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## PECULIARITIES OF THE COURSE OF CARDIOVASCULAR DISEASES IN PERSONS OF ELDERLY AND SENILE AGE

<sup>1</sup>Kausova G.K. <sup>2</sup>Nuftiyeva A.I.

<sup>1</sup>Graduate High School of Public Health of RK Public Health Ministry, Almaty, e-mail: g.kausova@ksph.kz;

<sup>2</sup>Kazakh National Medical University named after S.D. Asfendiyarov, Almaty, e-mail: nuf.anur@mail.ru

In the article, features of clinical process of diseases of circulatory system in elderly patients in Almaty district (Almaty) were analyzed. Retrospective examination of elderly patients was conducted during 2012 year in comparison with 2013. The result of this examination was as follows: DCS in elderly people is characterized insignificant symptoms and latent process with fast progress of complicating circumstance. That is why it is difficult to diagnose DCS at an early stage and it is necessary to introduce screening programs for gerontological service at a pre-hospital stage.

**Keywords:** diseases of circulatory system, elderly patients, clinical process, screening, prophylactic programs

One of the most actual issues of Public Health of the Republic of Kazakhstan is the growth of diseases of the circulatory system (DCS) among persons of elderly and senile age. In the dynamics from 2007 to 2009 the incidence rate of DCS per 100 thousand of the adult population has increased by 1,1 times. The main cause of mortality of the elderly population from DCS is arterial hypertension (AH), which has increased by 1,4 times [1, 2].

In this regard, the priority is the quality of rendered medical care for gerontological population, including pre hospital stage.

**The aim of the study** was to study the peculiarities of the clinical course of DCS among elderly patients in one of districts of Almaty.

### Materials and methods of research

We have made a complete statistical analysis of statistical cards of admissions of elderly population of Almaty district attached to the GCE "Clinic of Great Patriotic War participants" for the period from 01.01.2012 to 31.12. 2012. In total there were registered 15,424 patients with DCS that made 51,3% of the total number. The leading place made the patients (7480–48,5%) with diseases characterized by high blood pressure, then followed by ischemic heart disease (IHD) and vascular diseases – 5796 (37,6%). 3392 patients with angina (58,5%), acute myocardial infarction (AMI) – 12 (0,2%), paroxysmal tachycardia – 4 (0,07%), other conduction disorders – 2 (0,03%), impaired heart rate – 195 (3,4%), chronic heart failure (CHF) – 406 (7%), cerebrovascular diseases – 1374 (23,7%), endarteritis, obliterating thromboangiitis – 12 (0,2%), varicose veins of the lower extremities – 18 (0,3%), (Fig. 1).

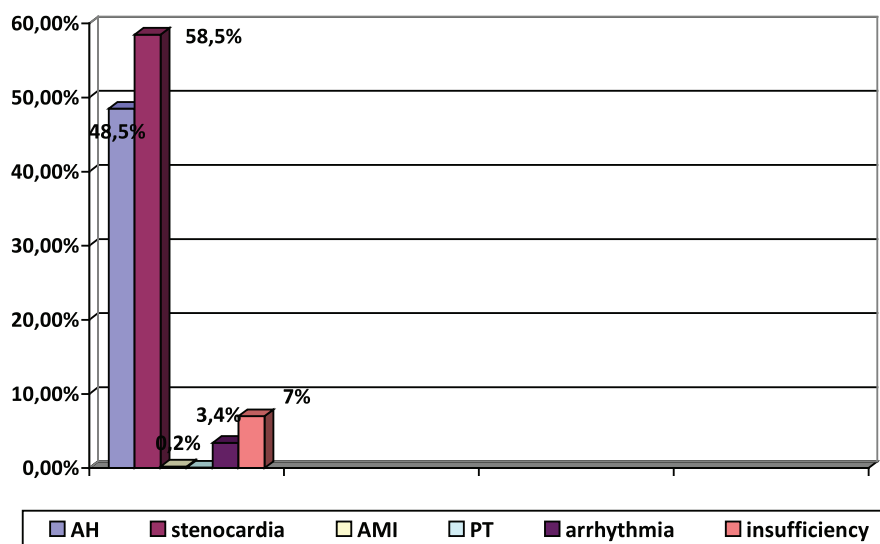


Fig. 1. The structure of coronary system diseases, 2012 year

For 8 months of 2013 according to routine inspections there were identified 565 patients with DCS.

Internal audit analyzed clinical examinations, rehabilitation and administration of free prescriptions for

patients with DCS. There were also selectively checked medical records: 48 outpatient cards of dispensary patients with DCS. The structure of patient morbidity was analyzed: essential hypertension prevails (in 31 people –

64,6%) as the primary diagnosis, as concomitant arterial hypertension – in 10 (20,8%). IHD. Exertional angina was marked in 8 patients (16,7%), atherosclerotic heart disease – in 6 patients (12,5%). Diabetes as an associated diagnosis was observed in 10,4% (5 patients). Out of comorbidities the effects of acute cerebrovascular conduction (CVC) occurred in 2 people (4,2%). One patient (2%) had a myocardial infarction complicated by chronic heart failure. On this occasion, there was performed a coronary artery bypass grafting. Rhythm disorders by atrial fibrillation type were also revealed 1 in patient. One patient (2%) had chronic rheumatic heart disease. It should be noted that in 8 patients (16,7%) there was revealed over diagnosis of DCS (Fig. 2). 6 people, representing 12,5% were not taken at the dispensary (“D”)

registration. The remaining patients were taken under observation, but there were not “D” – examinations in 10 patients (20,8%) in ambulatory cards. Incomplete examination was noted in 3 people – 6,25%. When conducting an ambulatory card there were defects, such as a mismatch in the diagnosis of the patient complaints in “D” – inspections (8,3% – in 4 patients), incorrect history data (4,2% – in 2), incorrect objective data (8,3% – y 4).The diagnosis not appropriate to International classification of diseases 10 (ICD – 10) and protocols of diagnosis and treatment – in 6 patients (12,5%). Incorrect treatment was administered to 1 patient (2,08%). Rehabilitation was not performed in 12 patients with DCS (25%). Not made preferential prescribing drugs in 10 patients (20,8%).

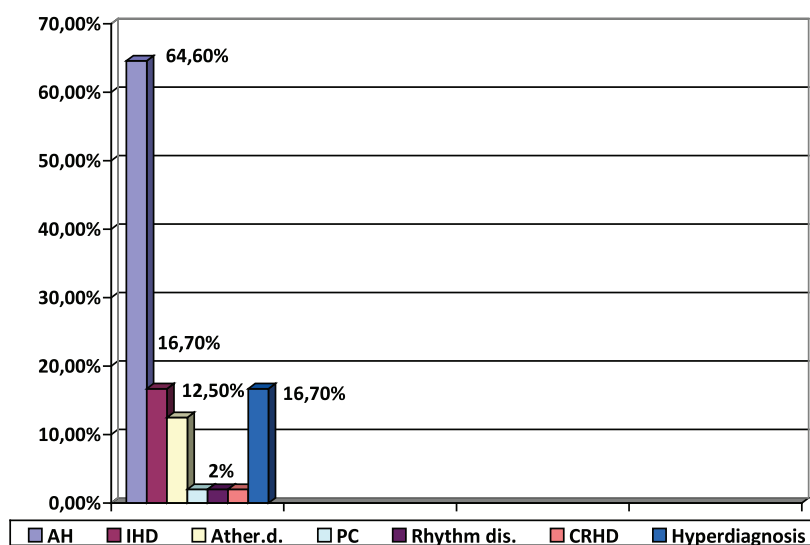


Fig. 2. The structure of coronary system diseases, 8 month of 2013 year

According to the results – registry accounts for the period from 01.01. 2013 to 14.08.2013, at SCE on PVC “Polyclinic of WWII veterans” in total there were noted 3604 active calls.

We selectively viewed 106 ambulatory cards of patients who made active calls to “ambulance”.

Out of them, 62 calls were made to chronic patients on the “D” registry and to patients with acute conditions. The most predominating calls were made by patients with chronic hypertension – 28 calls (45,2%), ischemic heart disease (6–9,7%) and dyscirculatory encephalopathy (5–8%). Drug hypotension, developed on the background of antihypertensive drugs overdose, was the occasion to call in 2 patients (3,2%) for ambulance (EMA) (Fig. 3).

In the future, in order to analyze the work of local service availability and service continuity between ambulance and the primary link there was carried on an internal audit analysis of active calls service.

Updated medical records were checked: a book recording of the active home visits and outpatient cards of served patients at home by district doctors. There were selectively tested 33 outpatient records of patients served by district physicians.

Call registration book is filled in a timely manner and it’s conducted in the prescribed form. Almost all calls were served and district doctors made records of

active visits. However, the most common shortcoming in the work of local doctors is the presence of defects in completing patient cards – identified in 20 of outpatient cards (60,6%). Further, it should be noted the incorrect treatment – in 8 patients (24,2%), lack of inspection – in 7 (21,2%), and incompatibility of the clinical diagnosis of ICD – 10. Incorrect diagnosis was made to 3 patients – 9%. Short recording description of the active visits was also in 3 patients (9%). In describing the complaint did not correspond to epicrisis of diagnosis in 2 patients (6%), patient history – in 1 (3%), the objective data of the patient – in 1 (3%), treatment of the patient – in 1 (3%). Anamnesis was made with errors – in 1 patient (3%), objective data were described with inaccuracies – 3% (1 patient). Objective data of 1 patient did not correspond to diagnosis made by physician.

**Results of research and their discussion**

According to the analyzed data the majority of the surveyed patients had “unmotivated” weakness, malaise, decreased capacity for work, feeling of heaviness and bursting in the head, at least – headache. Later the symptoms of progressive atherosclerosis joined and became leading: sleep, memory, vision distur-

bances, dizziness, buzzing in the ears, head, heart pain, dyspnea, irregular heart rhythm, emotional lability. Elderly people with prolonged duration of DCS had marked memory impairment on recent events, difficulties in assimilating new information, weakening of attention, the appearance of inappropriate emotional reactions. It should be noted a decrease (compared to younger patients) of frequency of hypertensive crises (HC), espe-

cially of type I (sympatho – adrenal). However, at decreasing the frequency of crises it proceeded considerably heavier in elderly patients than in the young people. Exacerbation of HC course in geriatric patients led to more frequent occurrence of complications – rhythm disorders, exertion angina, acute myocardial infarction, acute cardiac-left ventricular failure, (ACLVF) dynamic disorder of cerebral circulation or stroke.

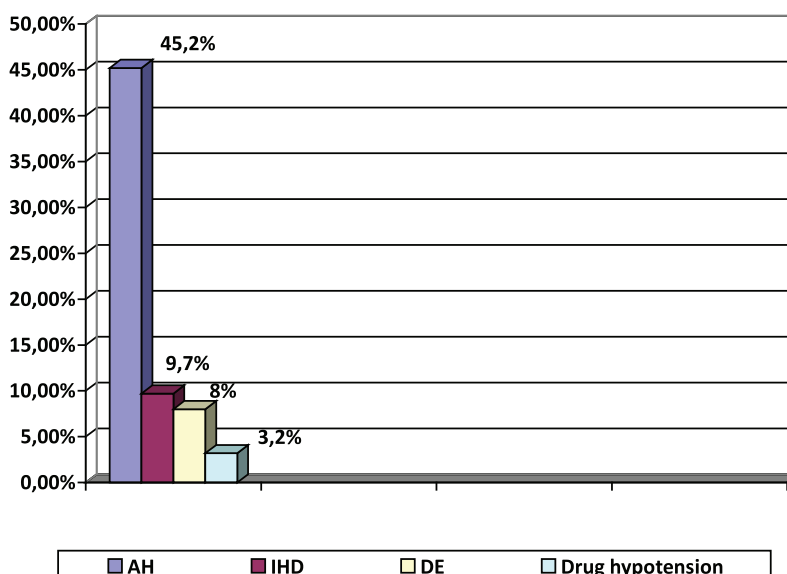


Fig. 3. The structure of the active calls, 2013 year

Thus, the examined patients have the following clinical features of DCS:

1. The disease most often occurs in later life of people (6–7–8 decade). Less common is a continuation of the disease, which started in an earlier period of life, but acquires the characteristics of late disease.

