approx 3$. The authors report studies of a galaxy about 2-3 Gyr after the Big Bang. One of the very significant results of the work is the regular, bi-symmetric velocity field revealed by the O III emission lines measurements. Examining the velocity field in more detail, the authors extracted a rotation curve with a circular velocity of about 67 km/s. Figure 1 of the article clearly shows an arm-like structure. Mark Swinbank who is one of the authors, commenting on the paper on the site EurekAlert![18], has said that "The distribution of gas seen with our amazing resolution indicates we are witnessing the gradual build-up of a spiral disk with a central nuclear component". Recently, in 2001, Wilson et al. [19], using high resolution X-ray observations with Chandra, have managed to solve the puzzle concerning the anomalous ghostly opposite arms of M106 (NGC 4258) which are dominated by young stars: they are jets that originate in the nucleus of the galaxy.

Another aspect of the subject is provided by analyses of metalicity gradients in spiral galaxies. The NED/IAC/Caltec h document[20] on this issue is a thorough text which takes into account the works of many researchers. The text shows that the data for the Milky Way are in line with those from other spirals, and that the metalicity data expressed in terms of $12 + \log(O/H)$ decreases with the distance from the centers of spirals, clearly showing that their disks are younger than their bulges and that the hydrogen has its origin in the centers of galaxies.

Taking a closer look at the morphologies of some galaxies we can clearly see jets or arms coming out from their nuclei. It is the case of some galaxies classified as peculiar galaxies as those shown below in Figures 1, 2, 3, and 4 that have high redshifts. All pictures of UBVR images (UGC's and VV 114*) shown in figures 1, 2, 3, and 4 are credited to Hibbard, Liu and Armus[21].



Figure 1. UBVR image of UGC 04264*. The arms in the spiral galaxy are young and the lower arm is not affected by tidal forces from the interacting galaxies. Figure credited to Hibbard, Liu and Armus[21]



Figure 2. UBVR image of UGC 06748*. On the left we see a pair of interacting spiral galaxies with young arms. Figure credited to Hibbard, Liu and Armus[21]

A very enlightening image is that of UGC 04264* as shown in Fig. 1 where we see two young arms in the lower spiral galaxy. The lower arm is not affected by tidal forces. Still another clear example is the image of UGC 06748* (Fig. 2) where we can observe young arms being formed in the spiral galaxies. Observe that the top arm of the left galaxy and the right arm of the middle galaxy do not suffer tidal forces. The remarkable image below (Fig. 03) of UGC 08929* reveals the formation of a very young arm in the spiral galaxy. The arm is just beginning to curve and on the other side we already see some protuberance being formed.



Figure 3. UBVR image of a very young arm just beginning to curve in UGC 08929*. Observe the protuberance on the opposite side. UGC 06748*. Figure credited to Hibbard, Liu and Armus[21]

Fig. 4 below is another quite remarkable UBVR image of a young spiral galaxy in which the spiral arms are just being formed. We clearly notice that the upper arm is much more developed than the lower arm. It is worth mentioning that along with outflows of gases there are also inflows of gases towards the centers of galaxies. A particular inflow is actually the result of a previous outflow because if the outflow velocities are smaller than the escape velocity from the very massive center, the gases just fall back and suffer inflows. As it is well known this happens a lot in barred spirals.



Figure 4. Spiral arms just being formed in spiral galaxy VV 114* (Arp 236). Figure credited to Hibbard, Liu and Armus[21]

Closing this introduction let us address the mathematical description of the arms in spiral galaxies. It is well known that the arms of spiral galaxies are excellently described by a logarithmic spiral of the form

$$r = ae^{b\theta} \tag{1}$$

as proposed by Danvar[22]. The constants a and b are just constants which can be appropriately chosen.

2. The Model

Taking into account what was shown and discussed above this work proposes that the spiral arms are formed by the shedding of matter from the nuclei of spiral galaxies. This is actually an old idea, proposed in 1964 by Oki *et al.*[23]. So, let us consider that a certain extended mass of gas *m* is ejected from the bulge of the galaxy with a radial velocity v_r as is shown in Fig. 5. In the bulge the mass *m* was rotating with an angular velocity Ω . When it leaves the bulge at a later time v_{θ} is not affected by the radial driving forces that cause the shedding of matter, and as it is shown below the mass keeps the tangential velocity approximately constant because of conservation of the angular momentum. Let us recall again that *m* is not pointlike.



Figure 5. While the bulge sweeps an angle ϕ , the mass *m* makes an angle θ in its displacement from *A* to *P*.

The Milky Way and other galaxies show that the mass m frequently has the form of an arc of matter which gets approximately distributed along a spiral so that we have an equation of the form for the angular momentum of m

$$mRv_{\theta} = \sum_{i} m_{i} r_{i} v_{\theta_{i}}$$
(2)

where R is the radius of the bulge, v_{θ_i} are the tangential velocities of the different parts of the extended mass m which are located at r_i , just after having left the bulge. We notice that after having left the bulge the mass m can continue with an average v_{θ} given by

$$v_{\theta} = \frac{1}{mR} \sum_{i} m_{i} r_{i} v_{\theta_{i}} = \sum_{i} \left(\frac{m_{i}}{m}\right) \left(\frac{r_{i}}{R}\right) v_{\theta_{i}}$$
(3)

in which, since $m_i/m < 1$ and $r_i/R > 1$, v_{θ_i} can thus have values around v_{θ} . We obtain more detail on this if we analyze the behavior of the kinetic energy. Just before leaving the bulge the mass m (in the form or an arc, for example) has the kinetic energy

$$K = \frac{1}{2}m\left(v_r^2 + v_\theta^2\right) \tag{4}$$

and just after having left the bulge the mass m has the kinetic energy

$$K = \frac{1}{2} \sum_{i} m_{i} \left(v_{r_{i}}^{2} + v_{\theta_{i}}^{2} \right)$$
(5)

As K is constant across the border of the bulge, we obtain

$$\frac{dK}{dt} = \sum_{i} m_i \left(v_{r_i} \frac{dv_{r_i}}{dt} + v_{\theta_i} \frac{dv_{\theta_i}}{dt} \right) = 0 \qquad (6)$$

whose solutions are

 V_{r_i}

$$\frac{dv_{r_i}}{dt} + v_{\theta_i} \frac{dv_{\theta_i}}{dt} = 0$$
(7)

with
$$\frac{dv_{\theta_i}}{dt} \neq 0$$
, $\frac{dv_{\tau_i}}{dt} \neq 0$, and
 $v_{\tau_i} = const; v_{\theta_i} = const$ (8)

However, observations have shown that Nature prefers the solution given by Eq. (8), and our fittings below show that this is indeed the case. The reason for this lies in the fact that the driving forces that shed matter outward are radial forces and, hence, do no work in the direction of \vec{v}_{θ_i} . The simple arguments above show that the constancy of the tangential velocity of spiral galaxies is directly related to the ejection of matter from their bulges and to the conservation of mass, energy and angular momentum. Thus

$$v_{\theta} \approx const$$
 (9)

throughout the galaxy.

After having left the bulge, after a time interval Δt , the center of mass of the extended mass *m* will be located at point P, at a distance *r* from the center O (Fig. 5), and since v_{θ} remains approximately constant, we have

$$mr\omega = mr\frac{d\theta}{dt} = mR\frac{d\phi}{dt} = mR\Omega = mv_{\theta}$$
 (10)

where ϕ is the angle that the center of mass of m would have if it had not been ejected from the bulge, that is, it is the angle that the bulge made during the time interval Δt . Thus, Eq. (10) yields

$$\omega = \frac{R\Omega}{r} \tag{11}$$

From Eq. (10) we also obtain

$$d\theta = \omega dt = \frac{R\Omega}{r} dt = \frac{v_{\theta}}{rv_r} dr$$
(12)

because $v_r = \frac{dr}{dt}$.

At the bulge border the energy of the mass m (at point A in Fig 5) is equal to

$$E = \frac{1}{2}m\left(v_{ro}^{2} + v_{\theta o}^{2}\right) - G\frac{mM}{R}$$
(13)

where v_{ro} and $v_{\theta o}$ are the initial radial and tangential velocities of m, and M and R are the mass and radius of the bulge, respectively, and G is Newton's constant. At point P the energy is given by

$$E = \frac{1}{2}m(v_{r}^{2} + v_{\theta}^{2}) - G\frac{mM}{r} - G\frac{mM''}{r}$$
(14)

where M is the mass of the bulge and M'' is the mass of the disk up to distance r. Considering the disk as a flat

cylinder of height h we can write M'' as

$$M'' = \rho_D \pi \left(r^2 - R^2 \right) h \tag{15}$$

where ρ_D is the density of matter in the disk and *h* is the disk thickness. As the centers of galaxies and their bulges contain most of the mass, we can make $M \gg M''$, and using conservation of energy we obtain

$$v_r^2 = v_{ro}^2 - \frac{GM}{R} + \frac{Gm}{r}$$
(16)

in which we have also made the approximation $v_{\theta} \approx v_{\theta o}$. But $(2GM / R)^{1/2} = v_e$ is the escape velocity from the bulge, and thus, we can write

$$v_r^2 = v_{ro}^2 - \frac{v_e^2}{2} + \frac{v_e^2}{2} \frac{R}{r}$$
(17)

which can be written as

$$v_r^2 = \Delta V_{re}^2 + \frac{v_e^2}{2} \frac{R}{r}$$
(18)

where $\Delta V_{re}^2 = v_{ro}^2 - v_e^2/2$. The above equation can be written as

$$v_r^2 = \Delta V_{re}^2 \left(1 + \frac{v_e^2}{2\Delta V_{re}^2} \frac{R}{r} \right)$$
 (19)

(20)

And, thus, substituting this result into Eq. (12) e obtain

$$d\theta = \frac{v_{\theta}dr}{\Delta v_{re} \left[r^2 + \frac{v_e^2}{2\Delta V_{re}^2} Rr \right]^{1/2}}$$

in which $\Delta v_{re} = \sqrt{\Delta V_{re}^2}$. Eq. (20) can still be given by

$$\alpha d\theta = \frac{dr}{\left[r^2 + bRr\right]^{1/2}} \tag{21}$$

with
$$b = \left(\frac{v_e^2}{2\Delta V_{re}^2}\right)$$
 and $\alpha = \frac{\Delta v_{re}}{v_{\theta}}$. Eq. (21), solved

with the initial condition $\theta = 0$ for r = R, yields

$$\sqrt{r^2 + brR} + r + \frac{b}{2}R = R\left(\sqrt{1+b} + 1 + \frac{b}{2}\right)e^{\alpha\theta} \quad (22)$$

When the expulsion of matter is such that $\Delta V_{re}^2 \gg v_e^2$,

$$b \ll 1$$
, and then we have $\alpha \approx \Gamma = \frac{v_r}{v_{\theta}}$, and we obtain

$$r = Re^{\Gamma\theta} \tag{23}$$

which is Danvar equation, obtained from Newtonian Mechanics. But now we see that Γ is a very important parameter, directly related to the kinematics of the galaxy. It was deduced by de Souza quite some time ago[24,25]. Danvar equation is only valid if the initial radial velocity is much larger than the escape velocity from the bulge. This is an important information on the AGN of spiral galaxies.

2.1. The Differential Rotation of Spiral Galaxies

Substituting Eq. (23) into Eq. (11) we obtain

$$\omega = \frac{R\Omega}{r} = \frac{v_{\theta}}{r}R = \Omega e^{-\Gamma\theta}$$
(24)

and thus the arms lag the bulge exponentially with respect to θ . Eq. (24) is the very known differential rotation that

takes place in the disks of spiral galaxies. Since $\Omega = \frac{d\phi}{dt}$,

$$\phi = \frac{1}{\Gamma} \left(e^{\Gamma \theta} - 1 \right) \tag{25}$$

This relation is important because knowing the maximum θ for a certain spiral arm we can find the maximum value of ϕ and find out how much the bulge rotated since the beginning of the formation of that particular spiral arm. Of course, this is very important for studying galactic evolution. We can also define the lagging angle $\Psi = \phi - \theta$ (Fig. 6).



Figure 6. The lagging angle $\Psi = \phi - \theta$ which is measured with respect to the initial stream of matter, across a dimater of the bulge by an observer corotating with the bulge.

2.2. The Upper Mass Limit for a Spiral Galaxy

The condition $\Delta V_{re}^2 \gg v_e^2$ means that $v_{ro}^2 \gg v_e^2$ that yields the upper limit for the mass of a spiral galaxy, given by

$$M_{upper} = \frac{Rv_{ro}^{2}}{2G}$$
(26)

which is a very important quantity. For the Milky Way the bulge has a radius of about 6000 ly [26] and the radial velocity is about 130km/s[27], and thus the upper limit for its mass is about 5.4×10^{34} kg which is very consistent since its total mass is estimated as being about 10^{32} kg.

3. Application of the Model to Some Spiral Galaxies

We considered that Danvar equation is valid and applied it to some spirals. The number of galaxies of the sample was limited by the information on the velocity of radial outflows in galaxies. In all galaxies below the data points were visually captured with the use of the software plot digitalizer following a dust lane or bright stars. The respective error bars were estimated and are indicated for each case.

3.1. M51 (NGC 5194)

We followed the black dust lane of the lower arm in Fig. 7 below (the arm that goes towards M51B). We took the lagging angle $-\Psi$ with respect to the beginning of the arm, that is, with respect to $\phi = 0$, and thus, $\theta = -\Psi$ in intervals of 30° , and measured the corresponding values of r. The calculated values of Γ are shown on Table 1. The average value of Γ is 0.37 ± 0.01 , and thus $v_r / v_{\theta} = 0.37 \pm 0.01$.

On p. 1151 of their paper Shetty *et al.*[28] present a detailed analysis of v_r and v_{θ} in terms of an arm phase angle defined by the authors. It is clearly shown that v_r values vary around 50km/s and v_{θ} have values around 150km/s, and thus the ratio $\Gamma = v_r / v_{\theta} \approx 0.30$ is quite close to the above value of Γ . As we will see below this is, actually, the worst discrepancy.



Figure 7. For M51 (NGC 5194) we considered data points along the dust lane as shown above

Table 1. The calculated values of Γ for spiral galaxy M51

$\Delta \theta$	Г
30°	0.40 ± 0.03
60°	0.36 ± 0.02
90°	0.38 ± 0.01
120°	0.35 ± 0.01
150°	0.35 ± 0.01
180°	0.33 ± 0.01
210°	0.41 ± 0.01
240°	0.37 ± 0.01

3.2. M74 (NGC 628)

In this case we considered points corresponding to bright stars around the middle of the arm. We took the lagging angle as in the case of M51.

According to Fathi *et al.*[29] for NGC 628 (M74) v_{θ} is about 170 km/s and according to Ganda *et al.*[30] its v_r is about 65 km/s, and thus, $\Gamma \approx 0.38$ which is quite close to our calculated values above (Table 2) whose average is 0.34 ± 0.01 . Reference[30] data refer to the dispersion velocity (σ) data of 18 spiral galaxies, but the radial outflow velocity is σ in the radial direction because σ is the velocity of the gas after the subtraction of the circular velocity.

Fathi *et al.*[29] have also measured the dependence of the angular velocity of NGC 628 (M74) with respect to the distance to the center of the galaxy. Their results agree approximately with Eq (11) because according to Fig. 7 of their paper $\omega \approx 161.5/r$ for r between 1.9 kpc and 11 kpc, with ω in km/(kpc)s and r in kpc. For example, $\omega \approx 85$ km/(kpc)s for r = 1.9 kpc, and $\omega \approx 15$ km/(kpc)s for r = 10 kpc.

Table 2. The calculated values of Γ for spiral galaxy M74

$\Delta \theta$	Г
60°	0.31 ± 0.02
90°	0.35 ± 0.02
120°	0.39 ± 0.02
150°	0.37 ± 0.02
180°	0.36 ± 0.01
210°	0.35 ± 0.01
240°	0.32 ± 0.01
270°	0.31 ± 0.01
300°	0.29 ± 0.01

3.3. NGC 1300

As in the previous example, intervals of 30° were used along the dust lane of the lower arm (Fig. 8). The calculated values are shown on Table 3. Γ decreases too much above 120° , probably because, due to its shape, the arm is attracted a lot towards the bar. The average of the calculated values below is 0.50 ± 0.03 .

According to Aguerri *et al.*[31] $v_{\theta} \approx 220$ km/s and Lindblad *et al.* [32] report a v_r in the arms of the order of 120 km/s, yielding, thus, a value of $\Gamma \approx 0.545$ which is very close to the calculated values above.

3.4. NGC 4030

In this case, since the bulge is very fuzzy, we considered angular differences with respect to a baseline across the center of the nucleus. Table 4 presents the results whose average value is 0.37 ± 0.04 .

Ganda *et al.*[30] report a value $v_r \approx 90$ km/s and Mathewson \& Ford[33] say that v_{θ} is about 236 km/s, and, thus, $\Gamma \approx 0.38$ which is quite close to the above calculated average value.



Figure 8. We considered the dust lane of the lower arm of NGC 1300 for the fitting (NASA/HST photo)

able 3. The calculated values of	Γ for spiral galaxy NGC 1300
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$\Delta \theta$	Г
30°	0.52 ± 0.05
60°	0.53 ± 0.03
90°	0.54 ± 0.02
120°	0.42 ± 0.01

Table 4. The calculated values of Γ for spiral galaxy NGC 4030

$\Delta \theta$	Г
30°	0.39 ± 0.06
60°	0.36 ± 0.04
90°	0.36 ± 0.03
120°	0.37 ± 0.03

3.5. NGC 1042

We performed the fitting in the longer arm following very bright stars, in intervals of 30° . The calculated values for Γ are listed on Table 5 and their average value is about 0.69 ± 0.02 .

Ganda *et al.*[30] report $v_r \approx 50$ km/s and Kornreich *et al.*[34] present $v_{\theta} \approx 69.4$ km/s which yield $\Gamma \approx 0.72$ that is very close to our average value above. Therefore, this galaxy is more like a barred spiral.

$\Delta \theta$	Г
60°	0.66 ± 0.02
90°	0.70 ± 0.02
120°	0.73 ± 0.01
150°	0.66 ± 0.01

Table 5. The calculated values of Γ for spiral galaxy NGC 1042

3.6. NGC 4254

Figure 9 shows how the three arms of this very asymmetric galaxy were labeled, and Tables 6, 7 and 8 present the calculated values of Γ . We considered bright stars along the arms.



Figure 9. The three arms of NGC 4254 considered for the fitting (Photo by Teresa OKeefe and Jeff Lawrey/Adam Block/NOAO/AURA/NSF)

Ganda *et al.*[30] report for arm A a value of $v_r \approx 80$ km/s and Kornreich *et al.*[34] $v_{\theta} \approx 150$ km/s that yield $\Gamma \approx 0.53$ which is very close to the average value of Γ of Table 6 which is 0.51 ± 0.03 .

And now we can understand why this galaxy is so asymmetric: arm A has a larger radial velocity than arms B and C, and has a Γ value of arms of barred spirals. With the above average values of Γ ($\Gamma_B \approx 0.33 \pm 0.03$, and $\Gamma_C \approx 0.33 \pm 0.03$) for arms B and C we find that their radial velocities are approximately equal to 49.5 km/s which is much smaller than the radial velocity of arm A.

Table 6. The calculated values of Γ for arm A (Fig. 9) of NGC 4254

$\Delta \theta$	Г
30°	0.49 ± 0.04
60°	0.50 ± 0.03
90°	0.53 ± 0.03
105°	0.51 ± 0.01

Table 7. The calculated values of Γ for arm B (Fig. 9) of NGC 4254

$\Delta heta$	Γ
60°	0.32 ± 0.05
90°	0.32 ± 0.04
120°	0.33 ± 0.04
150°	0.35 ± 0.03
180^{o}	0.34 ± 0.02
210°	0.33 ± 0.02
240°	0.33 ± 0.01

Table 8. The calculated values of Γ for arm C (Fig. 9) of NGC 4254

$\Delta \theta$	Г
30°	0.31 ± 0.04
60°	0.32 ± 0.03
90°	0.37 ± 0.03

4. Discussion of Results

We clearly see that the results are consistent and the parameter b of the Danvar equation is the ratio $\Gamma = v_r / v_{\theta}$ and it is, thus, directly connected to the kinematics of the galaxy. This means that the shape of a spiral galaxy is directly connected to its kinematics and evolution. The arms of young spiral galaxies are small and old spiral galaxies have long arms. Therefore, a spiral galaxy unfolds itself from the inside out throughout time up to the exhaustion of the mass of its nucleus. And it does not get tightly wound as a consequence of the unfolding and winding because of the radial velocity v_r . Of course, the nucleus should diminish slowly with time since its mass is shed outward. The Milky Way is still shedding matter outwards and there is a lot of mass in its center yet, and so it will keep on going during quite a while, probably a couple of billion years. The calculation of the parameter Γ for a galaxy from the shape of its arms provides important

information on its kinematics and will be very useful for the study of spiral galaxies. The above calculations and results mean that if v_{θ} varied too much with r spiral galaxies would not exist at all. We immediately observe that most galaxies have not rotated much because of the following argumentation. Considering the ends of the arms of a spiral and taking the angular difference between them we obtain a certain $\Delta \theta$, and so we have the approximate relation

$$\frac{R_D \Delta \theta}{2R_D} \sim \frac{\nu_{\theta} \Delta t}{\nu_r \Delta t} = \Gamma^{-1} \tag{27}$$

where R_D is the disk radius. Thus, we have $\Delta \theta \sim 2\Gamma^{-1}$. For M51, for example, $\Delta \theta \sim 2 \times 0.37^{-1}$ rad = 5.4 rad = 1.72π . Taking a look at its photo we observe that it has barely completed a full turn. The same holds for M74, for which $\Delta \theta \sim 2 \times 0.34^{-1}$ rad = 5.9 rad = 1.9π rad. We can see from its photo that it has just made a full turn. For NGC 1300 we obtain $\Delta \theta \sim 2 \times 0.50^{-1}$ rad = 4 rad = 1.27π which is very consistent since it has just made a half turn. Therefore, Γ can be used to estimate the age of a spiral galaxy since the shedding of matter outward should begin in its first stages.

According to what was developed above there should exist a redshift cut-off above which galaxies appear without arms. These are the extremely young galaxies that have not yet become spiral galaxies. Also, according to what was shown above young spiral galaxies should have small spiral arms and old galaxies should have well developed arms, that is, long arms. For the latter we can choose the nearby galaxies. In order to avoid any bias with respect to this we considered the Nobeyama CO Atlas of Nearby Spiral Galaxies[35] which is a survey of 40 nearby spiral galaxies with low redshifts. Taking out of the survey the flocculent and purely disk galaxies we clearly observe that all the other galaxies have well developed arms, and many of them have long spiral arms with at least a full turn. On the other hand the young spiral galaxies of the Hubble Deep Field (HDF)[36] and Hubble Ultra Deep Field (HUDF)[36] surveys present short or very short arms. Some of the results of the Hubble Deep Field survey are discussed by Dawson[37] in his PhD thesis. On page 84 of his thesis he says "Careful, multi-wavelength morphological studies of the HDF-N reveal no galaxies with any kind of recognizable spiral structure at z>2 (Dickinson 2000). To wit, the redshift distribution of a sample of 52 late-type spiral and irregular galaxies complete to K < 20.47 shows a dramatic cut-off at $z \le 1.4$, with only two galaxies in the sample exceeding this limit (Rodighiero et al. 2000). Similarly, a combined photometric redshift / morphological data set complete to \$I<26.0\$ shows a sharp drop in the spiral galaxy distribution at \$z>1.5\$ (Driver et al. 1998). Specifically, in the $22 < \{I \ AB\}\} < 23$ magnitude bin, there are no spiral galaxies beyond z>1.5; in the $23<{I {AB}}<24$ magnit ude bin, there is only one."

4.1. Distinction between Barred and Non-barred Spiral Galaxies

We observe that with respect to the tangential velocity, barred spirals have larger radial velocities (expansion velocities) than non-barred spirals and that is why their spiral arms are more open, that is, less tightly wound. Analyzing more galaxies we can establish what the minimum value of Γ for a barred spiral.

4.2. Studies on Asymmetry in Spiral Galaxies

The measurement of \$\Gamma \$ by means of the spiral arms will enable us to study what is going on in asymmetric galaxies as we did above for the case of NGC 4254.

4.3. Consequences for the Milky Way

The tangential velocity of the Milky Way is about 220 km/s[28] and at our galactic longitude $v_r \approx 130$ km/s[28], so that $\Gamma \approx 0.59$ and, thus, the Milky Way is probably a barred spiral. And now, knowing its Γ we can calculate the shape of its arms.

4.4. Cosmological Consequences

We should readdress the time of galaxy formation because, according to the above results, galaxies were formed much earlier than what is presently considered. And since spirals were small when they were young, they probably were formed from quasars which is an old idea proposed by de Souza[38],[40] and Arp[39]. This agrees very well with the findings of the HDF and HUDF surveys.

4.5. Consequences for Dark Matter

We observe that the dynamics of the disk of a spiral galaxy is mainly dictated by v_r , v_{θ} and its ratio Γ , and v_{θ} is approximately constant in the disk because the driving forces that shed matter outward are radial forces and do no work on the perpendicular direction, and thus, cannot change v_{ρ} . Therefore, dark matter plays no role in the constancy of the tangential velocity of spiral galaxies. Actually, if dark matter existed, Γ would not be approximately constant and, thus, spiral galaxies would not exist at all. Therefore, dark matter does not exist in spiral galaxies. It is worth noting that, very recently, dark matter has suffered two great blows: The papers by Moni-Bidin et al. [41] and Pawlowski et al. [42] have shown that dark matter does not exist at all in the Milky Way. On the other hand Geha et al.[43] have found that the dynamics of the dwarf galaxy NGC 147 can be explained without any need of dark matter. Since galaxies should be composed of the same type of matter we can just say that dark matter does not exist at all.

Moreover, it is easy to see that dark matter has no place in Particle Physics due to the following argumentation. Particles are either fermions or bosons. As it is well known bosons do not clump together simply because they make the mediation between fermionic states. Thus, the supposed large volumes of dark matter cannot be composed of bosons. Therefore, dark matter would have to be composed of fermions, but from these we have to take out the baryons because baryons interact with light. Then, we are left with leptons, but only the light leptons (electron and neutrinos and their antiparticles) are stable. And also all leptons with mass are charged. This way dark matter would have to be composed of a very strange lepton that would have to have zero charge and be very massive, a WIMP. There is a very important question with respect to this proposal: where would the WIMP fit with respect to the 3 generations of fermions? Of course, it would not fit. It would have to be a particle of a separate generation of fermions. But the LHC did not find any new lepton. And Ahmed *et al.*[44] have presented the latest data on dark matter and have concluded that there is no WIMP with a mass below 10 GeV/ c^2 .

Therefore, it is more than clear that dark matter does not exist at all.

4.6. The AGN Engine

The values of Γ , v_r and v_{θ} above presented for barred and unbarred spirals can be of some help in the search for the nature of the AGN engine that powers spiral galaxies.

4.7. Bifurcation of Spiral Arms

In the light of what was developed above we can understand how a spiral arm can bifurcate into two arms: it happens when the radial velocity changes to a lower or upper value. This is a phenomenon that takes place a lot in spirals. This is another contribution for the understanding of AGN's.

4.8. Irregular Galaxies

Irregular galaxies are formed when the shedding of matter outward is done in a more chaotic way. In this case there may not exist any bipolar flow either. This means that in this case the outward flow has characteristics of an explosion.

5. Discussion of Results

We have presented a new model for the formation of the arms of spiral galaxies which is directly connected to their kinematics and evolution in which the Danvar equation is derived from Newtonian Mechanics. The application of the model to some spiral galaxies shows full consistency with the available experimental data. We did not fit more galaxies because of a lack of data on the outflow velocities in spiral galaxies. We have then discussed some important consequences of the results. The results reached in this paper show that dark matter does not exist at all in spiral galaxies.

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THE RESEARCH «RING-CHAIN» TAUTOMERISM OF 2-(1-H-1,2,4-TRIAZOL-5-YLTHIO)ACETALDEHYDES

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Abstract

Due to the complex using of instrumental methods of analysis(GC-MS, IR, ¹H NMR, X-ray) and chemical reactions (condensation, recovery, cyclization) is set a presence of «ring-chain» tautomerism in 2-((3-phenyl-1H-1,2,4-triazol-5-yl)thio)acetaldehyde (*1a*). As a result of the research revealed, that in solid form is dominated a «ring»-form, and in solution - a «chain»-form. Also, in a result of the X-ray research is revealed a crystal structure of 3-phenyl-5,6-dihydrothiazolo[2,3-c][1,2,4]triazol-5-ol.

Keywords:

2-(1-H-1,2,4-triazol-5-ylthio)acetaldehydes, «ring-chain», tautomerism.

1. Introduction

For the first time term «tautomery» was proposed by german scientist Konrad Laar for the characteristic of the dynamic equilibrium between two substances, that containing a mobile hydrogen atom [1]. On this stage of the chemical science development are examined different kinds of tautomeries [7-9]. Enough interesting kind is a «ring-chain» tautomerism (RCT). P.R. Jons in his own work characterizes RCT concept pretty detail [1]. For example, in his view realization of RCT phenomenonis possible in tautomery with open chain in case of the presence at least of two functional groups. First group must contain a double connection, second – is able to join this connection.On *Scheme 1* is depicted an example of two possible cyclic tautomers (II, III), form of which depends from the direction of functional groups connecting.

Analyzing a scientific literature is possible to note, that a«ring-chain» tautomerism in derivatives of heterocyclic systems, containing atoms of nitrogen is studied good enough [2-6]. However, to the derivatives of 1,2,4-triazole, namely 2-(1-H-1,2,4- triazol-5-ylthio)acetaldehydes is not given proper attention.

In a process of confirmation of the synthesized aldehydes structure, we faced with a problem of the data absence, typical for carbonyl group, in report Infrared

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spectroscopy (KBr), Nuclear magnetic resonance spectroscopy, X-ray crystallography. Based on specified higher, we did a supposition about the existence of 2-((3-phenyl-1H-1,2,4-triazol-5-yl)thio)acetaldehyde (1a) in a form of tritautomers (*Scheme 2*).So, aim of this work is setting of the presence and form of RCT 2-(1-H-1,2,4-triazol-5-ylthio)acetaldehydes, on example of 1a compound, which was synthesized by us earlier[10].



Scheme 1.«Ring-chain» tautomerism of compounds with double connection.(YZ-functional group with double connection, is able to X-group linking)



Scheme2. Possible tautomery forms for 2-((3-phenyl-1H-1,2,4-triazol-5yl)thio)acetaldehyde (1a).

2. Results and discussion

For achieve of the main aim we used two ways of the set task decision.First way – using of instrumental methods of analysis – chromatography-mass spectrometry (GC-MS), Infrared spectroscopy(IR), ¹H Nuclear magnetic resonance spectroscopy (¹HNMR), X-ray crystallography (X-ray). Second– application of chemical reactions: condensation, restoration, cyclization.