2. It is clinically characterized by less severe painful sensations, which hampers difficulty making early diagnosis.

3. Due to age-related changes in blood vessels and hemodynamics there occurs a relatively high level of systolic blood pressure (SBP) and low – diastolic blood pressure (DBP), which leads to an increase in pulse pressure (PP).

4. The symptoms of functional insufficiency of the major organs and systems in relation to age-related changes and progressive atherosclerosis are to be joined quickly.

5. Significantly more likely than in younger ones, there develop severe complications such as acute myocardial infarction, stroke, ACLVF, kidney failure, even from minor additional adverse effects.

6. There are relatively rare observed hypertonic crises – sympathoadrenal (I) type. Crises often occur on water-salt type (II) and are ac-

companied by left ventricular failure and circulatory disorder [3, 4].

### Conclusions

DCS in elderly people proceed with minimal clinical manifestations, but with more frequent rapid development of complications. Oligosymptomatic latent course for DCS impairs early and timely diagnosis of the disease in patients of elderly and senile age, which reduce the chance of successful treatment of DCS in this age category [4].

In order to successfully diagnose of DCS it's necessary to introduce actively various diagnostic screening programs in assisting gerontological population.

### References

1. Filatova S.A., Bezdenezhnaya L.P., Andreeva L.S. Gerontology: the textbook. – Ed. 5th, complem and reproces. – Rostov n/D: Phoenix, 2009. – P. 510. – (STRs).
2. Sagyndykova A.Z. Organization of medical care for elderly people – important task of Public health // CONSILIUM MEDICUM. – 2010. – Vol. 27, № 3. – P. 94–95.
3. State Program for development of Public Health “Salamatty Kazakhstan” in 2011–2015.
4. Vorobyova T.E., Kunitsyna A.Ya., Maleyeva T.Yu. Geriatrics. – Rostov n/D.: Phoenix, 2009. – P. 152.

## PREVENTION OF COMPLICATIONS OF GESTATION AT PREGNANT WOMEN WITH THE ACUTE APPENDICITIS

Khvorostukhina N.F., Stolyarova U.V., Novichkov D.A.

Saratov State Medical University n.a. V.I. Razumovsky, Saratov, e-mail: khvorostukhina-nf@ya.ru

The article provides results of dynamic research of stress hormone prolactin and indexes of endogenous intoxication among 78 pregnant women who suffered surgery regarding appendicitis. We have established increase in prolactin level 1,5–1,8 times in 5–7 days after appendectomy ( $P < 0,05$ ) with further decrease in hormone concentration after days 10–14, and also development of endogenous intoxication syndrome that was attended by signs of clinical symptoms that can lead to termination of pregnancy. Progression of the revealed disturbances has a negative influence upon the flow of gestational process, thus it increases risk of pregnancy loss up to 42,5% (comparison group). Additional facilitation of discrete plasma exchange in complex of treatment measures on days 3 and 5 after the surgery (main group:  $n = 36$ ) provides for preservation of stable prolactin concentration among the pregnant during all periods after the surgery and allows us to decrease frequency of pregnancy loss up to 2 times.

**Keywords:** appendicitis, pregnancy, prolactin, indexes of endogenous intoxication

Miscarriage has been one of the most urgent problems of obstetrics and gynaecology during a lot of years. Nowadays a tendency towards growth in extragenital diseases, including surgical pathologies, is registered among pregnant women, and it affects the flow and result of gestational process [2, 5]. Acute appendicitis is the most widespread surgical disease of stomach cavity organs among the pregnant (from 0,05–0,12 to 5,2%), and it requires emergency operational treatment [7, 13]. Complications of diagnosing an urgent pathology during pregnancy provide for a growth in destructive forms of appendicitis, and it increases the share of gestation complications. Regardless of the great number of works, devoted to problems of diagnosing and types of surgical treatment of appendicitis among the pregnant, insufficient attention is paid to problems of preventing gestation complications after appendectomy [9, 11]. So far the well-known and generally-accepted method of terminating pregnancy after appendectomy, carried out during the 1st trimester, has been prescribing spasmolytics, vitamins, gestagens [1]. During pregnancy trimesters 2 and 3 tocolytics are usually used to terminate pregnancy. At the same time, according to the bibliographic data, frequency of miscarriage under non-complicated appendicitis equals 19,4–50%, and it increases up to 90% in case of peritonitis development [1, 10].

**Research objective:** optimize preventive measures on miscarriage after appendectomy at the foundation of studying pathogenetic features of gestation flow under acute appendicitis.

### Materials and methods of research

Complex inspection of 78 pregnant women who had been operated regarding acute appendicitis during gestation period 4–30 weeks, has been carried out. During postsurgical period all patients were treated via therapy, aimed to prolong pregnancy. Apart from general spasmolytic and vitamin therapy, the main group ( $n = 36$ ) has been treated with discreet plasma exchange on days 3

and 5 after appendectomy in order to prevent intoxication and correct hormonal disturbances. Considering period of pregnancy, anti-bacterial preparations of penicillin and cephalosporin group have been prescribed to prevent purulent-septic complications. Patients of comparison group ( $n = 42$ ) received standard volume of treatment-prevention measures after the surgery. Control group ( $n = 37$ ) was formed of the pregnant with physiological flow of gestation.

All women have been treated with a complex of laboratory examinations, echography of organs of small pelvis and stomach cavity. In order to estimate unspecific immunological reactivity of an organism, leukocytic index of intoxication (LII) was calculated according to modified formula of Y.Y. Kalf-Kalif (1941). Level of general endotoxin was defined in blood serum of patients via Perceptibility of the method – from 4 pg/ml LPS E. Coli or Sal. typhi. Specificity of method equaled 98,7–99,2%. Concentration of prolactin in blood serum of patients was defined via method of immunoferment analysis with facilitation of commercial set, produced by “Bio-Rad”. Accounting immunoferment hormone definition results was carried out via photometer “Uniplan” (“Picon”, Russian Federation). Statistic procession of the research results was carried out with application pack Statgraphics (Statistical Graphics System).

### Results of research and their discussion

Patients of all groups were comparable in age, pregnancy period, and also presence of genital and somatic pathology. Age of patients varied from 19 to 32 years, average age of the main group equaled  $24,5 \pm 4,7$  years and it was  $25,3 \pm 4,4$  within comparison group, and  $24,2 \pm 5,6$  for control group ( $p > 0,05$ ). Gestation period at the moment of receiving patients in the hospital was within the limits 4–12 weeks for the majority of patients (40,5–41,7%), and it corresponds to opinion of many authors on greater frequency of acute appendicitis development (up to 75%) during the first half of pregnancy [2, 12]. 34 women of the main group (94,4%) and 40 (95,2%) – of the comparison group anticipated their first delivery.

Regardless of vagueness and untypical nature of appendicitis clinical displays in com-

bination with pregnancy, accurate diagnostics and surgical treatment have been carried out on the first day of patients' presence in hospital. Analysis of morphological research results shown prevalence of destructive forms of appendicitis under pregnancy in both groups (82,1%): phlegmon of appendix has been revealed among 45 patients, phlegmon-ulcer form has been established among 4 patients, gangrenous – among 6 women, and gangre-

nous-perforated form – among 10 patients (Fig. 1). Catarrhal appendicitis has been registered only among 13 pregnant women. According to bibliographic sources, frequency of diagnostic mistakes in case of acute appendicitis among pregnant women remains within 11,9 to 44,0%, thus proving for non-profile hospitalization, late diagnostics, and delayed surgical treatment, and increasing frequency of destructive forms of appendicitis [2, 8].

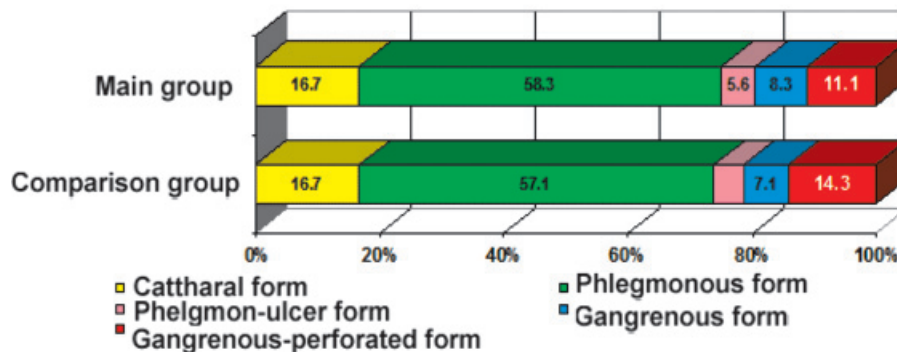


Fig. 1. Morphological features of appendicitis in groups of the studied women

Analysis of hemogramm indexes and calculation of LII at the moment of receiving patients in the hospital has shown its reliable growth from  $0,9 \pm 0,42$  units in case of physiological flow of pregnancy, and up to  $2,62 \pm 0,34$  in case of appendicitis development ( $P < 0,01$ ). Further increase in LII up to  $3,05 \pm 0,61$  units has been

registered during postsurgical period on days 2–3. Definition of endotoxin serum concentration has revealed a significant increase in this index among women with appendicitis before and after surgery on days 2–3 in comparison to the control group ( $P < 0,01$ ), and it points to development of endotoxiosis (Fig. 2).

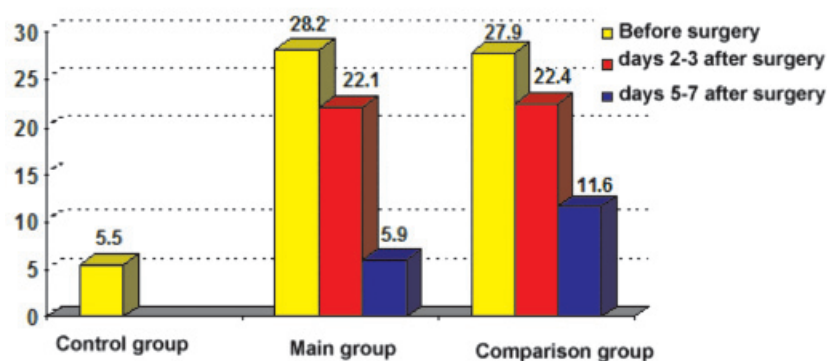


Fig. 2. Results and study of endotoxin in blood serum of the examined women

It is known that any inflammatory process is attended by development of endogenous intoxication syndrome. A work by O.S. Shubina and co-authors shows a negative influence of endotoxins upon the structure of

placenta tissue [6]. According to different authors, syndrome of endogenous intoxication is a starting point of trombophilia pathogenesis, and progression of it causes disturbance of vessels' endothelium with disruption of its



thromboresistant characteristics that play a key part in regulation of hemostasis [3].