2.1.Instrumental analysis

For the conduction of research, *la* connection was purified by recrystallization [10].

For installation of purity and identity of synthesized 1a compound GC-MS was conducted. In a result of research installed, that in report is available peak with 100% area and with output time 0,866 min. Such facts give us an opportunity to confirm during the further research , that a connection is individual, and responsible with calculations of relative molecular mass.

At analysis of the received IR-spectra, which were obtained in KBr, were fixed bands of oscillation of the -C-S- groups at 690 cm⁻¹, instead are absent bands of oscillation within the limits of 2600-2550 cm⁻¹, that can point at the absence in a molecule – SH. At the detail analysis was observed the absence of oscillation groups, typical for 1,2,4-triazole core, namely NH- within the limits of 3100-3400 cm⁻¹. Characteristic feature is that in spectra are absence bands of aliphatic carbonyl group absorption within the limits of 1740-1720 cm⁻¹.

To confirm the presence of carbonyl group in synthesized compound, we obtained IR-spectra in chloroform. Enough important fact is that chloroform solution appears a band of low intensity absorption, typical for carbonyl group with the meaning 1715 cm^{-1} .

On the next stage we used ¹H Nuclear magnetic resonance spectroscopy. In ¹HNMR spectra available signals of phenyl radical protons in a form of doublet and multiplet with meanings 7,95 and 7,43 ppm. suitably. Also, available the proton resonating, connected with C_6 atom of 1,2,4-tiazole cycle in a triplet form by 6,1 ppm. (*Scheme 2*, form **B** and **C**). Conducted further analysis, it's possible to note, that a signal of the hydroxyl group proton (*Scheme 2*, form **B** and **C**) is screened by the signals of methylene groups proton of 1,2,4-tiazole cycle. So, methylene protons resonate as triplet and quartet at 4,3 and 3,65 ppm. suitably.

For the final verification of synthesized compound structure, we applied X-ray analysis (Fig.1). As a result of such analysis, installed a structure of synthesized compound, which responds 2-phenyl-5,6-dihydrothiazolo[3,2-b][1,2,4]triazol-6-ol (Scheme 2, form **B**).



Figure 1.Structure of 2-phenyl-5,6-dihydrothiazolo[3,2-b][1,2,4]triazol-6-ol.

2.2. Methods of chemical reaction

For establishment of RCT presence with using of instrumental analysis methods, we used series of reactions, typical for carbonyl compounds. Aldehyde *1a* condensation with aromatic hydrazines in acidic environment leads to the reception of 5-((2-(2-(2,4-dinitrophenyl)hydrazono)ethyl)thio)-3-phenyl-1H-1,2,4-triazole (*Scheme 3, 4a*). At the recovering of compound*1a*by sodium borohydride formed 2-((3-phenyl-1H-1,2,4-triazol-5-yl)thio)ethanol (*2a*). Cyclization of 2-((3-phenyl-1H-1,2,4-triazol-5-yl)thio)acetaldehyde in concentrated sulfate acid environment, phosphorus oxychloride and phosphoric acid in all cases leads to reception of 2-phenylthiazolo[3,2-b][1,2,4]triazole (*3a*).



Schema 3. Reactions of condensation, recovering and cyclization 2-((3-phenyl-1H-1,2,4-triazol-5-yl)thio)acetaldehyde.

3. Conclusions

It is set the presence of the «ring-chain» tautomerism for 2-((3-phenyl-1H-1,2,4-triazol-5-yl)thio)acetaldehyde, which caused by proton transition from imino-group of 1,2,4-triazolecore to oxygen atom of carbonil group. In a result of conduction IR-spectroscopy (KBr), ¹HNMR-spectroscopy, X-ray crystallography installed. that *1a* compound in solid form is being as 2-phenyl-5,6dihydrothiazolo[3,2-b][1,2,4]triazol-6-ol. (Schema 2,B). Records of the IR-spectra, received in chloroform, indicate on the existence 2-phenyl-5,6of dihydrothiazolo[3,2-b][1,2,4]triazol-6-olin open form (Scheme 2.A). This statement is confirmed by the row of chemical reactions. So, 2-phenyl-5,6dihydrothiazolo[3,2-b][1,2,4]triazol-6-ol forms corresponding hydrazone (4a), reducedto2-((3-phenyl-1H-1,2,4-triazol-5-yl)thio)ethanol (2a), dehydrated under the action of water absorbing reagents into 2-phenyl thiazolo[3,2-b][1,2,4]triazole (3a). Summing above specified, it is possible to note, that in solid form studied

compound is beingin a «ring» form (*Scheme* 2,B), in solution prevails a «chain»form (*Scheme*2, A).

4. Experimental protocols

Research physic-chemical properties of received compounds were conducted according with the methods, which are listed in State Pharmacopoeia of Ukraine. The melting temperature point identified by open capillary method on example of PTP (M). The structure of matter confirmed by means of elementary analysis on the example of Elementar Vario L cube (CHNS), IR-spectra (4000-400 cm⁻¹) were taken off on the module ALPHA-T (KBr, CHCl_{3HPLC}) of spectrometer Bruker ALPHA FT-IR. ¹H NMR-spectra of compounds were recorded by the means of DMSO_{d6}, «Mercury 400», solvent internal spectrometer standardtetramethylsilan (TMS). Chromatomas-spectral research conducted on the example of Agilent 1100 Series LC/MSD System, method of ionization - chemical ionization at atmospheric pressure (APCI). X-ray diffraction research conducted on the diffractometer «Xcalibur-3» (MoKa radiation, CCD-detector, graphitic monochromator ω -scanning , 2θ max. =50°).

The structure is decrypted by direct method for complex of programs SHELXTL [12].

4.1.2-((3-Phenyl-1H-1,2,4-triazol-5-yl)thio)acetaldehyde (1a):

General procedure for the preparations of 2-((3-Phenyl-1H-1,2,4-triazol-5-yl)thio)acetaldehyde and IR(KBr) records were described by us in previous work [10].

Yield, 90%, m.p.: 202-204°C. IR (CHCl_{3HPLC}) cm⁻¹: 3068 (NH); 1715 (-COH); 689 (-C-S-); ¹HNMR (400 Mz, DMSOd₆) δ ppm: 7.95 (d, 2H, Ar), 7.43 (m, 3H, Ar), 6.1 (t, 1H, -C-H), 4.3 (t, 2H, -CH₂), 3.65(q, 2H, -CH₂). GCMS; m/z 220; Elemental analysis: C₁₀H₉N₃OS, Calc.(%)/Found (%): C:54.78/54.74, H:4.14/4.18, N: 19.16/19.14 S: 14.62/14.64

Crystaldata:

In symmetrically independent part of elementary crystal cell situated two molecules(A i B), which are differ by measure of dihydrodiazol heterocyclic folding. At both conformers cycle is situated in a twist conformation. Deviation of C(1) and C(2) atom from plane, conducted through the atoms of the cycle, is 0.24 A and 0.18 A in molecule A, 0.29 A i 0.10 A in B.

Hydroxyl group is situated in pseudoaxial position (torsion angles C(3)- $N(1)-C(2)-O(1)-96(1)^{\circ}$ in A and $95(1)^{\circ}$ in B). Phenyl substituent is practically coplanar to area of the triazolcycle (torsion angles N(2)-C(4)-C(5)-C(6) 2(1)^{\circ} A, -8(2)^{\circ} B). Such its conformation, perhaps additionally stabilized by the attractive interactions C(6)-H(6)...N(2) 2.60 Å (molecule A), 2.57 Å (B) (sum of the vandervaaldse radius 2.66 Å) [11], C(10)-H(10)...N(3) 2.62 Å (A), 2.59 Å (B) (2.66 Å), which are cannot be considered as intermolecular hydrogen connections because of very sharp corners C-H...N (99° and 102° in A and B,accordingly).

In a crystal molecules A and B form zigzag similar chains along the crystallographic direction at the expense of intermolecular hydrogen connections

C(10)-H(10)...N(3)' (x-1, y, z) H...N 1.98 Å, C-H...N 158° A in A, 1.96 Å, 162° in B.. Neighboring chains connected between each other at the expense of intermolecular hydrogen chains C(2)-H(2)...N(2)' (-x-1, -y+1, -z+1 - A, -x, -y+1, z - B) H...N 2.52 Å, A,B, C-H...N 172° A, 167° B. Between each other molecules A and B connected at the expense of intermolecular hydrogen connections C(1B)-H(1BB)...C(7A)' (-x, -y+1, -z+1) H...C 2.81 Å, C-H...C 117°, C(8B)-H(8B)...S(1A)' (-x+1, -y+2, -z) H...S 2.89 Å, C-H...S 164. Length of the connections (Å) in A structure: S(1)-C(3)-1.70(1), S(1)-C(1)-1.81(1), O(1)-C(2)-1.37(1), N(1)-C(3)-1.36(1), N(1)-N(2)-1.40(1), N(1)-C(2)-1.40(1), N(2)-C(4)-1.36(1), N(3)-C(3)-1.32(1), N(3)-C(4)-1.43(1), C(1)-C(2)-1.55(1), C(4)-C(5)-1.32(1), N(3)-C(4)-1.43(1), C(1)-C(2)-1.55(1), C(4)-C(5)-1.43(1), C(4)-1.43(1), C(41.42(1), C(5)-C(10)-1.38(1), C(5)-C(6)-1.45(1), C(6)-C(7)-1.41(1), C(7)-C(8)-1.45(1), C(8)-C(9)-1.35(1), C(9)-C(10)-1.40(2).**B**:S(1)-C(3)-1.68(1), S(1)-C(1)-1.80(1), O(1)-C(2)-1.38(1), N(1)-C(3)-1.37(1), N(1)-N(2)-1.38(1), N(1)-C(2)-1.48(1), N(2)-C(4)-1.32(1), N(3)-C(3)-1.29(1), N(3)-C(4)-1.38(1), C(1)-C(2)-1.55(1), C(4)-C(5)- 1.44(1), C(5)-C(10)-1.34(1), C(5)-C(6)-1.41(1), C(6)-C(7)-1.43(1), C(7)-C(8)-1.41(1), C(8)-C(9)-1.40(1), C(9)-C(10)-1.39(1).

4.2.General procedure for the preparations of 2-((3-phenyl-1H-1,2,4-triazol-5-yl)thio)ethanol (2a):

To 2,19 g (0,01 mol) 1a in 50 methyl alcohol in portions, during 3 hours is added 0,74 g (0,02 mol) NaBH₄. Received solution remained at room temperature on 12 hours, diluted 100 ml H₂O and neutralized CH₃COOH to pH=7. Target compound extraget chloroform, which evaporated on the water heater. For the next experiences compound 2a has cleaned by the recrystallization from n-butanol.

Yield, 45%, m.p.: $128-130^{\circ}$ C. IR (KBr) cm⁻¹: 3071 (NH);1075 (-OH);689 (-C-S-); ¹HNMR (400 Mz, DMSOd₆) δ ppm: 8.21 (d, 2H, Ar), 7.26 (t, 3H, Ar),3.73 (s, 4H, -CH₂), 3.62 (s, 1H, -OH). GCMS; m/z 220; Elemental analysis: C₁₀H₁₁N₃OS, Calc.(%)/Found (%): C:54.28/54.19, H:5.01/5.09, N: 18.99/19.07 S: 14.49/14.52

4.3. General procedure for the preparations of 2-phenylthiazolo[3,2b][1,2,4]triazole (3a):

a)To 2,19 g (0,01 mol) of compound *Ia* adds 10 ml $H_2SO_4(98\%)$. Compound stayed on 36 hours to full dissolution of sediment, added 50 ml H_2O and neutralizing NaHCO₃ to pH=7. Forms a sediment, which filtered and washed by water.

b)To 2,19 g (0,01 mol) of compound *Ia* is added 15 ml POCl₃ (98%).Compound boils on the water heater, equipped by the inverse refrigerator during 4 hours. Received solution pours out on a crushed ice and neutralized NaHCO₃ to pH=7. Forms a sediment, which filtered and washed by water.

*c)*To 2,19 g (0,01 mol) of compound *Ia* is added 20 ml $H_3PO_4(85\%)$. Compound boils on the water heater, equipped by the inverse refrigerator during 20 hours, is added 50 ml H_2O and neutralized NaHCO₃ to pH=7. Forms a sediment, which filtered and washed by water.

For the next experience 3a compound has cleaned by recrystallization from nbutanol. Yield, 81%(a), 44%(b), 68%(c),m.p.: $108-110^{\circ}$ C. IR (KBr) cm⁻¹: 3084 (Ar-H);1466 (-Ar); 701 (tiophen), 667 (-C-S-);¹HNMR (400 Mz, DMSOd₆) δ ppm: 8.28 (d, 2H, Ar), 8.06 (d, 1H, thiazole), 7.36 (q, 3HAr); GCMS; m/z 201; Elemental analysis: C₁₀H₁₁N₃OS, Calc.(%)/Found (%): C:59.68/59.76, H:3.51/3.45, N: 20.88/20.85 S: 15.93/15.99.

4.4. General procedure for the preparations of 5-((2-(2-(2,4-dinitrophenyl)hydrazono)ethyl)thio)-3-phenyl-1H-1,2,4-triazole (4a):

To 2,19 g (0,01 mol) of compound 1a is added 15 ml CH₃COOH. Compound is warmed on water heater to dissolution and adds 1,98 g (0,01 mol) (2,4-dinitrophenyl)hydrazine. Continue the heating during 5 minutes, and leaved at room temperature on 24 hours for the formation of sediment, which filters. For next experiences 4a compound cleans by recrystallization with CH₃COOH.

Yield, 85%, m.p.: $123-125^{\circ}$ C. IR (KBr) cm⁻¹:1681 (-CH=N-);1329 (-NO₂), 696(-C-S-); ¹HNMR (400 Mz, DMSOd₆) δ ppm: 11.52 (s, 1H, NH-triazole), 8.88 (s, 1H,Ar), 8.20 (q, 3H,Ar), 7.99 (d, 2H, Ar); 7.88 (d, 1H, -CH=N-);7.45 (s, 1H, -NH-);4.08 (s, 2H, -CH₂);GCMS; m/z 399; Elemental analysis: C₁₆H₁₃N₇O₄S, Calc.(%)/Found (%): C:48.12/48.08, H:3.28/3.32, N: 24.55/24.50 S: 8.03/8.08.

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SYNTHESIS AND BIOLOGICAL PROPERTIES OF S-DERIVATIVES OF 5-HETERYL-4(R-AMINO)-1,2,4-TRIAZOLE-3-THIOLS

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Abstract

Novel derivatives of 5-heteryl-4-(R-amino)-1,2,4-triazole-thiols were synthesized in search of new biologically active substances. The structures of the compounds are revealed by the elemental analysis, IR spectroscopy, and ¹H NMR spectroscopy. The Quantitative Structure-Activity Relationship of the derived substances was studied.

1. Introduction.

Modern medicine always requires more drugs with acute new pharmacological activity and a small number of side effects. There is a plenty of soporific and analeptic medications, but they all have a whole range of side effects. Drugs regulating CNS functions include psychotropic, narcotic, and soporific medicines, as well as analgesics, anticonvulsants, and analeptic medications, etcetera. The activity of neurotropic drugs is based on their capability to change the process of the excitatory inter-neuron communication. Considering the character of the drug action on the human body, the medications are classified into inhibitory and excitatory ones, which are in their turn conditionally divided into substances with non-selective (for example, narcotics) and selective activity (analgesics, antianxiety and antiparkinson drugs, etc.).

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Medications, which have the 1,2,4-triazole nucleus in their structure and show antiseizure, analgesic, antidepressant, antimicrobial, and antifungal activity, proved to be reliable among novel promising low-toxic and highly effective medications [3-11, 13].

2. Chemistry

Such substances as 4-(4-chlorobenzylamino)-5-(heteryl)-4H-1,2,4-triazole-3thiol and 4-(furan-2-ylmethylamino) were used as precursors, with previously derived [11] fragments of pyridine nucleus (I, II, III, IV, V, VI Tabl. 1) serving as heteryl substituents. The synthesis of 2-(4-(4-chlorobenzylamino)-5-(heteryl)-4H-1,2,4-triazole-3-ylthio)-1-(R)ethanones and 2-(4-(furan-2-ylmethylanimo)-5-(heteryl)-4H-1,2,4-triazole-3-ylthio)-1-(R)ethanones (compounds Ia, IIa, IIIa, IIIb, IVa, Va, Vb, VIa Tabl.1) is performed by the interaction of the corresponding thiols (compounds I, II, III, IV, V, VI Tabl. 1) with α-halogenketones (2-bromine-1-(4-methoxyphenyl)ethanone and 2-bromine-1-(3-methoxypnenyl)ethanone) in methanol base (1). The substances of 2-(4-(4-chlorobenzylamino)-5-(heteryl)-4H-1,2,4-triazole-3-ylthio)-1-(R)ethanols 2-(4-(furan-2-ylmethylamino)-5and (heteryl)-4H-1,2,4-triazole-3-ylthio)-1-(R)ethanols (2) are synthesized by adding double amount of sodium borohydride to the corresponding ketones in the methyl alcohol and water base in proportion of 30:1. The solution is filtered in 24 hours and neutralized by acetic acid. The sediment of corresponding alcohols is formed (compounds lb, IIIc, IIId, IVb, Vc, Vd, VIb).



Scheme 1. Synthesis of 2-(4-(R₂-amino)-5-R-4H-1,2,4-triazole-3-ylthio)-1-(R₁) ethanones and 2-(4-(R₂-amino)-5-R-4H-1,2,4-triazole-3-ylthio)-1-(R₁)ethanols.

3. Results and discussion

The structures of the synthesized compounds were confirmed by analytical (Table 1) and spectral data (IR, ¹H NMR) (Table 3, Table 4) [2]. The IR-spectra of Ia, IIa, IIIa, IIIb, IVa, Va, Vb, VIa exhibited C=O bands in the 1697-1657 cm⁻¹. The absorption bands at 705-570 cm⁻¹ are due to the presence of -C-S-. The evident fluctuation bands are characteristic to the groups of 1,2,4-triazole nucleus: NH- within 3400-3100 cm⁻¹, -C=N-1681-1606 cm⁻¹. The ¹H NMR spectra of compounds Ia, IIa, IIIa, IIIb, IVa, Va, Vb, VIa reveals OCH₃ within the interval of 3,63 – 3,84, as well as N-CH₂ within the interval of 3,90 – 4,31 and CO-CH₂ within the interval of 4,93 – 5,03.

Table 1.Physical and chemical constants of 4-(4-chlorobenzylamino)-5-R-4H-1,2,4-triazole-3-thiols and N-(4-chlorobenzyl)-3-R₁-5-R-4H-1,2,4-triazoles-4-amines.



Comp	R	R ₁	\mathbf{R}_2	M.p. ⁰ C	Formula	Yield
d						(%)
Ι	pyridin-	Н	4-	193-195	$C_{14}H_{12}CIN_5S$	59,79
	2-yl		chlorobenzyl			
Ia	pyridin-	CH ₂ COC ₆ H ₄ O	4-	146-148	$C_{23}H_{20}ClN_5$	83,69
	2-yl	СН ₃ -п	chlorobenzyl		O_2S	
Ib	pyridin-	CH ₂ CHOHC ₆ H	4-	40-42	$C_{23}H_{22}ClN_5$	52,63
	2-yl	₄ ОСН ₃ -п	chlorobenzyl		O_2S	
II	pyridin-	Н	furan-2-	148-150	$C_{12}H_{11}N_5OS$	63,09
	2-yl		ylmethyl			
IIa	pyridin-	CH ₂ COC ₆ H ₄ O	furan-2-	113-115	$C_{21}H_{19}N_5O_3$	68,88
	2-yl	СН3-м	ylmethyl		S	
III	pyridin-	Н	4-	217-219	$C_{14}H_{12}ClN_5S$	75,84
	3-yl		chlorobenzyl			
IIIa	pyridin-	CH ₂ COC ₆ H ₄ O	4-	137-139	$C_{23}H_{20}ClN_5$	62,23
	3-yl	СН ₃ -м	chlorobenzyl		O_2S	
IIIb	pyridin-	CH ₂ COC ₆ H ₄ O	4-	118-120	$C_{23}H_{20}ClN_5$	73,18
	3-yl	СН ₃ -п	chlorobenzyl		O_2S	
IIIc	pyridin-	CH ₂ CHOHC ₆ H	4-	52-55	$C_{23}H_{22}ClN_5$	40,66
	3-yl	₄ ОСН ₃ -м	chlorobenzyl		O_2S	
IIId	pyridin-	CH ₂ CHOHC ₆ H	4-	42-44	$C_{23}H_{22}ClN_5$	39,47

	3-yl	₄ ОСН ₃ -п	chlorobenzyl		O_2S	
IV	pyridin-	Н	furan-2-	105-107	$C_{12}H_{11}N_5OS$	71,83
	3-yl		ylmethyl			
IVa	pyridin-	CH ₂ COC ₆ H ₄ O	furan-2-	178-180	$C_{21}H_{19}N_5O_3$	54,98
	3-yl	СН ₃ -п	ylmethyl		S	
IVb	pyridin-	CH ₂ CHOHC ₆ H	furan-2-	38-40	$C_{21}H_{21}N_5O_3$	42,76
	3-yl	₄ ОСН ₃ -п	ylmethyl		S	
V	pyridin-	Н	4-	270-272	$C_{14}H_{12}ClN_5S$	75,00
	4-yl		chlorobenzyl			
Va	pyridin-	CH ₂ COC ₆ H ₄ O	4-	120-122	$C_{23}H_{20}ClN_5$	66,67
	4-yl	СН3-м	chlorobenzyl		O_2S	
Vb	pyridin-	CH ₂ COC ₆ H ₄ O	4-	80-82	$C_{23}H_{20}ClN_5$	70,38
	4-yl	СН ₃ -п	chlorobenzyl		O_2S	
Vc	pyridin-	CH ₂ CHOHC ₆ H	4-	52-54	$C_{23}H_{22}ClN_5$	22,66
	4-yl	₄ ОСН ₃ -м	chlorobenzyl		O_2S	
Vd	pyridin-	CH ₂ CHOHC ₆ H	4-	50-52	$C_{23}H_{22}ClN_5$	39,47
	4-yl	₄ ОСН ₃ -п	chlorobenzyl		O_2S	
VI	pyridin-	Н	furan-2-	226-228	$C_{12}H_{11}N_5OS$	66,66
	4-yl		ylmethyl			
VIa	pyridin-	CH ₂ COC ₆ H ₄ O	furan-2-	119-121	$C_{21}H_{19}N_5O_3$	60,80
	4-yl	СН3-п	ylmethyl		S	
VIb	pyridin-	CH ₂ CHOHC ₆ H	furan-2-	53-55	$C_{21}H_{21}N_5O_3$	46,05
	4-yl	₄ ОСН ₃ -п	ylmethyl		S	

Compd.	Required, %				Found, %				
	С	Η	Ν	S	С	Н	Ν	S	
Ι	52,91	3,81	22,04	10,09	52,75	3,79	22,04	10,04	
Ia	59,29	4,33	15,03	6,88	59,58	4,34	15,10	6,87	
Ib	59,03	4,74	14,97	6,85	59,26	4,73	15,02	6,88	
II	52,73	4,06	25,62	11,73	52,88	4,04	25,54	11,76	
IIa	59,84	4,54	16,62	7,61	60,01	4,55	16,57	7,63	
III	52,91	3,81	22,04	10,09	52,91	3,79	21,90	10,12	
IIIa	59,29	4,33	15,03	6,88	59,17	4,34	14,95	6,89	
IIIb	59,29	4,33	15,03	6,88	59,05	4,31	15,06	6,85	
IIIc	59,03	4,74	14,97	6,85	58,85	4,76	14,89	6,87	
IIId	59,03	4,74	14,97	6,85	58,85	4,75	15,01	6,87	
IV	52,91	3,81	22,04	10,09	53,06	3,83	22,15	10,05	
IVa	59,84	4,54	16,62	7,61	59,54	4,55	16,53	7,58	
IVb	59,56	5,00	16,54	7,57	59,32	4,98	16,49	7,60	
V	52,91	3,81	22,04	10,09	53,06	3,83	22,15	10,05	
Va	59,29	4,33	15,03	6,88	59,09	4,31	15,10	6,91	
Vb	59,29	4,33	15,03	6,88	59,52	4,31	15,07	6,92	
Vc	59,03	4,74	14,97	6,85	58,73	4,74	14,94	6,83	
Vd	59,03	4,74	14,97	6,85	59,32	4,76	15,04	6,83	

VI	52,73	4,06	25,62	11,73	52,57	4,08	25,72	11,69
VIa	59,84	4,54	16,62	7,61	59,66	4,56	16,68	7,64
VIb	59,56	5,00	16,54	7,57	59,38	4,99	16,58	7,55

4. Biological activity

We applied the interaction of the researched substances with the narcotic substances to the rats. The phenomenon of potentiating of sodium thiopental narcosis (30 mg/kg) by new 1,2,4-triazole derivatives was studied in the research.

For the goal to be achieved, the researches were conducted on the intact white non-linear rats of different gender weighing from 90 to 210 grams with 7 animals in each group. Polysorbat-80 stabilized (for those insoluble in water) water suspension of 1,2,4-triazole derivatives and water solution (for those soluble in water) of compounds (in dose of 1/10 from LD_{50} with 1 ml of solution\suspension for 100 gram of the animal's weight) were to be taken per os 1 hour before the injection of sodium thiopental. The duration time of the sodium thiopental narcosis action was judged in accordance to the period of time during which the animal was lying on its side, to be more distinct, since the moment of turn-over reflex disappearance. As the comparison etalon, Aminazine and Caffeine and sodium benzoate were used, with them being injected in doses of 10mg/kg and 50mg/kg correspondently [1].

5. Conclusion.

The study of the effect of 5-heteryl-4-(R-amino)-1,2,4-triazole-3-thiols derivatives on the central nervous system demonstrates that these compounds show activity in the interval of -89,40 – 274,17% (P < 0,05). The most evident analeptic effect is shown by 2-((4-((4-chlorobenzyl)amino)-5-(pyridin-4-yl)-4H-1,2,4-triazole-3-yl)thio)-1-(4-methoxyphenyl)ethanol (compound Vd), which contains pyridine-4-yl substituent by the C₅ carbon atom of 1,2,4-triazole cycle, 4-chlorobenzyl substituent compounded with the amino group by N₄ atom, and (4-methoxyphenyl)ethanol by the sulphur atom. 2-((4-((4-chlorobenzyl)amino)-5-(pyridin-3-yl)-4H-1,2,4-triazole-3-yl)thio)-1-(3-methoxyphenyl)ethanone demonstrates the inhibitory effect and exceeds the comparison etalon by 59,54 % (P < 0,05).

The moderate inhibitory effect is demonstrated by such compounds as I, II, IIIb, V, Va, with their activity increased within the interval of 18,84 - 176,62% (P < 0,05). Among them, the most significant inhibitory effect is shown by 2-((4-((4-chlorobenzyl)amino)-5-(pyridin-3-yl)-4H-1,2,4-triazole-3-yl)thio)-1-(4-methoxyphenyl)ethanone, which contains 4-chlorobenzyl radical that is compounded with the amino group by N₄ atom, the substitution of which with furan-2-ylmethyl atom causes the decrease of the effect (compound II, IV).

The substitution of the pyridine-3-yl substituent with the pyridine-4-yl one and the reduction of the ketogroup in the molecule of 2-((4-((4-chlorobenzyl)amino)-5-(pyridin-3-yl)-4H-1,2,4-triazole-3-yl)thio)-1-(4-methoxyphenyl)ethanone cause the analeptic effect.

Table 2. The effect of 5-heteryl-4-(R-amino)-1,2,4-triazole-3-thiols derivatives on the central nervous system.

N⁰	Compound code	Average duration of	Control group	comparison
п/п	_	sleep in rats, M±m	proportion, Δ %	_
1	Control	53,82±2,064	0	
2	Aminazine	175,21±23,997	225,57	
3	Sodium	16,80±31,193	-68,78	
	caffeine-			
	benzoate			
4	Ι	79,35±12,788	47,44	
7	II	71,60±5,888	33,05	
9	III	63,96±6,191	18,84	
10	IIIb	148,87±20,525	176,62	
11	IIIc	39,96±23,196	-25,75	
12	IIId	42,83±4,796	-20,41	
16	V	85,84±6,740	59,50	
17	Vc	40,85±5,303	-24,10	
18	VI	56,03±7,857	4,11	
21	Control	52,74±4,533	0	
22	Aminazine	165,93±22,464	214,63	
23	Sodium	19,54±28,773	-62,95	
	caffeine-			
	benzoate			
24	IIIa	213,90±36,287	274,17	
25	Va	83,04±7,110	37,58	
26	Vb	30,78±3,840	-46,16	
27	Vd	6,40±12,053	-89,40	

6. Experimental protocols.

Researches of physical and chemical properties of the compounds got by us were conducted accordingly to methods which are resulted in State Pharmacopoeia of Ukraine. The temperature of melting was defined by the opened capillary method on the device of PTP (M). The structure of matters is confirmed by the element analysis on the device of Elementar Vario L cube (CHNS), IR-spectra (4000-400 cm⁻¹) were taken off on the module of ALPHA-T (KBr) of Bruker ALPHA FT-IR spectrometer. The ¹H NMR-spectra of compounds were written by the spectrometer of «Mercury-400», with DMSO_{d6} used as a solvent.

 $6.1 \ \text{General procedure for the synthesis of } 2-((4-((\text{furan-2-ylmethyl})\text{amino})-5-(R)-4H-1,2,4-\text{triazole-3-yl})\text{thio})-1-(R_1)\text{ethanone} \\ and 2-((4-((4-((4-((A-(R_1))(1+(A-(R$

0,01 mol of NaOH is added to 0,01 mol of 4-(4-chlorobenzylamino)-5-R-4H-1,2,4-triazole-3-thiol or 4-(furan-2-ylmethylamino)-5R-4H-1,2,4-triazole-3-thiol, in which R is pyridin-2-yl, pyridin-3-yl or pyridin-4-yl, in methanol base. It is warmed till the sediment dissolves. Then 0,01 mol of α -halogenketone (2-bromine-1-(4-methoxyphenyl)ethanone or 2-bromine-1-(3-methoxyphenyl)ethanone) is added. It is boiled till the neutral pH base is formed. It is vaporized. Then it is over-crystallized from methanol, ethanol or n-propanol.

6.2 General procedure for the synthesis of 2-((4-((4-chlorobenzyl)amino)-5-(heteryl)-4H-1,2,4-triazole-3-yl)thio)-1-(R)ethanol and 2-((4-((furan-2-ylmethyl)amino)-5-(heteryl)-4H-1,2,4-triazole-3-yl)thio)-1-(R)ethanol.