Dynamic examination of prolactin among the pregnant with acute appendicitis has shown increase in its serum concentration in comparison to the control group, moreover, more expressed increase in it (1,5–1,8 times) was registered on days 5–7 after appendectomy ( $P < 0,05$ ) (Table). In our opinion, a significant increase in prolactin is a protective reaction of a woman's organism against pain syndrome and stress, defined by development of the surgical disease and operation. On the other hand, high concentrations of prolactin in blood serum of the pregnant after appen-

dectomy have a blocking effect on flexing activity of alvus, regardless of surgery, and this phenomenon provides for progression of pregnancy during this period (up to days 7–10 of postsurgical period). Decrease in hormone concentration by 2 (Table) and emergence of myometrium hypertone according to US inspection has been registered on days 10–14 after appendectomy, at the same time, clinical indications of miscarriage risks (pulling pains in stomach area, bloody secretions from reproductive tracts) were expressed in the majority of cases (65,9%), it required further treatment of patients in conditions of obstetrical or gynaecological department.

Results of dynamic study of prolactin among pregnant women with appendicitis

Group of the examined women	Prolactin level (ng/ml) in dependence on pregnancy period			
	Weeks 4–12	Weeks 13–20	Weeks 21–25	Weeks 26–30
Control group ( $n = 37$ )	$n = 14$ $23,18 \pm 2,11$	$n = 9$ $50,43 \pm 2,36$	$n = 7$ $81,13 \pm 3,28$	$n = 7$ $162,58 \pm 7,88$
Pregnant women with appendicitis (the day of receipt) ( $n = 78$ )	$n = 31$ $27,82 \pm 4,37$	$n = 19$ $65,56 \pm 4,67$	$n = 13$ $97,35 \pm 6,32$	$n = 15$ $195,09 \pm 10,13$
Main group ( $n = 36$ ) (days 5–7 after appendectomy)	$n = 14$ $28,43 \pm 6,52^{**}$	$n = 9$ $53,47 \pm 5,17^{**}$	$n = 6$ $82,24 \pm 4,21^{**}$	$n = 7$ $171,36 \pm 8,15^{**}$
Comparison group ( $n = 42$ ) (days 5–7 after appendectomy)	$n = 17$ $41,72 \pm 6,21^*$	$n = 10$ $85,71 \pm 6,32^*$	$n = 7$ $121,69 \pm 13,24^*$	$n = 8$ $260,13 \pm 12,62^*$
Main group ( $n = 36$ ) (days 10–14 after appendectomy)	$n = 14$ $22,86 \pm 3,41$	$n = 9$ $49,88 \pm 3,74$	$n = 6$ $81,43 \pm 5,18$	$n = 7$ $164,11 \pm 9,27$
Comparison group ( $n = 42$ ) (days 10–14 after appendectomy)	$n = 17$ $17,87 \pm 1,49^*$	$n = 10$ $37,82 \pm 2,02^*$	$n = 7$ $62,41 \pm 3,16^*$	$n = 8$ $125,23 \pm 6,19^*$

Note: \*  $P < 0,05$ , difference in indexes from the control group;

\*\*  $P < 0,05$ , difference between indexes of the main group and comparison group.

Comparative analysis of studying laboratory indexes in dynamic indexes has shown that after facilitation of plasma exchange on pregnant women (main group) has shown that concentration of prolactin in blood serum on days 5–7 after appendectomy was reliably lower than hormone level among patients who had received standard treatment during postsurgical period (Table). Besides, we have not registered a sharp decrease in prolactin on days 10–14 after appendectomy in the main group. Serum concentration of the hormone among pregnant women of the main group didn't vary significantly during all periods of postsurgical period, at the same time, no reliable difference in prolactin level has been observed in comparison with this index of physiological flow of pregnancy during same periods of gestation [4]. The authors have established a relation between decrease in serum concentration of prolactin and initiation of flexing function of

alvus in case of factitious abortions or preterm deliveries.

We should also outline that additional introduction of discreet plasma exchange on days 3 and 5 after appendectomy provided for a more expressed decrease in endotoxin concentration in blood serum (Fig. 2).

Observation of pregnant women was carried out during the whole period of gestation. Analysis of flow and results of pregnancy after appendectomy has shown a greater frequency of gestational complications in case of standard treatment of postsurgical period (Fig. 3). Threat of miscarriage during the first month after surgery took place in all observations of the comparison group. After appendectomy and treatment in surgical department, 15 patients (35,7%) were transferred to obstetrical and gynaecological departments for the further therapy due to the remaining clinic of abortion threat or premature delivery.

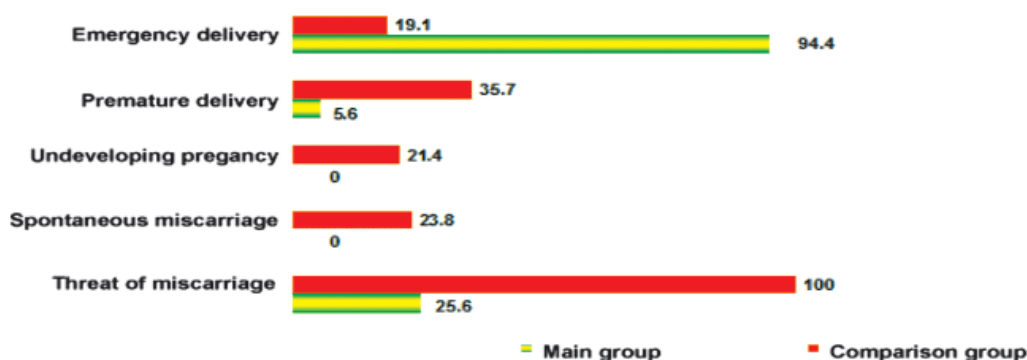


Fig. 3. Flow and result of pregnancy after appendectomy

The further observation of the pregnant allowed us to reveal the greatest share of miscarriage in the group of comparison in case of appendicitis development during gestation periods up to 12 weeks ( $n = 17$ ), frequency of factitious miscarriage equaled 41,2% ( $n = 7$ ), undeveloping pregnancy – 23,5% ( $n = 4$ ). In our opinion, instability of hormonal background during early periods of gestation (less than 12 weeks), sharp oscillations of prolactin, and also development of endotoxiosis during this gravid period have unfavorable impact upon the process of embryogenesis and pregnancy development, thus increasing frequency of reproductive losses.

Favorable result of pregnancy after appendectomy was stated only among 54,8% of women ( $n = 26$ ) in comparison group, and in 35,7% of cases pregnancy resulted in premature delivery at gestation period of 30–36 weeks. Implementation of plasma exchange after appendectomy among patients of the main group provided for prolonging pregnancy in all cases (Fig. 3). We shall point out that additional implementation of plasma exchange in complex of treating measures among the pregnant after appendectomy allowed us to decrease frequency of miscarriage threats by 4 and decrease total number of miscarriages by 2, thus increasing total number of favorable results.

### Resume

1. Development of endogenous intoxication syndrome has been registered in case of simultaneous acute appendicitis and pregnancy. Progression of the revealed disturbances among the pregnant during postsurgical period has an unfavorable influence upon the flow of gestational process, thus increasing risk of miscarriage.

2. Studying dynamics of prolactin among pregnant women with appendicitis has shown a significant increase in its serum concentration, especially on days 5–7 after surgery, this phenomenon can be evaluated as protective reaction of a women organism against pain syndrome

and stress. A sharp decrease in prolactin level on days 10–14 after appendectomy was attended by emergence of miscarriage threat symptoms.

3. Additional facilitation of discreet plasma exchange after appendicitis surgery provides for preservation of stable prolactin concentrations among the pregnant during all times of postsurgical period, and also decrease in indexes of endogenous intoxication, all of it allows us to consider this method efficient and safe to prevent miscarriages after appendectomy.

### References

1. Obstetrics: national guide / Ed. by E.K. Ailamazyan, V.I. Kulakov, V.E. Radzinskiy, G.M. Sidelnikova. – M.: GEOTAR-Media, 2007. – P. 943–952.
2. Pregnancy and acute appendicitis / A.N. Strizhakov, A.F. Chernousov, M.V. Rybin, and others // Messenger of surgical gastroenterology. – 2010. – № 3. – P. 4–16.
3. Putilovam N.V., Bashmakova, L.A. Pestryaeva The role of endogenous intoxication syndrome in pathogenesis of thrombophyls // Ural medical magazine. – 2008. – № 12. – P. 59–62.
4. Modern approach towards treating pregnant women with dead embryo // I.A. Salov, N.F. Khvorostukhina, I.E. Rogozhina, and others // Russian messenger of obstetrician-gynaecologist. – 2007. – № 4. – P. 17–21.
5. Khvorostukhina N.F., Rogozhina I.E., Stolyarova U.V. Acute appendicitis and pregnancy: clinical flow, diagnostics, and treatment // News of higher educational institutions, Povolzhsk region // Medical science. – 2013. – № 1. – P. 102–112.
6. Shubina O.S. Influence of endogenous intoxication upon composition of placenta // Fundamental studies. – 2004. – № 4. – P. 21–23.
7. Appendectomy During Pregnancy: Follow-Up of Pregnancy Original Research Article / J.J. Choi, R. Mustafa, E.T. Lynn, C.M. Divino // Journal of the American College of Surgeons. – 2011. – Vol. 213 (5). – P. 627–632.
8. Augustin G., Majerovica M. Non-obstetrical acute abdomen during pregnancy // Eur. J. Obstet. Gynec. Reprod Biology. – 2007. – Vol. 131. – P. 4–12.
9. Laparoscopic Appendectomy s an acceptable alternative for the treatment of perforated appendicitis / R. Eryilmaz, M. Sahin, G. Bas et al. // Dig. Surg. – 2002. – Vol. 19 (1). – P. 40–44.
10. Laparoscopic appendectomy in pregnancy / J.M. Wu, K.H. Chen, H.F. Lin et al. // J. Laparoendosc. Adv. Surg. Tech. A. – 2005. – Vol. 15 (5). – P. 447–450.
11. Mishra R.K., Hanna G.B., Cuschieri A. Laparoscopic versus Open Appendectomy for the Treatment of Acute Appendicitis // World J. of Laparoscopic Surg. – 2008. – Vol. 1 (1). – P. 19–28.
12. MR imaging Evaluation of acute appendicitis in pregnancy / I. Pedrosa, D. Levine, A.D. Eyvazzadeh et al. // Radiology – 2006. – Vol. 238 (3). – P. 891–899.
13. Negative appendectomy in pregnant women is associated with a substantial risk of fetal loss / M.L. McGory, D.S. Zingmond, A. Tillou et al. // J. Am. Coll. Surg. – 2007. – Vol. 205 (4). – P. 534–540.

## INVESTMENT PROJECT AGRICULTURE ORGANIZATION AS A BASIS OF MEDICINAL AND AROMATIC INDUSTRY IN RUSSIA

Pashtekij V.S., Cherkashina E.V.

*Institute of Agriculture Crimea;*

*State University of Land, Moscow, e-mail: cherkashina@infokad.ru*

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An important task at the present stage of economic development is to create a solid base for the production of medicinal aromatic raw materials. To solve this problem it is necessary to ensure investment in production of raw materials. For this purpose it is necessary to develop investment projects for agricultural organizations producing medicinal and aromatic raw materials.

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**Keywords:** medicinal and aromatic production, investment project

Invest-innovation project "Creation of production-scientific enterprise specializing in growing and integrated processing of essential oil crops in the Republic Crimea" corresponds one of the foreground lines of development of the agricultural sector in The Republic Crimea. This project is seen as a pilot project for the introduction of advanced technologies in the production of medicinal and aromatic.

The project envisages the creation of a complex for the production of essential oils and medicinal raw materials in the production cycle which includes the following steps:

- Storage of planting (seed) stock;
- Planting (sowing) campaign and care of the crops;
- Harvesting of medicinal and aromatic crops;
- Preparation of medicinal and aromatic raw material for processing;
- Processing of raw materials to give the corresponding products.;
- Storage and realization of the products [1].

According to the conditions of realization of the project and having regard to the task to process raw material maximum efficiently (wastefree) the following lines of using of investments are intended:

1. Formation of planting material according to a schedule of sowing campaign based on two year period of development of sowing fields (475 hectare).

2. Carrying out capital repair and reconstruction of the existent industrial and administrative premises as well as building an additional production facility made of easy-constructed unit constructions for processing roses.

3. Purchasing of agricultural equipment for carrying out sowing and planting campaign and harvest.

4. Organization of pre-plant cultivation of the soil and carrying out sowing and planting campaign of the first cycle (the first laying of plantations) paying attention to the fact that profit is not going to be formed in that period. The second and the following cycles of sowing of crops will be put into effect within the framework of economic activity of enterprise.

5. Execution of design works around the enterprise in general and around the complex of processing. The design works provide developing documentation for building new facilities, plan of placement of production lines and their packaging, execution of design works on setting and binding the main production equipment, organizing procurement and storage facility.

6. Purchasing basic process equipment, node points and installation, constructing and assembling of production lines, subsidiary objects, admission of service lines, carrying out startup-setup operations.

7. Inputs connecting with implementation and putting into production.

8. Current capital formation of the enterprise.

In the framework of the whole complex the Project provides creation of self-contained cycle on growing and deep processing of essential oil raw materials into different kinds of products such as essential oils, bio-extracts, toilet water, pharmaceutical medicine as well as supplements for cattle. In the framework of realization of the project it provides reaching planned capacity of production caused by both high level of work content connected with planting seedlings and with the long term of growing of some crops till the first harvesting.

In the Table 1 consolidated information about the lines and capacity of investing expenses in the framework of carrying out the project of creation of pilot production on processing of essential oil crops is presented.

According to the state document of using the land on August 2013 the PF "Crimea Rose" owns 2072 hectare of land. The land is given for scientific researches and productive activity. According to the Agreement about joint-cooperation from 6 April 2010 y. a part of the land was given to a private enterprise LLC "Agroproject "Troyanda Nova" (Lugansk city). For the period of 2013y. there was 1086,0 he. covered by crops. This way the PF "Crimea Rose" owns 553,2he of lands that are not used this time [2].

While realizing the project the following economic and social activities are intended to achieve which are presented in the Table 2.

Table 1

The lines of investment and capacity of investment

Investing expenses item	Capacity of investment
	Thousands of dollar USA
General crop complex total, including.:	1 499,0
– purchasing of planting stock	753,0
– purchasing agricultural equipment	601,0
– expenses on planting crops	145,0
Processing complex total, including.:	2 412,5
– expenses on drafting and put into operation	120,0
– civil and erection works and repairing works	470,0
– purchasing main productive nod points and aggregates, subsidiary subjects and materials	1 252,5
– expenses on installation and commissioning works	400,0
– finances (current capital)	170,0
total investing expenses	3 911,5

Table 2

the main activities of economic and social efficiency of the project

An activity	Unit of measure	1 year	2 year	3 year	4 year	5 year	6 year	total
Profit from realization	Thousand dollars	456	2 019	4 070	4 720	7 956	5 204	21 429
Net profit	Thousan. dollars	–116	366	1235	1430	1505	1582	6002
Profitable work	%	–	22	36	36	36	36	28
Creation of working places with increasing result	Unit	47	55	58	58	58	58	58

Significant increase in production capacity of medicinal raw materials and essential oils with high quality and reasonable price enable displace imports and increase export potential significantly. Implementation of the project will influence on the social development of the region in the best way.

Investing efficiency of the project was analyzed by calculating of the activity of net present

value of the project (NPV), internal rate of profitability (IRP), a term of recoupment and a present term of recoupment of investments on the measures specified in this business-plan and the index of profitable inputs. The results of this calculation is presented in the table below. Discount rate was accepted on the level of 10% (an average deposit rate is 5%, as well as perils of decreasing of a level of profitability are 5% in the project).

Table 3

A consolidated table of activities of efficiency of the project

An activity	Units of measuring	Value
A period of recoupment	year	4,7
Discount period of payback (DPP)	year	5,4
Net present value of the project (NPV)	thous.dollars	1639
Inner rate revenue (IRR)	%	22
Profitable index of inputs (PI)	unity	1,46
Revenue of investments (ROI)	%	17,6

The project has enough level of inner rate of revenue that is 22% that exceeds discount rate more than two times. As it becomes clear from the table the project is effective, implementable and attractive for investments.

Table 4 presents data on volumes of production of medicinal and aromatic raw materials in Crimea. It should be mentioned that the given structure of sowing areas and gathering essential oil raw material remains without any changes during last years.

Table 4

Production of essential oil raw material in ARC in 2012 year [3]

A name of region	Name of production													totally	
	sage			lavender			coriander		rose			others		Total area	Production, t
	Area, he		Croppage, t	Area, he		Croppage, t	Area, he	Croppage, t	Area, he		Croppage	Area, he	Croppage		
	total	fertile		total	fertile				total	fertile					
Bakhchisarayskiy	285	129	110	318	318	439			25	25	12	153	148	771	710
Belogorskiy	381	108	1062	1272	1040	814	1629	650	60	30	36			3343	2562
Dzhankoiskiy							647	195						647	195
Kirovskiy				182	182	1	728	635						910	636
Krasnogvardeyskiy	98	30	67	414	414	178	3288	1942				25	1	3825	2186
Krasnoperecopskiy							542	137						542	137
Leninskiy							276	164						276	164
Nizhnegorskiy							2116	2086						2116	2086
Pervomaiskiy							665	194						665	194
Sakskiy							587	445						594	447
Simferopolskiy	374	374	841	291	291	279	1072	523	16	16				1482	1643
Sovetskiy							1208	1157						1208	1157
Chernomorskiy				171	171	75						25	15	196	90
Alushtinskiy pl.of es.				107	107	32			32					141	32
Totally	1138	641	2080	2755	2523	1818	12758	8128	133	71	48	203	164	16716	12239

Basis for successful production are::

- natural-climate conditions;
- technologies;
- culture of production, professional skills of a producer.

Those producers who own more advanced technologies have considerable advantages and higher rate of profit over the rest.

Currently Crimea has all three components for quality medicinal and aromatic raw materials. Natural-climate and soil conditions are very favourable for it. On detritus and marly soils where crop capacity of cereals 6–7 c/he and crop capacity of lavender is 40–50 c/he, sage – 60–70 c/he. Besides that so rare essential oil plants as rockrose, rosemary, gumweed

and some other plants that can be cultivated in the framework of planned enterprise are grown only in the Crimea.

Our country only on the Crimean resources may be the world's largest producer of essential oils and medicinal herbs.

**References**

1. Cherkashina E.V. Economics and Organization of rational use and protection of land medicinal and aromatic industry. Monograph / E.V. Cherkashina. – M.: GUZ, 2013. – 284 p.
2. The site materials.URL: <http://klepinino.crimea-ua.com>.
3. Cherkashina E.V. Integration process Republic of Crimea in the Russian economic space as a stimulus for aromatic and pharmaceutical industry in the country // Modern problems of science and education. – 2014. – № 2; URL: <http://www.science-education.ru/116-12776>.

*Materials of Conferences***RETROSPECTIVE ANALYSIS  
OF EMERGENCY LAPAROSCOPIC  
CHOLECYSTECTOMY**

Bayzharkinova A.B., Ergaliev K.E.,  
Taishibaev K.R.

*ZKGMU named after Marat Ospanov railway hospital,  
Aktobe, e-mail: bayzharkinova@mail.ru*

The article provides retrospective analysis of work of surgeons on successful laparoscopic cholecystectomy in case of acute cholecystitis. A rare type of complication within the problem of diagnosis is described: overhepatic abscess, it has been removed via method of relaparotomy.

**Introductions.** Laparoscope “Krasnogvardeyets”, produced in Leningrad, has been introduced for diagnostic purpose in railroad hospital of Aktyubinsk medical institute in the center of West-Kazakhstan railroad. The first introduction of laparoscope with medical purpose in Kazakhstan took place in 1992 in the clinic of Scientific surgical center of Syzganov in Almaty, and the first planned laparoscopic cholecystectomy was carried out in 1993 in our railroad hospital via Japanese apparatus “Olympus”.

LCE has become a common type of surgery for chronic and acute cholecystitis nowadays. During years experience has been accumulated, and indications for implementation of laparoscopic surgeries have broadened. Many articles have been published and candidate works prepared on implementation of laparoscope in diagnostics and complex treatment of acute cholecystitis.

The obvious simplicity of these surgeries for non-complicated forms of chronic cholecystitis and good results allow us to introduce emergency laparoscopic cholecystectomy for destructive forms of the disease. Readiness of surgeons to use endovideotechnics and stable operation of the latter, surgeons’ knowledge in the area of clinical and pathological anatomy of gall channels and bladder have played an important part in carrying out urgent laparoscopic cholecystectomies.

**Urgency.** Acute cholecystitis occupies the second place in frequency and forms 10–15% of all acute surgical diseases of stomach area organs, at the same time, number of men and women, affected by this disease is equal after 50 years of age.

Therefore, the problem of emergency laparoscopic cholecystectomy in case of acute cholecystitis remains urgent, as implementation of LCE requires attentive training, studying approaches and possible complications after such complex operations in case of inflammation of portal veins of liver. During emergency on destructive forms of cholecystitis neck, body, and bottom of gall bladder are changed pathologically, hyperaemia and edema are observed in the surrounding tissues.

Sometimes Hartman recess is increased and welded with cystic channel that complicates diagnostics of the place of cystic channel inflow into choledoch. Anatomic intra-liver location complicated mobilization of the neck of gall bladder. In certain cases under an acute inflammatory process long or short cystic channel was welded by a fibrous tissue with choledoch and vessels, and it caused danger of damaging the latter. Sometimes cystic channel took shape of spiral ruffle of mucous membrane that was recognized as Heister’s valve. It created certain complications during drainage (according to indications, for example, in case of cholangitis) of choledoch through the stump of cystic channel. In case of empyema or dropsy of gall bladder aspiration of its contents has been carried out completely via syringe for bacteriological sawing. After the bladder cavity is cleaned and nitrofuril (30–50 ml) is placed in it, wall in the bottom area can be captured freely. Growth in stomach cavity up to 18 times under LCE combines radicalism (removal of pathologically-altered bladder with concretions), low possibility of trauma, and efficiency. Laparoscopic cholecystectomy provides patients with low possibility of trauma, short period of hospitalization, and quicker return to normal life in comparison to open cholecystectomy (Gilchrist B.F., Vlessis A.A., Kay G.A. et al., Soper N.J., Barteau J.A., Clayman R.V. et al., McGregor C.G. Evaluating systems stress response in single port vs multi-port laparoscopic cholecystectomy // *J. Gastrointest. Surg.* – 2011. – № 15(4). – P. 614–622). During recent years reports on implementation of emergency LCE in case of acute cholecystitis have become frequent, however, not all problems of relaparotomy, possible periods of secondary operations, technical principles and methods of treating complications (subhepatic abscess) have been defined yet (Westerband A. Van-De-Water J. Amzallag M.).