The double amount of sodium borohydride is added to 0.01 mol of 2-(4-(4-chlorobenzylamino)-5-(R)-4H-1,2,4-triazole-3-ylthio)-1-(R₁)ethanone or 2-(4-(furan-2-ylmethylamino)-5-(R)-4H-1,2,4-triazole-3-ylthio)-1-(R₁)ethanone, where R is pyridin-2-yl, pyridin-3-yl or pyridin-4-yl and R₁ is 3-methoxyphenyl or 4-methoxyphenyl, in methyl alcohol and water base in proportion of 30:1. The solution is filtered in 24 hours and neutralized by acetic acid, after that the

sediment of corresponding alcohols appears. The sediment is filtered and overcrystallized from methanol (compounds Ib, IIIc, IIId, IVb, Vc, Vd, VIb).

No.	C=O	C=N,	NH	No.	C=O	C=N,	NH	No.	C=O	C=N,	NH
		C=C				C=C				C=C	
Ia	1674	1596	3310	IIIc		1599	3225	Vb	1657	1596	3290
Ib		1586	3300	IIId		1596	3230	Vc		1600	3290
IIa	1678	1581	3260	IVa	1660	1594	3340	Vd		1606	3218
IIIa	1697	1596	3330	IVb		1595	3330	VIa	1666	1595	3300
IIIb	1683	1597	3259	Va	1697	1597	3360	VIb		1605	3245

Table 3. Infra red (KBr, cm⁻¹) Spectral Data for Compounds

Table 4. ¹H-NMR Spectral Data for Compounds

No.	¹ H-NMR (DMSO-d ⁶ δ ppm
Ia	3,78 (s, 3H, OCH ₃), 4,09 (s, 2H, N-CH ₂), 5,03 (s, 2H, CO-CH ₂), 7,02 (d, 2H, Ar-H), 7,21
	(q, 3H, Py-H), 7,49 (m, 7H, Ar-H), 8,62 (d, 2H, Ar-H), 8,85 (s, 1H, Py-H)
IIa	3,71 (s, 3H, OCH ₃), 3,90 (s, 2H, N-CH ₂), 5,01 (s, 2H, CO-CH ₂), 6,05 (d, 2H, Fur-H), 7,01
	(d, 2H, Ar-H), 7,21 (q, 3H Ar-H), 7,53 (m, 7H, Ar-H), 7,97 (d, 2H, Ar-H), 8,62 (d, 2H,
	Py-H), 8,85 (s, 1H, Py-H)
IIIa	3,79 (s, 4H, OCH ₃), 4,05 (s, 2H, N-CH ₂), 4,97 (s, 2H, CO-CH ₂), 7,00 (d, 2H, Ar-H), 7,17
	(q, 4H, Ar-H), 7,53 (m, 7H, Ar-H), 8,05 (d, 1H, Py-H), 8,63 (d, 1H, Py-H), 8,86 (s, 1H,
	Py-H)
IIIb	3,70 (s, 3H, OCH ₃), 4,06 (s, 2H, N-CH ₂), 4,99 (s, 2H, CO-CH ₂), 6,94 (d, 2H, Ar-H), 7,15
	(q, 3H, Ar-H), 7,55 (m, 7H, Ar-H), 7,95 (d, 1H, Py-H), 8,60 (d, 1H, Py-H), 9,20 (s, 1H,
	Py-H)
IVa	3,81 (s, 3H, OCH ₃), 4,31 (s, 2H, N-CH ₂), 4,93 (s, 2H, CO-CH ₂), 6,05 (d, 2H, Fur-H), 7,12
	(d, 2H, Ar-H), 7,38 (d, 1H, Ar-H), 7,54 (s, 2H, Py-H), 8,05 (d, 1H, Fur-H), 8,42 (d, 1H,
	Ar-H), 9,17 (s, 1H, Py-H)
Va	3,63 (s, 4H, OCH ₃), 4,06 (s, 2H, N-CH ₂), 5.00 (s, 2H, CO-CH ₂), 6.99 (d, 2H, Ar-H), 7,19
	(q, 3H, Ar-H), 7,57 (m, 7H, Ar-H), 8,03 (d, 1H, Py-H), 8,35 (d, 1H, Ar-H), 8,75 (d, 2H,
	Py-H)
Vb	3,74 (s, 3H, OCH ₃), 4,15 (s, 2H, N-CH ₂), 5.01 (s, 2H, CO-CH ₂), 7,05 (d, 2H, Ar-H), 7,34
	(q, 4H, Ar-H), 7,82 (d, 2H, Ar-H), 8,00 (d, 2H, Py-H), 8,63 (d, 2H, Py-H)
VIa	3,84 (s, 3H, OCH ₃), 4,15 (s, 2H, N-CH ₂), 4,95 (s, 2H, CO-CH ₂), 6,12 (d, 2H, Fur-H), 7,07
	(d, 2H, Ar-H), 7,39 (d, 2H, Ar-H), 7,81 (d, 2H, Ar-H), 8,03 (d, 2H, Py-H), 8,61 (d, 2H,
	Py-H)

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ALGORITHM OF DIVISION OF THE CONFIDENTIAL KEY OF THE DIGITAL SIGNATURE

In article are considered questions of division of a confidential key of a digital signature without disclosure of parts.

Keywords: secret divisions, digital signature.

Introduction. The protocol it is distributed algorithm with two and more participants. The protocol is cryptographic if it solves, at least, one of three problems of cryptography: ensuring confidentiality, integrity, not traceability [1]. Components of the protocol are participants of the protocol, communication channels between participants, and also the algorithms which used by participants, or statement of that task which the protocol is urged to solve. Protocol named cryptographic only in that case when in its basis lies any cryptographic idea. Protocols of division of secret are urged to solve a problem of storage of information so that those groups of people it would be allowed to them to know a secret, could restore it, and those groups it isn't not allowed to them to know a secret, could restore it even by search [2]. In the protocol of division of secret there are *n* of the participants called also by subscribers (we will designate their *P1*, *P2*, ..., *Pn*), and one allocated participant of *D*, called by the dealer, or distributing. Set of all subscribers we will designate $P = \{P1, P2, ..., Pn\}$.

The resolved group, or group of access, we will call a nonempty subset $A \subseteq P$ of participants who, if having gathered, have the right to receiving a secret. Structure of access Γ we will call a nonempty set of all groups of access of the scheme. Then we will think that any subscriber from P is included at least into one group of access, differently presence of such subscriber at P it is senseless. Also we consider that Γ it is closed, so, if $A \subseteq B \subseteq P$, and $A \in \Gamma$, so $B \in \Gamma$. Really, if subscribers P1, P2,...,Pk can restore in common a secret, so, if some more subscribers join them Pk+1, ..., Pk+t, the turned-out group especially will be able to restore a secret. The protocol of division of secret consists from two main phases [3].

1. On a distribution phase, or divisions of secret - the dealer knowing a secret of m, generates n of parts of secret of m1, m2, ..., mn and sends mi share to the participant of Pi (i=1,...,n) on the defended communication channel. Distribution has to be organized so that the resolved groups of participants, having gathered, could restore unambiguously m secret, and not resolved – couldn't.

2. On a phase of restoration of secret any group of structure of access of unites the parts of secrets of mi (i=1,...,n) so that to receive *m* secret.

Main material of research. Protocols of division of secret are applied to the distributed storage of information. Most often confidential keys or passwords of any subscriber appear such information.

Secret division, or division of keys, represents procedure of crushing of a confidential key on some

parts by means of a special technique so that possibility of enciphering or decoding of messages arose only on condition of collecting all parts together. The main destination of this technology — equal participation in cryptographic operations of several users who aren't trusting each other, as the uniform person [5].

For example, three co-owners of firm wish to read all ciphered correspondence under any contract only in case of personal presence of all three. Other widespread example — application in schemes of deposition of keys: the pass of a confidential key to one authorized representative places the owner of a key in storage in a complete dependence from it, and here division (between two and more independent participants) allows though somehow to be defended in a possible arbitrariness.

So, we enter more strict concept of the scheme of division of secret. At first - receive some designations [4].

For any function $f: X \to Y$ and for any $A \subseteq X$ through f^A we will designate restriction of f on A (that is $f A: A \to Y: fA(x) = f(x)$ for all $x \in A$).

P – final great number of participants of the scheme of division of secret;

 Γ – access structure on P with the properties, closed;

M – final set of secrets which can be divided in the scheme;

S – final set of parts of secrets;

Fm for each $m \in M$ – a final set of rules of division of secret of *m* where each rule is function *f*: $P \rightarrow S$, computable for polynomial time;

G – the rule of restoration of secret, that is algorithm of polynomial complexity with $FA = \{f A: f \in Fm, m \in M, A \in \Gamma\}$ and area of values of M, possessing property G(f A) = m for all $m \in M$, $f \in Fm$, $A \in \Gamma$.

Then the general scheme of division of secret [4] is defined by a set of $D = (P, \Gamma, M, S, \{Fm: m \in M\}, G)$. Concerning *D* and Γ say that the scheme of division of secret of *D* realizes structure of access of Γ .

Earlier was noted isolation of Γ . Besides, we will notice that on property of the rule of restoration of secret, for any $A \in \Gamma$ and for any rules of division of secret of $f \in Fm$, $f^* \in Fm^*$ from this $m \neq m^*$ so $f A \neq f^* A$. Let further everywhere $F = \bigcup_{m \in M} F_m$.

The scheme of division of secret is called perfect [4], if for any $A: AP, A \notin \Gamma$ and for any $f \in F u \ m^* \in M$ exists $f^* \in Fm^*$: $f A = f^*A$. It means that on f A any of secrets $m^* \in M$ we won't distinguish from secret m. Other words, in case of the perfect scheme of division of the secret, not authorized group of participants, having united the parts of secret, can't reject any of secrets in M as impossible.

For each participant of $Pi \in P$ we will determine $S(Pi) = \{f(Pi): f \in F\}$ – a set of parts of the secret getting to *i* to the participant. Let

$$\rho(\mathrm{Pi}) = \frac{\log|M|}{\log|S(P_i)|}; \quad \rho = \min_{P_i \in P} \rho(P_i)$$

Size ρ is called as the speed of information of the scheme of D [4]. It serves as an indicator of efficiency of the scheme of D and shows how lengths (in bits) a divided secret and its parts in the scheme

correspond. The more this indicator, the more strongly the maximum length of a share of secret surpasses length of the secret. Such scheme of division of secret, for which $\rho = 1$ is called ideal.

Theorem. In the perfect scheme of division of secret $\rho \leq 1$ [4].

Shamir's scheme is perfect and ideal [5]. Ideality follows from this that the size of secret is equal to the size p, as well as the size of the share, relying to each participant. To show a sovershennost, we will put that the secret in Shamir's scheme is restored by a solution of system of comparisons. Not resolved great number of participants will make system from less, than k of comparisons with k unknown. The decision of such system is the set, the points lying on hyperplane in k-dimensional space, and, so no value of secret can be rejected as impossible.

Let's describe formally and we will show, how on the basis of the description, (n, n) – the threshold scheme of division of secret, it is possible to construct the perfect scheme of division of secret for any structure of access.

Let's consider (n, n) – threshold scheme. Let m – a secret which should be divided between n participants. And the structure of access consists of one set of $\Gamma = \{P\} = \{\{P1, P2, ..., Pn\}\}$. Choose the module d > m.

Phase of division of secret: Choose random numbers of s1, s2,..., sn-1 from Zd and is calculated number $sn=m_s1_s2_\ldots_sn-1 \mod d$. As s1, s2, ..., sn-1 – random numbers, and sn-1 too will be a random number. Then parts of secret are dispatched to participants: $D \rightarrow Pi : Si$.

Phase of restoration of secret: Participants of *P1*, *P2*, ..., *Pn* unite the parts of secret and calculate $m=s_1+s_2+...+s_n \mod d$ [4].

Let's present a situation that at the enterprise there is a director and it has three deputies. The director has a confidential key (Sk) by means of which he signs various bank documents. But it happened so that the director is compelled to go to hospital, respectively he will have no opportunity to run financial business of the enterprise independently. Therefore it divides the confidential key (Sk) into three parts and distributes to each of deputies a share of a key (Sl, S2, S3). Even if all three deputies will want to sign any third-party document by means of association of the parts of secret, received digital signature won't correspond a document hash value. It will occur because one of parts of a confidential key already contains a document hash value, and to substitute with a hash value of the document intended for signing, on a hash value of other document participants of division of secret won't be able as for the solution of this task it is necessary to know decomposition of a large number of N on simple multipliers.

The scheme offered by authors of division of secret without disclosure of parts looks as follows:

1. Generate two large numbers P and Q with a size of 512 bits.

- 2. Calculate N = P * Q.
- 3. Value of function of Euler is defined Fi=(P-1)*(Q-1).
- 4. Choose any confidential key of *Sk*, that it was $1 \le Sk \le n$.
- 5. Calculate the open key $Ok=Sk-1 \mod Fi$.
- 6. The hash value of the document (H) will be transformed to numerical value (M).
- 7. Two parts of a confidential key of digital signature *S1* and *S2* choose by random way, and the third part is calculated by formula: $S3 = \frac{Sk}{S1*S2*M} \mod Fi$.

The only restriction at a choice of numbers of *S1*, *S2*, *S3* and *M* consists that these numbers have to be in pairs mutually simple as among themselves, and with value of function of Euler.

8. Further calculations do by the following formulas:

$$S_A = M^{S1} \mod N,$$

$$S_{AB} = S_A^{S2} \mod N,$$

$$S_{ABC} = S_{AB}^{S3} \mod N.$$

9. The received value (*SABC*) is erected in degree a document hash value: $S_{ABCM} = S_{ABC}^{M} \mod N$.

10. Thus, without disclosure of shares the correct digital signature under the concrete document of what it is possible to be convinced was created having analyses the following equation:

Signature = $M^{S_A * S_B * S_C} \mod N = M^{\frac{S_1 * S_2 * M * Sk}{S_1 * S_2 * M}} \mod N = M^{Sk} \mod N$.

This algorithm is intended for the one-time signature of the concrete document, which a hash value, is hidden in one of the secret parts. If participants of division of secret try to apply the parts of secret to the signature of other document, this signature will be invalid. On parts of secret it is impossible to restore a confidential key of digital signature for acceptable time because operation of restoration of value of confidential key is carried out on the module to equal value of function of Euler, and calculation of value of function of Euler assumes knowledge of decomposition of number N on simple multipliers of P and Q, that is the solution of a problem of factorization.

This algorithm was realized in the program - *Aribas*, successfully passed tests for correctness of results of work and can be used as algorithm of division of a confidential key of digital signature without disclosure of parts for information security from unauthorized access.

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Condition and prospects of the Russian OFS market

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Abstract

The article reviews the condition of the Russian OFS market. It covers the most influential factors that affect the Russian OFS market. The article makes a conclusion about the stable development prospects of the Russian OFS market.

Keywords: Russian OFS market, oilfield services, oil and gas companies, oil recovery, offshore drilling.

Stable development of oil and gas branch is the key factor of stability of world economy. Effective functioning of oil and gas branch directly depends on development of branches providing it, first of all branches of OFS services. The branch of oilfield services is presented by subjects which provide their assistance to oil and gas corporations on drilling of prospecting and operational wells, carrying out of geophysical researches and etc.

For today the market of oilfield services has reached a considerable level. Because of the expected prospects of oil production growth the necessity of intensified scouting and development of deposits rises more and more. Besides, the exhausted deposits also demand involvement of new technologies. These factors lead to an increase in a role of the service works whose cost makes the greatest part in the expenses on oil production.