Our doctors have experienced complications during the period of mastering practice of laparoscopic cholecystectomy regarding uncomplicated cholecystitis, such as hypodermic emphysema (on face, chest, etc.) in case of insufflation of gas. Emergency LCE on an acute calculus cholecystitis can result in complications such as gall flow from the additional channel that was not located and clipped, prolapse of calculus from perforated places of gall bladder wall, and insignificant parenchymatous bleeding from the cavity. These complications have been removed by laparotomy and draining. One complication was difficult to diagnose: overhepatic encysted abscess. This case requires a separate explanation, as lower-lobe pneumonia has been suspected in the right and in sinus of heights during roentgenological inspection of lungs (obviously a joint reaction of lungs). This data stopped us from

secondary penetrations. Repeated ultrasound inspection and laboratory-clinical observation over female patient N, 56 years of age (attended disease sugar diabetes of the 2<sup>nd</sup> type) led to the conclusion: relaparoscopy is required. Therefore, insufflation of gas has been carried out through subhepatic drainage that was left after emergency LCE. Diagnosis "encysted subphrenic abscess" has been verified after relaparoscopy, then it was misformed, cleaned, and its jacking was completely removed via laparoscopy, drainage for introducing antibiotics was left. The patient recovered quickly and was discharged with improvement. Insignificant complications were observed from the side of near-umbilical wounds such as seroma where gall bladder with infected stones had been discharged. In later periods small postsurgical ruptures were registered in umbilical area, mostly among women who took physical work.

**Research objective.** The objective of this work is to improve results after emergency cholecystectomy with acute destructive cholecystitis through implementation of laparoscope and also share experience of carrying out emergency LCE on patients with acute cholecystitis.

**Materials and methods of research.** 1085 patients with cholecystitis have been received in general-surgery department of our clinic during the period 1993–2009. The patients arrived from Kazakhstan, nearby regions of Russia and Chechnya. Contingent of patients was different (authorities, lawyers, school teachers, doctors, pensioners, etc.), age varied from 17 to 85 years of age. Totally 1034 patients were operated via laparoscopy. All patients were hospitalized in emergency to general-surgery department of the clinic in different periods from the beginning of disease. 32,4% of patients were hospitalized during the first day of the disease, the rest were delivered to the hospital after more than one day. 51 patient of 1085 was not operated due to various reasons.

532 of 1034 patients were operated in a planned order via laparoscopy, and 511 patients were treated with emergency LCE with the diagnosed calculus cholecystitis, and 11 (2%) patients were transferred to TCE under emergency LCE. Since 2010 LCE has been carried out on commercial basis, so the number of laparoscopic surgeries for the research has been taken for the period 1993–2009.

There were 105 men (21%) and 395 women (79%). Diagnosis "acute cholecystitis" was established among all patients before surgery, and then confirmed after 7–10 days during histological inspection. During surgery acute phlegmonous cholecystitis has been established among 387 (77,4%) patients, gangrenous cholecystitis – among 85 (17%) patients, and empyema of gall bladder and local peritonitis – among 28 (5,9%) patients.

Attending diseases have been registered among 87 (63%) of patients, besides, several attending diseases have been registered among 43 pa-

tients. Heart-vascular diseases were most frequent (25,3% – hypertonic disease, 27,1% – ischemic heart disease, 18,3% – cardiosclerosis). Chronic bronchitis has been registered among 16,3% of patients, bronchial asthma – among 0,5%, lungs emphysema has been observed among 1,2% of patients. 258 patients had obesity of different degree (24,2% – 1<sup>st</sup> degree, 16% – second degree, and 9% – 3<sup>rd</sup> degree).

The following indications were set for emergency laparoscopic cholecystectomy: presence of acute (phlegmonous, gangrenous, and other forms) cholecystitis. Patients were observed in priority: roentgenological inspection, US, ECG, general analysis of blood and urine, biochemical analysis of blood (bilirubin, blood coagulability and glucose, transaminase, remaining nitrous), blood inspection for HIV, reaction of Wasserman, Australian antigen, blood group and Rhesus factor, consultation of anaesthesiologist, cardiologist, endocrinologist, therapist, gynaecologist for women.

Absolute contraindications for emergency LCE were: chronic duodenal impassibility, mechanic jaundice and different types of gall peritonitis. Conditional contraindications were listed as: expressed welding process on the higher level of stomach cavity (earlier operation on stomach regarding perforated ulcer of duodenum), 1 patients was operated. No lethal outcomes were registered after emergency or postponed LCE.

#### Conclusions

Emergency laparoscopic procedures can be performed in acute, allowing early intensify patients and significantly reduce the length of stay in the hospital, get a good cosmetic effect, restore the ability to work, the most optimal deadlines emergency laparoscopic cholecystectomy is the first day of onset of the disease, as in this time do not have time to develop gross anatomical and morphological changes in biliodigestive zone. Performing emergency laparoscopic cholecystectomy in acute cholecystitis is technically more difficult than in chronic. Difficulties encountered when capturing busy with thickened gallbladder wall (especially if the stone inside the gallbladder large or pus), the allocation of the elements of the triangle Kahlo, aspirate the contents of the subhepatic space and removing the gallbladder from the abdomen, etc. Absolute contraindication for emergency LCE in patients with acute calculous cholecystitis are: chronic duodenal obstruction, gangrenous cholecystitis, ruptured and diffuse peritonitis. In the preoperative evaluation of patients, particular attention should be given to U.S. hepatobiliary zone because of the technical features depend LCE (better look with the operating surgeon Medical ultrasonography). Cholecystectomy using laparoscopic techniques in patients with acute calculous cholecystitis is performed under general anesthesia with tracheal intubation and the use of muscle relaxants. During emergency LCE in patients with acute calculous cholecystitis should:

1) puncture and aspirate the contents of the large and busy gallbladder; 2) CAUTION carefully and highlight elements of the triangle Kahlo and well klipirovat; 3) rinse thoroughly, drain and aspirate obstructive and suprahepatic space. Thus, emergency laparoscopic cholecystectomy was performed in 511 patients with acute cholecystitis, 11 of them with the transition to the traditional method. Were no deaths.

**List of our works**, published on topic of laparoscopic cholecystectomy:

1. "Advantages, possible mistakes, dangers, and complications of laparoscopic cholecystectomy", Collection, materials of Russian symposium, Moscow, May 1996, p. 26–28 (co-authors B.I. Bapayev, K.E. Ergaliyev, A.B. Baizharkinova, and others).

2. "Laparoscopic cholecystectomies" – Collection, 2<sup>nd</sup> Moscow international congress on endoscopic surgery, Moscow, IV, 1997, pp. 12–13 (co-authors B.I. Baspayev, A.B. Baizharkinova).

3. "Results of medical ezophagogastrodeudenscopy". Russian symposium Clear space endoscopic surgery: Theses of report – Surgery, № 5, 1998, pp. 150–151 (co-author A.B. Baizharkinova).

4. "Abilities and closest results of videolaparoscopic surgery" – Collection: 3<sup>rd</sup> Moscow international congress on endoscopic surgery, Moscow, April 1999, pp. 30–31 (co-authors B.I. Baspayev, A.B. Baizharnikova, and others).

5. "Closest and distant result results of videolaparoscopic surgery" – Collection: 4<sup>th</sup> Moscow international congress on endoscopic surgery, Moscow, IV, 2000, pp. 34–35 (co-authors B.I. Baspayev, A.B. Baizharnikova, and others).

6. "Complex treatment of ulcer disease of duodenum via videopendosurgical method" – Collection: 6<sup>th</sup> Moscow international congress on endoscopic surgery, Moscow, IV, 2002, pp. 377–378 (co-authors K.R. Taishibayev, Z.A. Doskaliyev, A.B. Baizharkinova, and others).

7. "Videolaparoscopy in surgery of complicated appendicitis" – Collection: 8<sup>th</sup> Moscow international congress on endoscopic surgery, Moscow, IV, 2004, 127–129 (co-authors M.N. Izimbergenov, A.B. Baizharkinova, etc).

8. "On laparoscopic treatment of acute cholecystitis". pp. 388–389, Materials of scientific-practical conference, Almaty, 1994, October (A.B. Baizharkinova).

9. "Results of endovideosurgery of complicated calculus cholecystitis". Materials of plenum of scientific society of surgeons in Republic Tatarstan. Workds on problems of emergency surgery, Almaty, 2000, pp. 46–49 (co-authors Z.A. Doskaliyev, A.B. Baizharkinova, and others).

10. "Some aspects on anaesthetization and carrying out laparoscopic surgeries". Materials of Republican scientific-practical conference with international participation "Actual problems of modern theoretical, clinical medicine, and medical educa-

tion", devoted to 50 years of Western-Kazakhstan state medical academy of Marat Ospanov, Aktobe, 2007, pp. 185–186 (co-authors B.I. Baspayev, A.B. Baizharkinova, and others).

11. "Combined research in diagnosing and treating diseases and injuries of stomach" The I Congress of Kazakhstan surgeons – 1997, IX, pp. 108–109 (co-authors B.I. Baspayev, A.B. Baizharkinova, and others).

12. "Laparoscopic cholecystectomy" The II Congress of Kazakhstan surgeons, 2003, IX pp. 38–40 (co-authors N.A. Akatayev, B.I. Baspayev, A.B. Baizharkinova, and others).

13. "On history of laparoscopic surgery", "Experience of 1000 of LCE", and other articulated in Kazakh medical editions of medical university, edited by A.B. Baizharkinova.

#### References

1. Gallinger Y.I., Kapenkova V.I., Vorobiyov V.K. Damages of hepaticoholedoch during carrying laparoscopic cholecystectomy // Surgical annotation, 1996, № 1, p. 301.

2. Genyuk V.Y Endoscopic technologies – method of preventing complications "Endoscope". – 2008. – № 3. – P. 13–15.

3. Germanovich C.S., Yakovlev S.I., Samsonov S.I. and others, Impact of scar-inflammatory process upon results of treating patients with calculus cholecystitis // Endoscopic surgery. – 2009. – № 3. – P. 12–14.

4. Rutenberg G.M., Rumyantsev I.P., Protasov A.V. and others Efficiency of implementing low-invasive surgeries in endoscopic surgery. – 2008. – P. 3–8.

5. MoGregor C.G. Evaluating systemis stress response in single port ys multi- port laparoscopic cholecystectomy // J. Gastrointest. Surg. – 2011. – № 15(4). – P. 614–622.

The work is submitted to the International Scientific Conference "Fundamental research", Jordan, June 9–16, 2014, came to the editorial office on 29.04.2014.

#### THE DIVERSITY OF THE MEDICAL DEVICE ARENA AND THE RATIONAL CHOICE OF THE REQUIRED PRODUCT

Frolova M., Frolov S.

*Tambov State Technical University, Tambov,  
e-mail: frolova@mail.gaps.tstu.ru*

Information systems in Health care that are based on service-oriented architectures should not only capture, present and evaluate information about the person's health status, but also they should increase the efficiency of the hospital. For example, health care information systems should control rational choosing a medical device in the hospital.

Medical devices are used to enhance health care in general and to enhance the health of everyone. On the one hand, the use of medical devices brings health care to the next level and it has a lot of benefits to the patients. One the other hand, the process of choosing a medical device is intricate. In many cases the choice and use of medical devices is not based on the needs of a hospital. So information systems, models and methods should be developed



in order to optimize the process of choosing a medical device. Developing a decision support system is one of the ways to solve the current problem of lack of a medical device management system and to improve health care.

It is worth noting that the medical devices market is growing. For example, only in Germany there are more than 170 manufactures of medical devices. How do doctors choose which one to buy when there is such a diversity of medical devices? Medical devices are often chosen for their technical attributes. Marketing politic of the seller or physician preferences also influence the decision. But there are a lot of problems to choosing and buying a medical device.

One of the major obstacles to rational choosing of a medical device is innovation. The fact that this particular medical device is innovative can influence the decision. The specialist does not always consider whether this technology will be used in the hospital. The second important barrier to choosing a medical device is the lack of adequate information. The marketing and selling specialists try to show the best options of the device. So sometimes it can be difficult for decision-makers to compare the analogues medical devices reasonably. Moreover, the post-market surveillance systems which are the way to follow-up on the safety and effectiveness of a device do not function properly. The third problem that decision-makers face when they want to choose the medical device rationally is the high costs of it. Not only are the medical devices expensive, there are also hidden costs such as costs of accessory options, years of warranty, installation, procedures and recurrent costs for maintenance, spare parts, consumables etc. In addition, the doctor often chooses the medical device according to his preferences and previous experience. This choice may not be rational.

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The work is submitted to the International Scientific Conference "Modern high technologies", (Jordan), June 9-16, 2014 came to the editorial office on 10.04.2014.

#### **REACTIVE CHANGES AND FEATURES REPARATIVE REGENERATION MYOMETRIUM LOWER UTERINE SEGMENT DUE TO ITS EXTENSION**

Grigoryeva Y.V., Kulakova O.V.,  
Chemidronov S.N., Tulaeva O.N.

*Samara State Medical University of the RF Health  
Ministry, Samara, e-mail: JuliaG.va@yandex.ru,  
e-mail: gfrs@inbox.ru*

The regenerative ultrastructural changes in lower uterine segment myocytes have been investigated with phase contrast and electron microscopic examinations after experimental dilatation. The myometrial myocytes damage provocation takes place unevenly after lower uterine segment dilata-

tion. The fibrous connective tissue synthesis starts during the reparative regeneration, it leads to hysto-architectonics disruption and local myometrium dysfunction. The fibrillar structures synthesis in intercellular substance is carried out by phenotypic smooth muscle type transformation from contractile to "Synthesizing". Smooth muscle cells are not involved in cell proliferation. The myocytes intracellular regeneration takes place in lower uterine segment.

**Introduction.** A visceral muscle tissues study that form the hollow organs walls and various sphincters, is the most actually and poorly known [3]. There is no common understanding between pathologists and obstetricians about morphological and functional features of the lower uterine segment [4]. There is opinion that the lower uterine segment sphincter performs the obturator function of pregnancy cervix, also it has an indicator function in progress of abnormal occurrences in parturition [2, 5]. In addition, the lower uterine segment postpartum restoration forms a full barrier for ascending infection progress. The lower uterine segment traumatic injuries in obstetric practice which occurred after violent expansion of the cervical canal in induced abortions and diagnostic curettage, promote lower uterine segment functional insufficiency in pregnancy and have the adversely affect birth outcomes. It is necessary to develop the methods for correction the caudal uterus functional insufficiency after injury in the absence of morphological evidence, so we determined the purpose of our research [1, 6].

**The purpose** of present study was to research reparative regeneration in rat functionally important lower uterine segment myometrium after tension in experiment.

First we have to simulate the rat lower uterine segment stretching, also we have to characterize the myometrium myocytes lesions in lower uterine segment after experimental tensile, at last we have to find the leading mechanisms of myometrium reparative regeneration for achievement.

**Materials and methods.** Thirty nulliparous mature white rats were used. The remaining intact rats were used as controls. "Rules to the Use of Animals in Research" were used in present experiment. The lower uterine segment was extended with the rat under Aether anesthesia. All the rats of the experiment group were killed under anesthesia using Aether. The materials were examined on third, seventh, tenth, fifteenth, twenty first days, that's why the materials were fixed in glutaraldehyde, filled with Araldite-Epon mixture, then the materials were contrasted with uranyl acetate and lead citrate. Semithin and ultrathin sections were prepared. We used phase contrast and transmission electron microscopy.

**Results and discussion.** The uterus lower segment stretching leads to uneven smooth muscle tissue damages in myometrium. Some myocytes in functional syncytium retained their structure,

other myocytes have dystrophic and necrotizing changes on the third day after injury (Fig. 1). The cytoplasmic matrix compaction took a place in myocytes. Nuclei were found at different stages of cell death. The cisterns of sarcoplasmic reticulum are expanded, parietal located caveolae particularly affected. Myocyte mitochondria are swollen, it leads to partial or total crist destruction. The number of specific organelles is purposed. Myocyte membranes are violated – it leads to destruction of intercellular interactions. Well known, there are two main leyo-myocyte types of cell-cell junctions: mechanical (desmosomes) and functional (nexuses). There are preserved myocytes, which are visualized in the damaged lower uterine segment on 7–10 days after injury. Myofibrils decrease and free ribosomes and polysomes increase due to the development of granular endoplasmic reticulum are observed in preserved myocytes cytoplasm. This means that myocyte phenotype has changed from contractile to synthesize.

Intercellular spaces are expanded on the third day after lower uterine segment stretching. First, it is caused by interstitial edema and collagen stimulation by reactive inflammation cells. Then extracellular matrix is produced around cells since seventh till twenty first day after stretching. Intercellular spaces are filled with protein masses with fibril-

lar structure, which assembled into the fibers. The cells are packed in fibrillar matrix, their contacts are violated. Probably, these structural changes lead to myometrium dysfunction.

The fibrous connective tissue density is increased on twenty first day after stretching. There are cell location and newly formed fibers orientation disruption visualized in myometrium. (Fig. 2, 3).

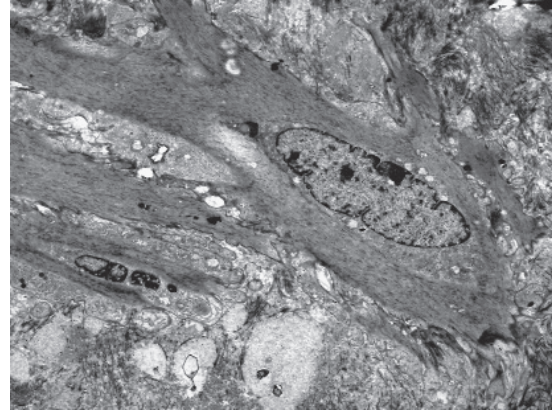


Fig. 1. Lower uterine segment on third day after injury. Preserved leyo-myocyte. TEM. 1000X

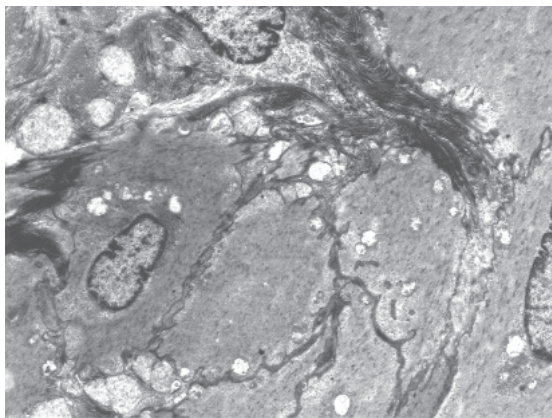


Fig. 2. Lower uterine segment on 21 day after injury. The fibril-forming interstitial collagen. UTEM. 1200X

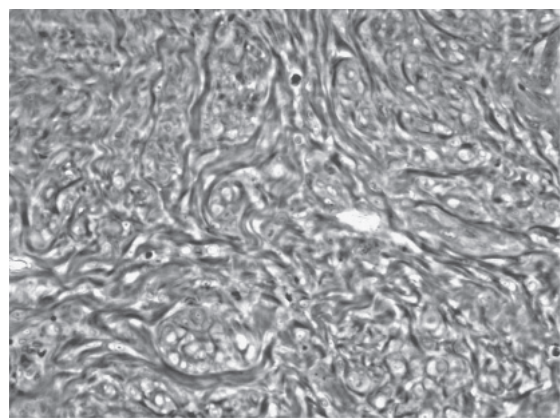


Fig. 3. Lower uterine segment on 21 day after injury. The collagenous fibers in myometrium. Phase-contrast microscopy. 1200X

There were no found myocytes mitosis during the whole period of observation.

So, we have found diffuse changes in myometrium after uterus lower segment stretching. The intracellular regeneration has taken a place in myometrium. We have found the myocyte phenotype transformation from contractile to synthesize. The myocytes synthesize extracellular fibril-forming collagen matrix. The cells are packed in fibrillar matrix, their contacts are violated. These structural changes lead to myometrium dysfunction

#### References

1. Badretdinova F. Prevention and treatment of the effects of obstetric injuries of the cervix in nulliparous women using laser technology / F.F. Badretdinova, S.H. Ghanaianis, R.F. Magafurov // International journal of applied and fundamental research . – 2013. – № 5. – P. 27–30.
2. Voskresensky S.L. The role of uterine activity in the generic process: Author. diss. PhD. – Minsk, 1995. – 35.
3. Zashikhin A.L. On the phenotypic differences between smooth muscle cells that make up the visceral and vascular smooth muscle / A.L. Zashikhin, V. Agafonov // Questions morphology of the XXI century. – 2010. – Vol. 2. – P. 134–138.

4. Savitsky A.G. Role of the lower segment in the birth process / A.G. Savitsky, V.V. Abramchenko, G.A. Sawicki // *Journal of Obstetrics and women's diseases*. – 2005. – Vol. 54, № 3. – P. 19–27.

5. Alvarez H., Caldeyro-Barcia R. The normal and abnormal contractility of the uterus during labor // *Gynaecologiae Basel*. – 1954. – Bd. 138. – P. 198–212.

6. Dales I. Uterine Contractility patterns of the outer and inner zones of the myometrium // *Obstet. Gynaec.* – 1974. – Vol. 44, № 3. – P. 315–326.

The work is submitted to the International Scientific Conference “Fundamental research”, Jordan, June, 9–16, 2014, came to the editorial office on 25.04.2014.

### TRAUMATISM AT CHILDREN OF THE REPUBLIC OF SAKHA (YAKUTIA)

Ivanova O.N.

*SVFU medical Institute  
under the name of M.K. Ammosov,  
Yakutsk, e-mail: olgadoctor@list.ru*

Traumatized by the child can lead to serious consequences, and sometimes and to death. Quite often trauma got in the childhood, becomes the reason of permanent functional violations in an organism. So, changes can lead to a curvature or extremity shortening. The hems remaining after burns, pull together joints, limiting their mobility. Insufficient physical activity of fingers owing to wound of a brush limits subsequently choice of profession. After concussion affected many years complain of headaches, sleeplessness, bad memory, impossibility to concentrate [1, 2].

In prevention of children's traumatism adults have to consider constantly features of development and behavior of the child of early age.

Work purpose: To study dynamics of traumas of various etiology at children of Republic of Sakha (Yakutia).

**Materials and methods.** We analysed the reports of reception and diagnostic office of National Centre over the last 5 years.

**Results of research.** Growth of number of traumas of various etiology at children in the Republic of Sakha (Yakutia) over the last 5 years is noted. So, indicators of home accidents of 2009 made the 3477th child, for 2013 5037 children addressed with home accidents already. From among addressed, children who demand medical care and supervision are hospitalized. In the Republic of Sakha (Yakutia) increase of number of a beating among children over the last 5 years is noted. In 2009 are hospitalized with a beating in National Centre – 78 patients (57,9%), in 2010 of – 113 children, in 2011 – 73 children, in 2012 – 91 child, in 2013 – 89 children. Seasonality of the bitten traumas is noted during the summer period (June-July-August).

Unfortunately, scheduled maintenance on the prevention of traumas at children in the Republic of Sakha (Yakutia) is insufficient. Further, carrying out preventive actions (work with parents and teachers) is necessary.

### Conclusions

1. Growth of quantity of traumas at children in Republic of Sakha (Yakutia) is over the last 5 years noted.

2. It is necessary introduction and development of programs of the prevention of traumatism at children at schools, to training of teachers in first-aid treatment in children with traumas.

### References

1. Volkov M.V. Diseases of bones at children. – M.: Medicine, 2005. – P. 34–45.

The work is submitted to the International Scientific Conference “Fundamental research”, Jordan, June 9–16, 2014, came to the editorial office on 06.05.2014.