According to the forecasts of "Spears and Associates, Inc.", the world market oilfield services in 2012 will exceed the amount of \$30000000000 (300 billion),

with an annual increase of 16 % and for the following 2012 and 2013 – of 11 %. The given growth is caused by stable high prices for hydrocarbons. From the economic point of view it is necessary to mention that drilling works are key in world oil and gas production, they demand more than 70 % of the total sum of investments in oil and gas production. The given figures show the exclusive importance of the branch in the world economy.

The market of oilfield services is rather wide, including various services related to scouting processes support, extraction, geophysical researches and etc. Some analysts also incorrectly (from the point of view of the world economy) relate the production of drilling and operational equipment to the OFS market, for the service market must be separate from the products market

So, the Fortune magazine allocates a separate sector under the name "The oil and gas equipment and the OFS" (Oil and Gas Equipment, Services). In the Fortune 500, the rating of the largest-gaining American companies for 2012, the sector is presented by four companies: "Halliburton", "Baker Hughes", "National Oil well Varco" and "Cameron International". Out of these four companies only "Halliburton" and "Baker Hughes" are oilfield companies. These multinational corporations strongly hold the positions, with a gain of 17,9 billion dollars in 2011. There are various classifications of OFS. According to the Russian researcher D. Chuev. it is possible to allocate 7 basic groups, each of which represents a separate subsector with its peculiar features:

1) seismic researches;

2) geophysical works;

3) drilling and accompanying works;

4) capital construction of infrastructure (roads and other objects);

5) well repair (workover);

6) increase of oil recovery of reservoir (in particular, hydraulic rupture of a reservoir);

7) services of technological and general transport.

Foreign analysts, on an example of Spears and Associates analytical agency, while detailing the above-stated classification, allocate 32 market segments. We will define a share of the basic segments in the world market of OFS (figure 1).



Figure 1. Structure of the world market of oilfield services in 2010

Source: Richard Spears. Oilfield Market Report 1999 – 2012. Spears and Associates, Inc.

According to this figure the largest segment (except other services) of the OFS market is offshore drilling. There are two principal reasons for this: first, the cost of OFS at drilling on the offshore considerably exceeds similar indicators at land drilling. Secondly, because of o-land deposits exhaustion and complications of drilling processes because of inaccessibility of the aforesaid deposits, the hydrocarbon offshore extraction becomes more attractive economically. Such

countries as Brazil, Norway, Mexico, etc are focused on strategic development of offshore drilling.



Figure 2. Fleet of offshore drilling units on world regions (in %)

Source: Richard Spears. Oilfield Market Report 1999 – 2012. Spears and Associates, Inc.

The Russian Federation is one of the largest manufacturers and exporters of oil and gas and one of the basic consumers in the world market of OFS. The OFS market in Russia is rather young, but at the same time it is one of the most dynamically developing. Estimating the volume of the OFS market in Russia is quite difficult, because some oil and gas companies ("Rosneft", "Surgutneftegaz" and a number of others) still use the internal divisions to provide their services. At the same time the dynamics of allocation of the OFS performed within the oil and gas companies is being registered. So, in 2003 more than 80 % of oilfield services were provided by

the affiliated OFS companies or divisions of the oil and gas companies. In 2011 yet about 55 % of OFS is provided by the independent OFS companies.

Nowadays there are about 200 operating OFS companies in our country, they can be divided into three categories: affiliated with the oil and gas companies, the large service companies, the medium and small service companies. The following scheme shows distribution of income between the basic players of the Russian OFS market

About 45 % of the Russian OFS market is taken by the oilfield services provided within the limits of Russian vertically-integrated oil companies (VIOC): "Rosneft", "Surgutneftegaz", "ANK Bashneft", etc.). The largest service provider from the independent OFS companies is Drilling Company "Eurasia" (13 %) which has been formed from the OFS divisions of Lukoil" in November, 2004. The largest foreign multinational corporations ("Haliburton", "Weatherford" and "Schlumberger") comprise about 18 % of the Russian market.

There are two ways of the OFS organization on the Russian oil and gas market services: the first - use of own service, the second is an attraction of oilfield service contractors. The majority of the oil and gas companies choose the second variant. Oilfield service business in Russia has reached a considerable level by today. The general tendency of the OFS market today is consolidation. Foreign holdings and Russian independent service companies buy medium and small OFS enterprises. Nowadays there are five largest OFS companies with a full spectrum of providing oilfield services that dominate the Russian OFS market: "Integra", "Drilling Company 'Eurasia', "Schlumberger", "Halliburton" and "The Siberian Service Company". Also there is a number of medium-business organizations with the limited range of possible services and the small companies which can perform one or two technological operations. They aren't likely to avoid the merging, absorption and replacement. It happens because the oil and gas companies getting additional profit thanks to the high prices for oil can pay for the improved modernized service on drilling, repair and geophysics, whereas the small companies offer the services of rather poor quality which is unacceptable for the large Russian oil companies.

Growth of the OFS market, and also requirement for exploration and development of new deposits demand serious investment in development of the oilfield companies. This requirement leads to consolidation of the OFS companies and gradual formation of the transparent domestic service market. The basic investors in this market are the western companies, and that poses a risk in strategic prospecting. Therefore the state should undertake a number of measures which maintain the development of the domestic service companies. Measures of financial support of the service companies from the state under condition of a sufficient transparency of their activity and reliability of their control systems will be the most effective.

The oilfield service market in Russia has very high prospects of growth, this is due to, first of all, the stable high prices for hydrocarbons and growth of drilling and extraction of hydrocarbons. So, drilling growth in 2011 and 2012 by calculations of analysts "Spears and Associates", Inc. will make not less than 3 % annually. The average quantity of working drilling units will increase from 808 in 2011 to 832 in 2012. The decision of Germany on closing of atomic power stations will lead to a decrease in manufacture of the electric power by a quarter. It, certainly, will affect growth of demand for the Russian natural gas as filling the given shortage of the electric power by means of alternative sources (solar energy, wind power, hydraulic power) it will be economically unprofitable.

The biggest part of the oilfield service market is occupied by drilling services, 65 % of which belong to the Russian market. The drilling service sector is most prone to the market's volatility and has the greatest fluctuations in comparison with services in geological prospecting and workover. Drilling services are the most expensive (all expenses comprise the arrangement of new wells, the usage of more

expensive equipment, etc.). The volume of expenses on the drilling of new wells is compensated by the oil and gas companies first of all.

Modern development of technologies allows reaching substantial increase of volumes of oil and gas recovery without drilling, applying various methods of an intensification of the extraction which are included in the workover sector. It is possible to attribute layer hydraulic fracturing to these methods (HSM), the UBD, simultaneous drilling and a number of others.

During the crisis which has begun in 2008, the oil and gas companies have reduced the amount of drilling to its minimum admissible values designated by the state for each licensed site. In 2010 the amounts of drilling services are stabilized, and the year becomes a turning point for the Russian drilling service market. Since 2011 stable growth of the given segment is being predicted. The dynamics of the cost of penetration of one meter has a similar trend, and in many respects depends on the overall market conditions. The dynamics of the cost of penetration of one meter has a similar trend, and in many respects depends on the overall market conditions.

The larger share of the oilfield services market is taken by current and thorough workover services. The size of the well workover market is defined, first of all, by the number of functioning wells. Out of all the sectors of the OFS market the given sector is the most competitive and is presented by several dozens of companies. The greatest shares belong to: "Drilling Company "Eurasia" – 10 %, "ANK Bashneft" – 10 %, the group of companies of "Integra" – 7 %, "Weatherford" – 5 %, "Gazpromneft-Nefteservis" – 5 % and a number of other companies. In the given sector the oil and gas companies are guided, first of all, by cost since quality of the services given by the companies differs slightly.

The Russian OFS market is influenced by the whole group of both external and internal factors. One of key external factors of the OFS market development is recovered oil and gas amounts, due to the extraction increase grows the demand for services in exploration and operational drilling, geophysical services etc. provided by oil and gas operators (table 1).

Table 1. Dynamics of oil recovery in Russia							
Year	Oil recovered	Oil recovered in	Share in the				
	worldwide, mln	Russia, mln	worldwide				
	tons	tons	recovery, %				
1970	2355	285	12,1				
1980	3088	547	17,7				
1985	2792	542	19,4				
1990	3168	516	16,3				
1995	3278	307	9,4				
2000	3618	323	8,9				
2001	3603	349	9,7				
2002	3576	380	10,6				
2003	3701	421	11,4				
2004	3863	459	11,9				
2005	3897	470	12,1				
2006	3914	480	12,3				
2007	3938	491	12,5				
2008	3820	488	12,8				
2009	3755	494	13,2				
2010	3914	505	12,9				
2011	4000	511,4	12,8				

As a result of calculations the linear factor of correlation between indicators of the amounts of oil recovery and the size of the Russian OFS market has made 0,852, showing strong direct communication between two parameters (within the limits from 0,7 to 0,9).

The logical chain of the oilfield services companies revenue's dependence on growth in hydrocarbon prices is as follows: increase in oil (gas) prices has a direct impact on revenue growth of oil and gas companies, which ultimately has an impact on investment programs of these companies, including investments in exploration and operational drilling, geophysics, seismic exploration, well workovers and other oilfield services.

Growth of the number of orders for carrying out these works therefore increases revenues and earnings of the oilfield service companies. Meanwhile, a similar trend is observed with a decrease in energy prices, which directly leads to a decrease in income

The situation on the world market of hydrocarbons and, as a consequence, the effective demand for oilfield services has an impact on the investment of oil and gas companies in the oil services, rig count, the number of wells drilled and the amount of drilling in absolute terms.

The number of rigs is the limiting factor that determines the maximum ability of companies to provide oilfield services, thereby affecting the companies' revenues and amounts of provided oilfield services.

Rig count increased from 40 units in 2000 to 189 in 2010, the financial crisis of 2008 – 2009. had an impact on the rate of increase in drilling rigs, as if from 2007 to 2008 the number of land rigs increased by 86 units, from 648 to 734, or 13,3 %, from 2008 to 2009, there is a significant decrease in the rate of growth: from 734 to 758, i.e. by 24 units or 3,3 %. A similar situation is observed in the period from 2009 to 2010, when the number of land rigs increased by only 23 pieces, from 758 to 781, or 3 %. Wherein a part of the total amount of the rigs is owned by oilfield service companies, the other part belongs to the service division of oil and gas corporations.

The number of wells drilled has a direct impact on the oilfield services market on the one hand, increasing the demand for drilling services (exploration and production), on the other hand, the increasing demand for services for the maintenance of efficiency of wells drilled (overhaul and repair).

The global financial crisis of 2008 – 2009 years has not had much effect on the number of wells drilled, this is due primarily to the fact that oil service companies during the crisis were forced to "freeze" or lower prices for their services, while maintaining the workload. The significant growth of wells in offshore oil fields in

2008 (from 10 to 20 wells) is associated with the commissioning of the platform LSP-1, which is working on drilling at the Yuri Korchagin field in the Caspian Sea and is owned by OAO "NK Rosneft".

Oilfield services in support of this platform are provided by the OFS company within the group of companies "Eurasia Drilling Company", the Eurasia Shelf Drilling Company. The company specializes in providing integrated services for the construction of all kinds of wells on the sea.

Fig. 3 shows the dynamics of the Russian oilfield services market, the average annual growth rate from 2003 to 2008 amounted to about 22,3 %, and in 2009 there was a decline in the amount of \$5 billion, caused by the global crisis. Since 2011 average growth by 10,7 % annually is forecasted.

The new General scheme of the oil industry development until 2020, approved on April 12, 2011, involves drilling of 50 thousand wells in 2010 – 2020. The main potential for growth in the Russian oilfield services market will be provided access to oil and gas companies in the new producing regions – East Siberia and Timan-Pechora. According to analysts, the decline in oil and gas companies active in the current traditional regions - in the Volga region, the Urals and Western Siberia, that take over 80% of the market – will be the full extent offset by the development of new deposits in the region.



Figure 3. Development of the Russian OFS market (U.S. \$ bn)

Among the strategic plans of Russian oil and gas companies are those that significantly affect the oilfield services market, such are Gazprom's plans for development of the South-Russian field in Western Siberia, as well as plans for production at fields in Sakhalin. Lukoil and Bashneft plans to develop two fields in the Nenets Autonomous District and is about to start production in 2013 – 2014. August 30, 2011 OJSC "NK Rosneft" and ExxonMobil signed an agreement on strategic cooperation, under which the companies plan to jointly implement a number of projects in exploration and development of hydrocarbon fields in Russia, the United States and other countries around the world are beginning to work on the exchange of technologies and experiment [3].

Russian oilfield services companies are also entering the foreign markets. They still cannot boast major successes, but the mere fact of the international presence that speaks of the competitiveness of the companies in the international arena is important. Speaking of Russian oilfield services abroad, it is first necessary to mention the near abroad, so, the Eurasia Drilling Company has long experience in the market of Kazakhstan and Uzbekistan, the company Integra in the markets of Kazakhstan, Uzbekistan, Turkmenistan, and Azerbaijan.

An example of successful international experience is the work of "Arktikmor neftegaz intelligence". Today, the ships and drilling rigs of "AMNGR" work in domestic and international markets. The geography of works of "AMNGR" is extensive and includes the waters of Europe, Africa, South-East Asia. Among the main types of work are drilling exploration wells, drilling rigs and supply vessels bunkering at anchorage.

Thus, a conclusion can be made about the prospects for sustainable development of the Russian oilfield services market. However, in order to become stronger for Russian companies in this market, they require 2 conditions: work on their part to increase their competitiveness (updated equipment and technology) and support from the state (protectionist measures to protect the Russian companies, tax credits, etc .).

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Population ageing in Slovak Republic – the current status, characteristics and future prospects Lukas Pavelek

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Abstract

Population ageing is a social problem whose consequences will soon have a significant impact on various areas of human life, and hence on social security. The ageing population is one of many factors that significantly affect the changes in social conditions of people's lives. It is a process that affectss the emergence of new social risks and crises. This causes the need to identify the consequences of these changes and appropriate measures to respond to them. This identification is not possible without a thorough understanding of genesis and propable developments of the aging process. The following paper briefly describes the demographic aging of the population in Slovakia and important context associated with this phenomenon.

Keywords: second demographic transition, population ageing, social security

Introduction

Europe today is facing major economic problems because of its aging population and a decreasing number of the working population. The demographic aging of population can be also considered a social problem, and its consequences will soon have a significant impact on various areas of life - work, education, health etc. Population ageing is one of the many factors that significantly influence the changes in the social conditions of people's lives, but also the emergence of new social risks and crises. This is caused by the need to identify consequences of these changes, as well as appropriate measures to respond to them. Identification of the impact of the changes is not possible without a thorough understanding of the process of aging. The following essay briefly describes the contribution of demographic aging of population in Slovakia and important context associated with this phenomenon.

The second demographic transition and population aging

Population ageing is an inevitable effect of so-called demographic revolution in which there has been a shift from extensive to intensive demographic reproductions, characterized by low birth and death rates respectively. to prolonging human life [1].

The term demographic revolution (demographic transition) was introduced by the French demographer Alfred Landry in 1934. This theory seeks to explain a set of demographic changes associated with the transition from high levels of mortality and fertility to low mortality and fertility [2].

The term population ageing describes the changes in the age structure, due to the increasing proportion of elderly in the population. Today, ageing is a global demographic process, manifested to greater extent in developed countries. This complex process is the result of previous demographic trends and is directly related to the first demographic transition and the overall modernization process after the Second World War. Technological and scientific advances enabled the mortality decline, which resulted in increasing life expectancy and better health. The twentieth century was a period of the most influential extension of human life [3]. Modernization processes also caused a decline in fertility and birth rates, thereby deepening the process of demographic aging (second demographic transition). While it may seem that the birth rate is low only in times of momentary observation, researches show that it may remain below the level needed to replace generations, which may lead to new demographic inequalities. Effects of inequality become visible already. Low levels of fertility can now be considered a major cause of rapid demographic ageing in the developed European countries (as well as post-communist countries such as Slovak Republic). Eastern European countries still have considerable room to improve the level of mortality (infant mortality, seniors and over-mortality of men) and thus increasing life expectancy, which in the future will certainly affect the process of demographic ageing. Demographic ageing is reflected in the increase of older age groups.

The elderly population is usually defined by the age limit of 65 years. In Western Europe this threshold usually coincides with the official retirement age. In Eastern Europe it may be replaced by the age of 60 years. Such defined elderly population is not internally homogeneous in terms of lifestyle, health, and thus in terms of their attitudes towards society. For this reason, it is commonly subdivided. The age group 65-74 is the called the ",third age" (young-old), persons aged 75 + "fourth age" (old-old). The term oldest old represents the population of 85 + year olds [3]. To reflect population ageing indexes can be used in addition to simple percentages of selected population groups by age $(0-14 \ (\%) \ 60 +$ (%) 65 + (%) 70 + (%) 80 + (%)). Among these the so-called Ageing index is propably the most used one. It expresses the number of people in the post-working age to those in pre-productive age and is usually expressed as a percentage. Another possibility to express the process of aging is the Billeter index, which expresses the difference between the number of persons in the pre-and post-reproductive age to persons of reproductive age. It is also expressed as a percentage [4].

Population ageing in European countries and in Slovak Republic

There is a high probability that in the future third of the population in various regions of the European Union will be older than 60 years. At present, the proportion of the population is about 20 percent [5]. Also the emergence of aging seniors is anticipated. Today, the proportion of people aged over 80 in the population is about 4 percent. By 2040, this percentage is likely to double. Dramatic changes can be expected after 2040, when the age group will be hit by the "baby - boom" generation (people born in the 60s of the 20th century). Proportion of seniors aged 80 will then exceed the limit of 12 percent of the total population.

Since the mid-60s significant changes occur in the CoE member states in all major components of population development, lifestyle and layout of people's lives [6]. To a greater or lesser extent, this development takes place also in other European countries. It is emphasized that fundamental changes occur between European cohorts, which significantly affects the economic and social situation of European countries.

The value of the aging index for the Slovak Republic in comparison with other European countries is still relatively low. Slovakia is now one of the youngest countries in Europe. But the changing demographic behavior over the last ten to fifteen years has caused an acceleration of demographic aging. According to the latest forecasts, Slovakia, maintaining the current level of fertility, respectively. with its slight increase happens to be in the mid 21 century, one of the oldest populations in the world. The continued aging is terminated by the abovementioned characteristics of the average age and the aging index. Both of these characteristics record a long-term growth, which is gradually accelerating. The current values of the average age and the aging index in Slovakia are historically high [7].

Over the past fifty years, numerous changes associated with the proportional representation of seniors occurred in the Slovak population. Their pace has quickened markedly during the nineties of the 20th century. The average age of the population increased from 1950 to 2000, about six to eight years, from 29 to 35 years for men and from 31 to 39 years for women. The share of seniors has doubled and mortality and improving health conditions add to changes of the internal structure of this category of the population. Among seniors, women will continue to dominate the age structure deformation due to war losses and overmortality of men. Noticeable is the doubling of the proportion of 85 + year olds. This proportion is continually on the rise. As in other EU countries, in Slovakia we can record a graduall aging population of seniors.

Per 100 inhabitants below 15 years accounted for Slovakia in 2005 68

people aged 65 and over (in 1995 it was "only" around 50 people). That is, the aging index, in over ten years has increased by 38.6%.

The aging process takes place in all age groups of the population. The working population is aging due to sliding of more boomers to the elderly and their replacement by weaker boomers. Strong post-war boomers from the 70s are slowly beginning to abandon the age of highest fertility. Conversely, to the productive age still come weaker boomers born in the 80s and 90s. This increases the process of population aging.

Slovakia is not a homogenous country. Individual demographic processes take place at different speeds and with varying intensity in different regions of Slovakia, which also causes a marked differentiation in terms of demographic aging. Slovakia still outnumbers young over older districts, as evidenced by the position of Slovakia in the European countries. In the future it can be expected that aging is the result of lower fertility and transition baby boomers in particular, to deepen mostly in socalled "average" districts. However, the entire population of Slovakia will age.

In conclusion, it is still necessary to mention the specifics of the countries of Central and Eastern Europe - the proportion of the Roma population in the total population. Demographic, socio-economic and often also the personal status of many Roma in Slovakia today is markedly different from the rest of the population [8]. The Roma population has different characteristics of fertility and mortality rates than the rest of the Slovak population. Specific numerical estimates can finalibe recorded only indirectly, as the movement data of the population of Roma nationality do not provide real results on the reproductive behavior of Roma. According to the latest available data were for the period 1970 to 1980 Roma men life expectancy is about 54 years and Roma women about 58 years old [9]. In retrospect, the demographics surveyed prior to 1989 in violation of human rights (for Roma individuals were called by others). The structure and spatial distribution of the Roma are changing relatively slowly, and therefore the data can be considered relevant even today. The Roma population is from a demographic point of view a developing population. which is characterized by a progressive type of age structure. Taking into account demographic patterns, the demographic situation of the Roma is not uncommon, such a development is common in developing populations. A change of reproductive behavior in developing populations is associated with the change of living conditions, increased standard of living and increased education levels. Due to the isolation of the Roma population these changes are realised more slowly than in the rest of the population of Slovakia. It is believed that improving the health status of the Roma population will decrease mortality and improve longevity. Demographic theories and laws based on estimates of the current

situation of the Roma population assume the aging of this population too.

Conclusion

It is very clear that the process of population aging is an inevitable process also for a relatively young ("young" from a demographic point of view) country like Slovakia. This process needs to be seen as a factor that may help the emergence of new social risks and crises. Their consequences hit the hardest socially vulnerable people, socially dependent, elderly and ill, long-term unemployed, minority communities and the like.

The situation today is more than ever the need for stabilization of desirable social security, reduction and eventual elimination of those security threats. Emphasis should be placed clearly on an interdisciplinary approach to the investigation of those risks and threats. This is a complex process in which a cooperation of responsible actors in the relevant area is necessary.

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CHINESE INTELLECTUALS IN MODERNIZATION PROCESSES OF SOCIETY

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Abstract

The appointment and role of chinese intellectuals in the society are analysed in this article. They suffered essential changes comparatively with the period before «Cultural revolution». The object and the subject, methodological approaches of the research work are defined. Intellectuals became more active social group which can influence the march, the contents and the tempo of the reforms. Social structure, functions and the origins of reproduction are exposed to transformation.

Keywords: intellectuals, society, modernization, structure, China

Китайская интеллигенция в аспекте модернизации общества

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Аннотация

Рассмотрены место и роль китайской интеллигенции в обществе. Установлено, что они претерпели существенные изменения по сравнению с периодом до «Культурной революции». Определены объект и предмет, методологические подходы исследования. Интеллигенция стала более активной социальной группой, влияющей на ход, содержание и темпы реформ. Социальная структура, функции и источники воспроизводства подверглись трансформации.

Ключевые слова: интеллигенция, общество, модернизация, структура, Китай

Во введении в исследование рассмотрены место и роль нтеллигенции

в китайском обществе. Модернизационный процесс, происходящий в КНР, обострил данную проблему.

Китайская интеллигенция является социальной группой, занимающей

специфическое место в социальной структуре общества, выступает

главным интеллектуальным двигателем преобразований и общественных

перемен, которые происходят в КНР. Ее роль состоит в том, чтобы своими

знаниями, опытом добиваться прогресса в социально-экономическом, политическом и духовном развитии общества. От ее деятельности, способности предвидения во многом зависит содержание, характер и темпы социальных изменений.

Объект исследования - интеллигенция Китайской Народной Республики в годы модернизации общества. Предмет – социальный статус, основные тенденции изменения структуры, функций, социального положения интеллигенции в условиях модернизации китайского общества последней четверти двадцатого века.

Основной целью исследования является анализ социального статуса, структуры китайской интеллигенции, основных тенденций и особенностей ее развития в условиях модернизации китайского общества.

Данная цель обусловила следующие задачи: выявление генезиса китайской интеллигенции; изучение социального статуса интеллигенции в структуре китайского общества; определение экономических, социальных, политических условий и факторов развития интеллигенции в период модернизации; анализ основных тенденций изменения социальной структуры китайской интеллигенции, включающий социальнопрофессиональную и отраслевую, этническую и поселенческую; выявление основных функций и их изменение; исследование источников воспроизводства китайской интеллигенции.

В подходе к изучению китайской интеллигенции автор опирается на фундаментальные общенаучные **методы** познания в их применении к анализу социальной структуры: системный, сравнительно-исторический, структурно-функциональный анализ, принцип историзма, цивилизационный и формационный подходы. Поскольку обращаемся к теоретическим концепциям разных обществоведческих наук, для работы характерен междисциплинарный подход.

В исследовании конкретного текстологического материала использованы методы анализа и синтеза, сравнения и аналогии, метод статистического анализа.

Источниками исследования послужили научные труды отечественных и зарубежных ученых по проблемам интеллигенции. В исследовании использованы работы на английском и китайском языках. Также в качестве источников применялись материалы переписей населения, съездов КПК, данные социологических исследований, редакционные статьи органа ЦК КПК «Жэньминь жибао», высказывания руководящих деятелей КПК и КНР, справочно-статистическая литература.

Результаты исследования и их обсуждение. Изменения, происходящие в социальной структуре китайской интеллигенции, представляют большой научный и практический интерес. Обстоятельства, которые обуславливают теоретическую и практическую актуальность изучения интеллигенции, тесно связаны с современным состоянием китайского общества. Модернизационные процессы и динамическое развитие КНР выдвигают необходимость исследования данной социальной группы на одно из первых мест. В современных условиях интеллигенция является силой, которая во многом определяет идеологию и стратегию развития китайского общества. Она стала более активной социальной группой, обладающей существенными потенциальными возможностями в деле реформирования страны.

Изучение китайской интеллигенции позволит получить представление об основных тенденциях роста численности, изменениях в отраслевой, профессиональной и квалификационной структурах, источниках воспроизводства, основных функциях интеллигенции на современном этапе развития общества, которые остаются наименее изученными в отечественной социологической и синологической литературе. Знание этих процессов будет способствовать формированию целостного представления о современном китайском обществе, динамике изменений, происходящих в нем, развитию добрососедских отношений между нашими странами.

В отечественном обществознании вопросы, связанные с проблемами китайской интеллигенции, ее места в обществе, источниках формирования, взаимоотношениях с государством в дореформенный период рассмотрены в различных исследованиях российских ученых. Наиболее интересными являются исследования В.Г.Гельбраса [1], Марковой С.Д.[2] в которых рассмотрены роль интеллигенции в революционном процессе, проблемы взаимоотношения с Коммунистической партией Китая, изменения в ее социальном составе в 50-60-е годы XX в. и на рубеже столетий. Особенностью вышеперечисленных работ является недостаток статистических данных по интеллигенции и небольшое число эмпирических исследований. Нужно отметить, что из всех классов и слоев китайского общества интеллигенция наименее исследована.

Изучением проблем современной интеллигенции КНР активно занимаются в США. Место и роль китайской интеллигенции в 80-е годы XX века, перемены в отношениях к ней со стороны государства, различия в подходах к интеллигенции в эпоху Мао Цзэдуна и Дэн Сяопина, изменение ее функций, самочувствия, участия в политической жизни страны рассматрива ются такими американскими учеными как М.Голдман, Т.Чик, А.Инглиш-Луек и другими. М.Голдман [5] является автором нескольких книг и других изданий, посвященных анализу положения и роли интеллектуалов, гуманитарной элиты в пост-маоистском Китае, китайского студенчества. В ее работе «Интеллектуалы в эру Дэн Сяопина»

рассматриваются изменения в социальном статусе интеллигенции в период реформирования китайского общества. Отмечается, что хотя интеллигенция является небольшой группой, она занимает ключевое место в модернизации общества.

Т.Чик [3], доктор Гарвардского университета, исследует роль интеллектуалов и идеологию в Китае, рассматривает отношения между интеллектуалами и государством, выявляет тесные связи между ними, развивающиеся с момента формирования интеллигенции, ее типы, роль и сферы активности в обществе. Интересна работа К.Л.Хамрин, специалиста по Китаю в государственном департаменте США, в которой рассматриваются отношения между китайской внутренней политикой, экономическим планированием и внешней политикой, а также ролью в этих процессах интеллигенции. Можно выделить также исследование Дж.-А. Инглиш–Луек [4], посвященное интеллигенции, не относящейся к ганьбу или диссидентам. В нем анализируются проблемы ассимиляции интеллигенцией достижений западной цивилизации, ее самоидентификации, поиска путей развития китайского общества.

Большое внимание уделяется экономическим, политическим, этническим аспектам модернизации. Меньше работ, посвященных развитию социальной сферы общества и изменениям социальной структуры. Вместе с тем следует отметить, что большинство крупных исследований посвящены периоду до «культурной революции», а те, что касаются проблем современной интеллигенции, рассматривают лишь отдельные ее аспекты. Несмотря на ценность вышеприведенных исследований, автор вынужден констатировать, что до настоящего времени не создано работ, особенно в отечественной социологии, рассматривающих социальный статус, функции китайской интеллигенции в их целостном виде в период модернизации, которая берет свое начало после 1978 года.

Научная новизна исследования заключается в том, что в работе исследуется понятие «интеллигенция» как социальной категории и определяется ее место в структуре китайского общества. Рассмотрена история формирования этого понятия в западноевропейской и китайской культурных традициях. Современный китайский термин «чжишифэньцзы» по своему социальному содержанию несколько шире, чем русское понятие «интеллигенция». Китайская интеллигенция имеет глубокие исторические корни, прошла длительный путь от небольшой группы образованных людей до сословия и социального слоя. Ее место в структуре китайского общества характеризуется как неустойчивое, зависимое от политики государства и его руководителей. С момента модернизации общества после «культурной революции» место и роль интеллигенции становятся все более значительными. Основными факторами, способствующими ее развитию стали: экономические и социальные реформы, развитие политических и законодательных институтов гражданского общества. В качестве сдерживающих выделяются в основном психологические: боязнь перемен, недоверие к внешнему миру, страх перед возможной нестабильностью. В целом они благоприятные. Социальная структура подвергается трансформации в сторону увеличения представительства интеллигенции во всех отраслях народного хозяйства, в том числе растет численность национальной интеллигенции. Основные функции представляют сложную и разветвленную типологию, в современном обществе они подверглись институализации. Источники воспроизводства китайской интеллигенции расширились и стабилизировались.

Социальный статус и структура китайской интеллигенции в условиях модернизации общества изменились по сравнению с периодом до 1978 г. в сторону увеличения ее роли во всех сферах общества. Эта тенденция связана с процессом реформирования общества и интеграцией китайской и мировой экономики, открытием внешнему миру. Интеллигенция стала более активной социальной группой, влияющей на ход, содержание и темпы реформ. Социальная структура, функции и источники воспроизводства подверглись трансформации.

Научно-практическая значимость исследования заключается в том, что полученные результаты могут быть использованы в обобщающих трудах по социальной структуре КНР, в учебных курсах на востоковедческих отделениях, для создания учебных и научных трудов по социологии, истории, политологии. Некоторые данные применимы для сравнения и использования опыта китайской модернизации в российской действительности. Результаты исследования могут использоваться для дальнейшего применения в области международных отношений и развития добрососедских отношений между нашими странами, распространения достижений российского образования, особенно в приграничных районах КНР.