*Short Reports*

**THE SPECIALIZED CENTER  
ORGANIZATIONAL MODEL  
ON PREGNANCY AND DELIVERY  
MANAGEMENT AT JUVENILES**

Mikhaylin E.S., Ivanova L.A., Savitsky A.G.,  
Minina A.G.

*The Maternity Hospital № 10, Sant-Petersburg,  
e-mail: mihailin@mail.ru*

The organizational structure description of the Center for the pregnancy and childbirth management at the juveniles, having created on the “The Maternity Hospital № 10” (Saint-Petersburg) basis, where since 2013 the “Little Mother” Municipal Social Program is implemented, has been given in the paper. So, the minors, pregnant girls and their parents, within the framework of this Program, can attend the obstetrician – gynecologist, take the additional tests, examine the functional status of the fetus. The consultations of the family psychologist and lawyer are being carried out, and the juvenile pregnant minors attend the lectures and the classes of the physical therapy in the Training for Childbirth Center. If it is necessary, the medical treatment in the day hospital, or at the Pregnant Pathology Department are being carried out, the childbirth and the postpartum period are being maintained in the “Little Mother” separate chambers and wards. The main purpose of the Project of the Center creation for Juvenile Pregnant, on the basis of the large obstetric Institution of Saint – Petersburg, has been aimed at the quality further improvement of the care assistance for the pregnant juvenile women, who have already decided to keep the baby, in order the early pregnancy from the tragedy would be turned into the family joy, and be allowed the very young woman to be established herself physically and psychologically, as in the family, well as in the society.

**The Introduction.** The various aspects study of the pregnancy, at the young age, has been devoted the large number of the papers, both in Russia, and abroad [6, 8, 9]. So, numerous papers have also been devoted to the medical and social, organizational nature studies and researches of the given challenge [2, 4]. However, up to the present date, the urgent and valid bases for the organization of the complex medical, medical and social, psychological, rehabilitation and legal assistance to the juvenile pregnant women are being remained. Thus, the main challenge is, practically, being solved in two possible ways: either early marriage and the child birth, or the termination of the pregnancy, and, very often, for the longer period. For any outcome, the pregnant adolescent has the strongest psychological and the physical stress, which, in its turn, is affected and is left its unforgettable traces

and stamp on the whole her further life, and, that is why, the special medical and the psychological help and assistance are much needed to the juvenile patients, in order the early pregnancy from the tragedy would be turned into the family joy, and be allowed the very young woman to be established herself physically and psychologically, as in the family, well as in the society [5]. So, the quality of the medical, and even more so, the psychological, and social assistance and corresponding support in the primary care establishments is often poor, and it, frequently, is left much desired, as the specialists and the experts have no suffice their necessary fundamental training on the physiology and the pathology aspects of the adolescence age [3], and, moreover, the juvenile patients’ satisfaction of the doctor, having led their pregnancy, is made up only about 50% [7]. Also, about 50% of the pregnant girls – adolescents and their parents would still receive in addition to the medical care in the general stream, and even psychological and social support [1]. Therefore, the scientific justification of the organizational bases of the specialized Centers for the pregnancy and the childbirth management at the juveniles, having provided the comprehensive medical and social, psychological, and legal assistance of this rather complex patients’ category of the population is relevant and urgent. Thus, in the publicly available scientific literature, the necessary information on such similar Centers organization on the Russian Federation territory could not be found by us.

**The Results of the Study and Their Discussion.** “The Maternity Hospital № 10” is specialized and focused on the birth conduct at the juveniles, since 1997. During this time, 482 pregnant underage women have successfully been delivered, in the framework of the special Program on the pregnancy and childbirth management, at the juveniles “The Little Mother”. So, the juvenile pregnant woman (e.g. the age is under 18 years), may, at any stage of her pregnancy, apply to the outpatient – polyclinic department “The Maternity Hospital № 10”. The female consultation physician, in which the juvenile pregnant girl has already been registered, also may apply to the outpatient – polyclinic department “The Maternity Hospital № 10” with her request to be recorded the juvenile pregnant at the first visit to the leading specialist of the Maternity Hospital. Such appeal is practically made to the current calls registry of the outpatient – polyclinic department. Her participation in the “Pregnancy and Childbirth Management at the Juvenile Females” Program in “The Maternity Hospital № 10” is not practically substituted for the juvenile pregnant conducting at the female consultation, but it is complemented it, at

the woman's request. So, all the consultations, further hospitalization for the medical departments, the classes in the preparation for the childbirth Center are held for the juvenile pregnant girls free toll. At the first visit, the obstetrician – gynecologist physician is practically made up the preliminary management plan of the juvenile pregnant girl, having based on the pregnancy length and the woman's social status, tells her on the Program. To all the visits of the obstetrician – gynecologist, and the psychologist, the juvenile pregnant, if desired, can come with her parents or the legal guardians, the representatives of the orphanage or with her boyfriend (e.g. the child's father). So, the special programs of the pregnancy and childbirth management at the juveniles have already been developed by the "The Maternity Hospital № 10" specialists and their experts. So, the "Pearl" Training Center for the Childbirth is practically played the special role in the pregnancy management at the juvenile girls in the outpatient – polyclinic department, the work with the juvenile girls, in which the following areas and the directions are being consisted: the physiotherapy, the lectures on the midwifery, the care for the newborn, and the lecture on the cosmetology. The sessions with the psychologist are allowed to be removed the internal stress, the anxiety, to be discussed "everything, that in the soul" while waiting for the new family member. Thus, the first and early pregnancy months – this is the time of the revolutionary changes not only in the female's physiology, but also in her psychology. Even, if the child is the welcome, and long – waited, not everyone can be accepted all these changes, at once. The numerous emotional and the social challenges, having piled heavily on the shoulders of the young and pregnant woman, are caused not only the fatigue feeling, and sometimes even the despair, but also they can be led to the many pregnancy complications, to be caused of the threatened abortion, and even the miscarriage. So, Little Mother, to the certain degree, feels herself to be trapped. The work with our psychologist in the small groups, the opportunity to be communicated with the similar, as she, helps to be understood, that she is not alone, and that others have successfully cope with their difficulties. So, in this quite difficult situation, it is very significant to be enlisted the support of the non – indifferent and caring adult – mother, father or the psychologist, who will not indiscriminately condemn, but help the girl to be coped with her numerous challenges, helps to be understood, that she is not so "bad", and, moreover, that she can be happy! The work individually or in the group with other pregnant girls under the guidance of the experienced psychologist is helped to be understood all these difficult moments of the new life of the girl and also her family. So, the lectures of the lawyer and the social worker are being affected the aspects of law

and legislation of our country, regarding the work and the rest of the pregnant, the maternity leave, the child care, the social benefits to the young parents. Thus, much time is paid on the rights of the juveniles, in general, and their parental rights, in particular.

If it is necessary, the obstetrician – gynecologist physician sends the juvenile pregnant girl for the hospitalization: at duration of the gestation up to 22 weeks for the Gynecology Department of the "Maternity Hospital № 10", at duration of the gestation over 22 weeks for the Pregnancy Pathology Department. So, the juvenile pregnant management at the Gynecological Department or at the Pregnancy Pathology Department is practically carried out by the Head of the Department. In any case, all the pregnant juvenile women, at full 38 weeks are usually sent to the Pregnancy Pathology Department, for the purpose of the further preparing for the childbirth and the delivery. So, the deliveries at the juvenile women are being carried out in the Maternity Department, in the single delivery room № 2 of "The Little Mother". At the request of the juvenile woman, the childbirth is carried out at the presence of her loved man. In the post-natal period, the juvenile puerperant is in the double chamber of the Post-partum Department. The juvenile puerpera management at the Post-natal Department is carried out by the Head of the Department. At the discharge, the juvenile mother is offered the free consultation visit of the obstetrician – gynecologist physician, neopathologist, psychologist in 1–2 weeks and also to do the ultrasound.

Thus, in their work with the juveniles, the "The Maternity Hospital № 10" employees interact intensively with the social services and the law enforcement agencies, and bodies. So, it is significant to be noted, that in the period from 2004 to 2013, there were only two special cases of the child abandonment by the juvenile mother.

**The Conclusions.** The final results, having obtained during the lifetime, on the basis of the "The Maternity Hospital № 10" of the specialized Center on the on the pregnancy and childbirth management, at the juveniles "The Little Mother", and as well as the many years experience on the Maternity Hospital staff working with the pregnant teenagers and the juveniles, are given the bases to be suggested, that the implementation of the comprehensive medical, medical and social, psychological, and legal assistance to the young girls, who become pregnant, under the specialized Center for the pregnant juveniles conditions, will be improved the pregnancy outcomes and the quality to be assisted them, in general. During this time, the complications frequency in the pregnancy and childbirth at the juveniles, who gave the birth in the Maternity House, had already been decreased, there was no the perinatal mortality, and,

moreover, it had not been the abandoned children. At the same time, it is quite obvious, that more additional studies and researches are needed of that role, which is played the creation of the specialized Centers on the pregnancy and childbirth management at the juveniles for the further quality improvement of the health, medical and social assistance for the given challenging category and group of the patients.

#### References

1. Goncharova V.P. The Motherhood in Early Reproductive Age: the Modern Medical and Demographic, and Social Trends. Author. Diss...the Cand. Med. Sciences. Ryazan. – 2002.
2. Dudnichenko T.A. The Perinatal Risks Factors and Ways to Reduce Perinatal Mortality and Sickness Rate at Young Women. Author. Diss...Cand. Med. Sciences // The Collection of Publications. – 2004.
3. Krotin P.N. The Scientific Justification of Security Service for Reproductive Health of Adolescent Girls. Author. diss... Doctor of the Med. Sciences. The Collection of Publications. – 1998.
4. Molchanov S.Yu. The Pregnancy among Juveniles, as Medical and Social Challenge. Author. Diss...Cand. Med. Sciences. – M., 2005.
5. Susloparov L.A., Ed. The Pregnancy and Childbirth among Juveniles: Educational and Methodical Recommendations // The Collection of Publications. – 1997.
6. Sharapova O.V. The Major Challenges and Tasks of Russian Pediatrics Development at the Present Stage // The Russian Bulletin of Perinatology and Pediatrics. – 2003. – № 1. – P. 3–4.
7. Sharova M.L. The Organization of Medical and Prophylactic Care for Pregnant Juveniles in the Antenatal Clinics (for example, Moscow). Author. Diss...Cand. Med. Sciences. – M., 2012.
8. Robertson A., Levin M.L. AIDS Knowledge, Condom Attitudes, and Risk-Taking Sexual Behavior of Substance-Abusing Juvenile Offenders on Probation or Parole // AIDS Educ Prey. – 1999. – № 11(5). – P. 450–461.
9. Scholl T.O., Hediger M.L., Belsky D.H. Prenatal Care and Maternal Health During Adolescent Pregnancy, a Review and Meta-Analysis TO Schol // Journal of AdoJescent Health. – 1994. – Vol. 15. – № 6. – P. 444–456.

## THE DICLOFENAC SODIUM RELEASE KINETICS EXAMINATION FROM 3% GEL “IN VITRO” EXPERIMENTS

Maksudova F.K., Kariyeva E.S.

*The Tashkent Pharmaceutical Institute, Tashkent, e-mail: yosk@mail.ru*

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For the 3% gel medicinal formulation of the diclofenac sodium by the single – factor analysis of the variance using with the repeated observations has been conducted the study on the scientific substantiation of the carrier – basis form. For the present purposes, the gels have already been developed at the 9 fundamentals, and, moreover, their qualitative characteristics have already been defined. According to the obtained final results, two formulations, due to the colloid and thermal stability absence, have already been excluded from the further special testing. The active substance release from the already developed gels has been defined by the equilibrium dialysis method by L. Kravchinsky. The studies obtained results have been indicated, that the carrier – basis form has its significant influence upon the active ingredient release just from the already developed gels. Thus, the conducted analysis of the variance has been shown, that the diclofenac sodium optimum release has already been provided by the carrier on the basis of the carbomer 934P.