В заключении можно сформулировать основные **выводы исследования**: Социальный статус китайской интеллигенции в настоящее время изменился. С момента модернизации общества после «культурной революции» место и роль интеллигенции становятся все более значительными. Определяющим условием развития выступает процесс модернизации и экономические, социальные, политические и духовные факторы. Социальная структура претерпевает изменения. Выделяются тенденции в

сторону увеличения численности интеллигенции, улучшения

квалификационной структуры. Стало шире представительство

национальной интеллигенции и женщин.

Социальные источники воспроизводства китайской интеллигенции

расширились и стабилизировались.

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Reproductive effort of radish oil as a factor of its performance depending on the technological parameters of sowing under conditions of the right-bank Forest-Steppe of Ukraine

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Abstract

The article highlights the peculiarities of the reproductive efforts of oil radish varieties Zhuravka depending on changes in seeding rate, sowing method on different backgrounds mineral fertilizer. The regularities of formation of generative plant parts by the ratio of the structure of inflorescences and pods are determined. An assessment of the role of reproductive effort in shaping the total phytomass of plants and optimum technological parameters of the density of plants per unit area, providing a combination of maximum reproductive effort of plants with individual performance indicators by weight of plants are showed.

1. Introduction

Recent studies showed that both plants and animals important in the survival strategies of the intensity and quality of the formation of the reproductive organs. According to the one-dimensional classification strategy to deposit energy in reproductive effort "system Maklyoda – Pyanky '[1 - 3] all annual plants classified as of" proletarians ", which form a large number of seeds and survive due to the fact that there is always some part of them enters the favorable conditions. Radish vegetable oil from the perspective of competition is a unique plant, namely simplicity to growing conditions and a precursor in the rotation, high productivity and nutritional value, productive and post-harvest use, tolerance to changes in sowing dates, the rapid pace of growth, a strong positive response to fertilizing, high competitiveness against segetal vegetation, the possibility of productive multicomponent use in fodder mixtures with a wide range of related crops [4].

According to the classification Ramenskoye – Trayma, reflecting not only the chances of survival at different energy consumption on reproductive effort, but the adaptation of plants to varying degrees of ease - L.H.Ramenskyy [5] divided all types of three botanical types: vyolenty, patiyenty and eksplerent. According to this classification radish oil belongs to violenty – a powerful competitive plants, vigorously developing, they capture territory and hold it for him, crushing, drowning opponents and completeness of vital energy usage environment.

The system of Ramenskiy unnoticed even in Russia because domestic phytocenology at that time ruled submission V. N. Sukachov. Abroad about it just did not know. [6]

Today reproductive effort (RE) is considered as part of the general resources of the body, which it uses to implement the process of reproduction [7], as an indicator of the potential capacity for seed reproduction type [7, 8].

Given the importance of this indicator is to develop technology for growing crops, especially, the optimum plant density on unit of area, which is derived from the seed rate we conducted its assessment in our study.

2. Methods of investigations

Field studies conducted during the 2010 – 2012 years on common experimental field Vinnitsa National Agrarian University and the Institute of Feeds and Agricultural of Podillya NAAS in two varieties – Zhuravka and Raduga.

Soils – Haplic Greyzems, arable layer (0 - 30 cm) is characterized by the following parameters within the experimental plots in rotation predecessor of averages content: 2,9 % humus, accessible nitrogen 8,1, 18,7 mobile phosphorus, exchangeable potassium 9,8 mg/100 g of soil, pH 5,5.

During the research the weather conditions differ from the average long performance. 2010 year was the most favorable for plant growth and development of oil radish with the amount of precipitation during April – September, 449 mm, average temperature of 17,2 ° C and hydrothermal coefficient – 1,49. Conditions in 2012 year were expressed arid with total precipitation for the same period of 272.4 mm and the average temperature of 17,7 °C and hydrothermal coefficient – 0,79. In

addition, vegetation oil radish 2011 - 2012 years was characterized by extremely uneven distribution of precipitation with alternating different moisture periods.

The research program was supposed to study two methods of sowing radish oil – row seeding (15 cm row spacing) at three seeding rates – 3, 2 and 1,5 million seeds/ha and wide-row seeding (30 cm), respectively, 1,5, 1,0, and 0,5 million seeds/ha. Each of the options seeding rate housed in three different supply: 1 st - without fertilizer (control), 2 nd – $N_{30}P_{30}K_{30}$ kg/ha; 3rd – $N_{60}P_{60}K_{60}$ kg/ha. Repeated experiments in four time. The placement of the variations was systematic in three tiers. Cultivated land area was 30 m², accounting – 25 m². The predecessor was maize. The Farming equipment in the experiment was a common for area of the cultivation.

Ratio of intensity of growth processes of different plant organs oil radish spent counting as an indicator of reproductive effort RE (reproductive effort), using the formula 1:

$$RE = \frac{Mg}{MR} * 100, \tag{1}$$

where: RE – reproductive effort, %;

Mg – mass of reproductive plant parts (buds, pods) (in absolute terms or dry matter), g (kg)

MR – total weight of plants (in absolute terms or dry matter), g (kg).

Observations and surveys were carried out in accordance with conventional techniques [9].

3. Studies

Our studies have shown that an important factor in studying patterns of plant productivity is their reproductive architectonics. We observed that the nature of growth processes largest oil radish reproductive effort (RE) was different for different seed rates and fertilizing (table).

We have determined that the highest reproductive architecture of a phase of flowering plant radish oil formed by seeding rate of 0,5 million pcs./ha similar seeds in reproductive effort from 17,4 to 25,2 % depending on the variety and fertilizing.

Reproductive effort of oil radish varieties Zhuravka depending on the method of

sowing,	seed rate and	fertilizing,	% (average	2010 - 2012 years)
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	Fertilizing	Peproductive effort (RE),%, per share:			
		inflorescences	pods in phase:		
Seeding rates (million seeds/ha), method of sowing			green pod	yellow pod	
2.0 million	Control	8,6	43,6	68,1	
5,0 million,	N ₃₀ P ₃₀ K ₃₀	9,3	46,8	71,1	
Tow seeding	N ₆₀ P ₆₀ K ₆₀	10,8	46,0	75,2	
The average rate <i>j</i>	9,6	45,5	71,5		
2.0 million	Control	10,3	49,3	68,0	
2,0 mminon,	$N_{30}P_{30}K_{30}$	11,5	46,0	68,8	
Tow securing	N ₆₀ P ₆₀ K ₆₀	13,3	50,1	72,2	
The average rate <i>j</i>	11,7	48,4	69,7		
1.0 million	Control	10,5	45,5	61,5	
row seeding	$N_{30}P_{30}K_{30}$	12,8	50,0	67,8	
Tow security	$N_{60}P_{60}K_{60}$	14,6	50,2	71,2	
The average rate j	12,6	48,5	66,9		
1.5 million	Control	12,6	43,2	61,1	
wide-row seeding	$N_{30}P_{30}K_{30}$	13,2	44,1	62,8	
wide-tow seeding	$N_{60}P_{60}K_{60}$	15,7	48,7	73,9	
The average rate <i>j</i>	13,8	45,3	66,0		
1.0 million	Control	12,4	43,0	68,4	
wide-row seeding	$N_{30}P_{30}K_{30}$	14,5	47,8	69,0	
wide-iow seeding	$N_{60}P_{60}K_{60}$	16,7	47,4	73,2	
The average rate j	14,5	46,1	70,2		
0.5 million	Control	17,4	41,3	61,5	
wide-row seeding	$N_{30}P_{30}K_{30}$	22,1	48,1	67,5	
	$N_{60}P_{60}K_{60}$	23,9	51,9	69,7	
The average rate for	21,1	47,1	66,2		
The least significant	16	1.2	21		
/0], 70		1,0	1,5	2,1	

The lowest value observed in option 3 million pcs./ha, similar to the control seeds -8,6-9,1 %. Reproductive effort pods per share was determined more fertilizing factor than normal seeding. However, increasing the seeding rate leads to a

decrease RE 1,8 - 3,0 % in the green pod stage and, conversely, its increase by 0,8 - 1,4 % in the yellow pod stage.

4. Conclusion

Thus, the reduction in the seed rate leads to the formation of oil radish plants with better-developed generative part of the background of more intensive vegetative development. This is most evident in the background making the $N_{60}P_{60}K_{60}$. Therefore, for seed purposes should apply wide-row method of seeding with normal of seed rate in 1,5 million pcs./ha similar seeds, including seed yield per unit area under this density.

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Education of children with difficulties in learning educational program in kindergarten by Elena Likhacheva

Abstract.

The development of the general education system as the general population and the quality of education of each member of society are fundamental to the growth of social welfare of any country. The foundation of the whole educational process is a pre-school education. Analysis of the education of children with difficulties in learning educational program in kindergarten was performed.

The development of the general education system as the general population, and the quality of education of each member of society are fundamental to the growth of social welfare, the national security of any country.

The foundation of the whole educational process is a pre-school education. Feature of the preschool period is that it provides a common development, which is the foundation for the acquisition of any further specific knowledge and skills, as well as the assimilation of different activities. For the first 6-7 years of life, there is an intensive mental health. During this period, child learns all the main types of human actions, masters expanded connected speech, to establish relationships with their peers. He formed cognitive activity: improved attention, develop various types of memory, it gradually takes possession of verbal and logical thinking. At preschool age evolving needs and are formed on the basis of a variety of interests. The path of development needs in this period is very significant - from the organic, the satisfaction of which is necessary to sustain life, to social (activities, communication), which are based on the desire to navigate in the child really explore it. The work goes from preschool interest in the process of committing to actions of interest to the results of their work, when there is a definite sense of purpose in action: the child is beginning to see the

target and choose the way to ensure its achievement. In the field of communication and contact with others more pronounced in the ability to build these relationships differentially based on the realization that it is possible and what is not. By the end of preschool child accumulates a certain social experience and knowledge that determine its readiness for school.

Currently, pre-school education in the Republic of Kazakhstan has a number of problems, among them especially important to the problem of access and quality of early childhood education. The possibility for equal access of children to pre-school education is not only in the level of funding, but also the need to create different models of pre-school education. In turn, the quality of pre-school education can not be seen in terms of the presence of well-trained groups of children. Quality development should be addressed, primarily due to the growth indicators of development, training and education of each child [1].

These provisions in the field of education due to the fact that at the moment a certain part of pre-school children have difficulty mastering the program material by virtue of their individual capabilities. Indeed, in the pre-school child's life is very much evident not only the general features of the age, but also substantial individual differences concerning, above all, the pace of mental development. For some children develop a proactive mental development, while some, on the contrary, its delay, which hinders the process of teaching and learning.

Analysis of the teaching characteristics of the child with mental retardation preschool revealed the following features.

Currently, some of the children with delayed mental development level pupils are not specialized and mass preschools. This phenomenon is due to several reasons: 1 There is low level of preschool diagnosis of children with disabilities. Preschool age is crucial in the formation of the fundamental structures of the individual. This period, which still retains sensitisation (sensitivity) for the formation of the basic foundations of personality, of optimizing the formation of children and allows the latter at an earlier stage of its formation to join the environment normally developing peers, thus avoiding subsequent layers (secondary) disorders. However, the majority (80%) of the children entered the psychological, medical, pedagogical consultation and, therefore, come to the attention of specialists practice only by the time they start school.

2 The coverage of educational support for children in need a part, due to mismatch of the number of special pre-school children with disabilities.

Statistical indicators of the education of children with disabilities in the past five years, the identification of significant negative trend growth discrepancy between the increase in the number of those in need in the training and the actual decrease such training. At present, the country found more than 150 thousand children with disabilities. The effectiveness of special education reached only 23.3% of children.

3 There is low level of specialized care for children with disabilities.

One weakness of the targeted educational assistance is to help children with mild disabilities, which concerns children with mental retardation. In the operation of educational and medical institutions, in research focus is on the sick and the healthy, and "erased" cases, when a child does not feel sick, but its development is not quite fit into the concept of normal, not been studied sufficiently. Teachers and doctors pay little attention to these children. College and university training of preschool education does not involve the acquisition of knowledge on special education and special psychology, and, therefore, does not allow them to provide effective assistance to children in need. Implementing education and training of children in preschool institutions, tutor has some difficulties.

Thus, the results of our survey of secondary teachers of pre-school institutions in the city of Karaganda and the Karaganda region of Kazakhstan showed that 80% of teachers have faced in their work with children who have difficulties in the assimilation of the pre-school curriculum. The solution to this problem teachers are in a self-education - 41%, to obtain advice from the experts - 17%, to grant the right to solve this problem parents - 15% [2].

As can be seen, many experts preschools not equipped with the knowledge of the special needs of children with difficulties in the assimilation of the preschool curriculum. In the practice of kindergartens, these features are often ignored. Attention caregivers usually concentrated only on unformed of a skill or ability. Noticing any difficulty, teachers strive to help your child through additional training, constant gain control of the whole educational process. With intensive training child can achieve certain results, but it will cost a lot of physical and neuropsychiatric costs. Simultaneously with prolonged fatigue in the child produced aversion to learning and carefully-passive type of behavior.

The full realization of the conditions of professional development of kindergarten teachers in the training and education of children with difficulties in the assimilation of the pre-school education program, may contribute to teacher training institutions. Currently great importance is attached to the process of retraining and advanced training of teachers. Key areas of improvement in this work stands out educational content. At the present stage of these educational programs should be aimed at developing professional skills of prospecting, research and creative activities in the work with different types of children. Education course will cover issues such as the study of psychological and educational characteristics of children with difficulties in the assimilation of the

pre-school curriculum, training teachers and teaching methods of psychological diagnosis, description of the individual remedial work with children in this category, as well as methods and techniques for working with the child's family, experiencing difficulties in the assimilation of the pre-school curriculum.

The main forms of training in this course are lectures, seminars and practical sessions. Lectures include raising the level of knowledge of educators in the field of training, education and development of children who have difficulties in the assimilation of the pre-school curriculum. Seminars have the task of discussing preschool teachers (teacher-led) independently prepared their reports on the above theme. Seminars allow students more depth and detailed study of the proposed theme, as well as expand its boundaries to achieve a creative approach to solving the proposed questions. Practical classes to the acquisition and improvement of skills of teachers in the training and education of children with difficulties in the assimilation of the pre-school curriculum.

The content of this course consists of four main parts:

1. The study of psychological and educational characteristics of preschool children who have difficulties in the assimilation of the pre-school curriculum.

2. Presentation of the theory and techniques of psychological and educational assessment of children age.

3. Description of individual remedial work to compensate for the deficiencies of development.

4. The material is on the organization of the family caregiver of the child experiencing difficulties in the assimilation of the pre-school curriculum.

Seminars are conducted in groups' activities. Each group of teachers asked to consider one aspect of the subject. During the practical training reliance was on the practical experience of educators, as well as the theoretical base, they have received while listening to the course. Practical classes are also conducted in batch mode, where each group of educators received a certain task, whose solution required the development of new and improvement of existing skills. The results of each practice session were the protection of the group to the project on the proposed topic. The rest of the group while at the same time acted as opponents.

The result of a course of lectures in the learning process of the Karaganda regional institute of training and retraining of civil servants and workers in education was to increase the level of knowledge among the teachers in question of psychophysiological characteristics of children with difficulties in the assimilation of the pre-school educational programs. At the same time teachers have mastered the method of psychological and educational assessment of preschool children, methods of correctional studies aimed at the development of mental processes, have mastered the techniques and methods of working with parents such children.

Development and implementation of a course of lectures in the learning process of the Institute does not solve the whole problem, further its development. One of the directions of this work should be her decision on the level of training of higher education.

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