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**Keywords:** diclofenac sodium, gel, carrier – basis, mathematical experiment planning, release

The non – steroidal anti – inflammatory drugs – is one of the most widely used groups of the medicinal preparations, which is included in itself the means of the quite different chemical structure, having united by the general pharmacodynamic properties and by the similar pharmacokinetic characteristics. The NSAID large “popularity” is explained by the fact that they are simultaneously possessed the anti – inflammatory, analgesic, and antipyretic effects, and they are brought the relief to the patients with the relative symptoms (e.g. the inflammation, pain, fever), which are celebrated in many diseases. Over the last 30 years (e.g. 360 months), the NSAID number has already been increased significantly, and today, the given group has the large number of the medicinal preparations and the drugs, having differed in their specific features, peculiarities, and application.

Thus, the given group is one of the most widely prescribed groups of the medicinal preparations and the drugs throughout the world. This is connected also with the fact, that many of them are practically included in the non – prescription lists, and, therefore, they are easily accessible especially for the population. At present, there is the NSAID large arsenal and the store of them (e.g. more, than 25 items), and in the practice of the medicine they are used to be treated more, than the 1,000 ones, having created on the basis of their medicinal preparations and the drugs [1, 2, 3, 4].

So, in the recent years, the tendency has been noted to be increased the NSAID range, in the form of the soft medicinal preparations. Thus, this fact is explained by the fact, that the external application method of the medicinal preparations with the method of the plastically viscoelastic dispersion medium (e.g. the gels, creams, ointments, liniments and etc.) are practically allowed to be provided the maximum concentration of the active substances directly

to the lesion focus. For example, they are in the place of the skin integrity violation, the inflammations, the bedsores, the burns, the damaged mucous tunic, and etc. The transcutaneous and transdermal route of the medicinal substances and the drugs administration is practically considered the most secure one, since the large dose fraction is at the surface, and it can be easily changed and modified by the partial means removal [5, 6, 7].

So, according to the biopharmaceutical conception, the soft medicinal preparations and the drugs forms creation should be carried out, having taken into account the pharmaceutical factors, having affected the rate and the extent of the active substances release, i.e. the bioavailability. The scientifically – based approach to the selection of one of the major biopharmaceutical factors – in mind to be used the basics – is practically allowed greatly to be achieved the maximum pharmaco-therapeutic effect [8, 9, 10].

Thus, the biopharmaceutical substantiation of the gel composition of the diclofenac sodium medicinal form has been the main purpose of the present examinations.

### Materials and methods of research

As the bases for the developing medicinal preparation form, – 3% diclofenac sodium gel, – the carriers have been used, which are widely used in the soft medicinal preparations and the drugs forms manufacture, having listed in the specialized literature. For all this, the special attention has been paid to the basis selection of the allergenic and sensitizing properties absence. So, the already prepared gels composition of the diclofenac sodium has been given in the Table 1.

So, the main quality indicators have already been studied at all the received gel compositions, and, for all this, the special and particular attention has been paid to the characteristics, such as the colloidal stability during the centrifugation and the resistance to the temperature changes. As a result of the already conducted examinations and corresponding researches, the № 2 and № 9 compositions have not been past the special tests on the

above – mentioned indicators, the mass dilution, and the slight loss of the white precipitation have already been

observed. Thus, all these compounds have already been excluded from the following examinations.

**Table 1**  
The Composition of Gel Formulations with Diclofenac Sodium

Ingredients	Carrier – Basis								
	№ 1	№ 2	№ 3	№ 4	№ 5	№ 6	№ 7	№ 8	№ 9
Diclofenac sodium	3,0	3,0	3,0	3,0	3,0	3,0	3,0	3,0	3,0
Sodium CMC					2,0				
Glycerine	7,0	5,0		8,0	10,0	10,0		2,5	5,0
Methyl cellulose	5,0					7,5		5,0	
Propylene glycol	8,0		5,0	7,5		5,0	30,0	2,5	
Carbomer 934P		0,8		1,0			1,0		0,75
Polyethylene oxide 400			35,0					10,0	10,0
Sodium benzoate			2,5						
Disodium edentate							0,01		
Metiparaben					0,2				
Propylparaben							0,05		
Ethyl alcohol			25,0	8,0					
Menthol				0,5					
Neroli oil			0,5						
Sodium hydroxide solution 10 %		0,5					0,15		0,5
Water purified to	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0

The following and next stage of the examinations and researches on the scientific basis of the carrier – basis choice justification in the diclofenac sodium gel composition has been to be used the single – factor analysis of variance with the repeated observations [11]. So, the diclofenac sodium release has already been determined by the equilibrium dialysis method by L. Kravchinsky [12]. So, the cellophane with the thickness of 50 mkm, as the semipermeable membrane, has been used by us. The dialysis medium has been served the purified water mixture, the carbon dioxide – free, and 0,1 M sodium dioxide solution. The examinations and investigations have been carried out under the thermostating conditions  $37 \pm 1$  °C: the temperature, which is necessary for the occurrence of the

medicinal substances and the drugs diffusion through the membrane. The diclofenac sodium concentration, having passed into the dialysis medium, has been adjusted spectrophotometrically at the wavelength of 276 nm.

### Results of research and their discussion

The results of the release study and examination of the diclofenac sodium from the gels, as well as the planning matrix have been given in the Table 2. For all this, the carriers – bases numbers, having taken for the factor A, have been the adequate to the carriers – bases numbers, having listed in the Table 1.

**Table 2**  
The Planning Matrix and Determination Results of Diclofenac Sodium Release (%) from the Gels

Number one after another	The carrier-basis type, according to the Table 1 (factor A)	Tests numbers			Total	Average
		I	II	III		
1	№ 1	46,44	47,29	46,15	139,88	46,63
2	№ 3	43,91	43,04	44,67	131,62	43,87
3	№ 4	57,28	56,31	57,11	170,70	56,9
4	№ 5	35,66	35,81	33,76	105,23	35,08
5	№ 6	42,70	40,85	39,18	122,73	40,91
6	№ 7	28,17	28,72	26,23	83,12	27,71
7	№ 8	37,70	35,60	37,75	111,05	37,02
Total					864,33	



So, it has been revealed, when estimating the model parameters that 3 effects (e.g.  $\hat{\alpha}_1 = 5,47$ ,  $\hat{\alpha}_3 = 2,71$ ,  $\hat{\alpha}_4 = 15,74$ ) have had the positive sign, and 4 effects (e.g.  $\hat{\alpha}_5 = -6,08$ ,  $\hat{\alpha}_6 = -0,25$ ,  $\hat{\alpha}_7 = -13,45$ ,  $\hat{\alpha}_8 = -4,14$ ) – the negative one. Since the response value (e.g. the diclofenac sodium release, in%) should be increased, it can be argued, that 3 types of carrier – bases № 1, № 3, № 4 have their efficient action.

The Cochran's test criteria has been used by us for the homogeneity of the variance to be checked. So, the Cochran's test criteria table

value for  $f_1 = 2$  b  $f_2 = 7$  at the significance level  $\alpha = 0,05$ , has been made up 0,5612, which is significantly larger, than the experimental value. So, the given ratio has been confirmed by the equally accurate experiments.

The received results analysis of variance has been presented in the Table 3.

According to the data results received,  $F_{\text{exper}} > F_{\text{tabl}}$ , therefore, the  $H_0$  hypothesis is rejected, that, in its turn, it is suggested the fact, that the carrier – basis type has a direct impact upon the active substance release from the gels.

Table 3

The Experimental Data Variance Analysis,  
to Be Determined the Diclofenac Sodium Release from the Gels

Source of invariability	Number of degrees of freedom	Sum of squares	Mean square	$F_{\text{exp}}$	$F_{\text{tab}}$
Carrier – basis type	6	1560,7	260,1	205,73	2,85
Errors	14	17,7	1,2643		
Total amount	20	1578,4			

The studies have been conducted on the examination the differences in the mean values of the data release of the diclofenac sodium from the gels with the multiple rank test Duncan [11] using. It, moreover, has been found, that by the influence of the gel carrier – basis to be completed the active ingredient release, they can be arranged in the following series: № 4 > № 1 (№ 3) > № 6 > № 8 (№ 5, № 7).

As a result of the conducted studies, the gel composition № 4, has been the most appropriate one, and it has been selected for the further studies.

### Conclusions

As a result of the conducted studies with the method of the mathematical planning of the experiment using, it was found, that the type of the used carrier – basis had been made the significant influence upon the diclofenac sodium release from the gel.

Thus, the conducted variance analysis of the studies obtained results has been allowed to be determined, that the optimal release of the diclofenac sodium from the gel is practically provided to be supported on the basis of the Carbomer 934P.

### References

1. Belousov Yu.B, Zyryanov S.K., Gurevich K.G. The Efficiency and Safety of Modern Analgesics // The Russian Medical Journal. – 2004. – Vol. 12. – № 5. – P. 283–286.

2. Ushlakova E.A. The Non-Steroidal Anti – Inflammatory Medicinal Drugs – a New Look at Efficiency and Safety // Pharmateka. – 2006. – № 7 (85). – P. 31–36.

3. Nanosov E.L. The Non-Steroidal Anti-Inflammatory Preparations (Application Prospects in Medicine). – M., 2000. – P. 342.

4. Nanosov E.L. NSAID Use: Therapeutic Aspects // The Russian Medical Journal. – 2002. – Vol. 10. – № 4. – P. 206–212.

5. Bagirova V.L., Demina N.B., Kulichenko N.A. The Ointments. Modern View of the Dosage Form // Pharmacy. – 2002. – № 2. – P. 24–26.

6. Zelikson Yu.I. The Domestic Technology Development of Ointments in the 3-rd Quarter of the XX century // Pharmacy. – 2001. – № 1. – P. 45.

7. Pertzov I.M., Gutorov S.A., Khaleeva E.L. The Control and Production Quality of Soft Drugs, in the Light of Requirements of the State Pharmacopoeia of the Ukraine // Pharmacist. – 2002. – № 8. – P. 29–31.

8. Semkina O.A., Dzhavakhyan M.A., Levchuk T.A. The Auxiliary Substances, Used in the Medicine Dosage Forms Technology (Ointments, Gels, Liniments, Creams) // Pharmaceutical and Chemistry Journal. – 2005. – Vol. 39. – № 9. – P. 45–48.

9. Pertzov I.M., Kotenko A.M., Chushov O.V., Khaleeva E.L. The Pharmaceutical and Biological Aspects of Ointments. – Kharkov, 2003. – P. 288.

10. Nazarova Z.A. The Current State and Soft Medical Drugs Prospects for Local Application // The Pharmaceutical Journal. – 2007. – № 4. – P. 78–81.

11. Groshovy T.A., Markova E.V., Golovkin V.A. The Mathematical Planning of Experiment in Pharmaceutical Technology (The Variance Analysis Plans). – K., 1992. – P. 187.

12. Krowczynski L.S. Goawej Badon naukowych w dziedzinie technologii postaci lecu // Farm. Pol. – 1984. – Vol. 40. – № 1. – P. 21–26.

## NANOTECHNOLOGICAL SIGNAL AMPLIFICATION METHODS FOR IMMUNOASSAY

Pestovsky Y.S.

*LLC Ekolit, Moscow, e-mail: organics@mail.ru*

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Autometallography and enzyme metallography that are methods of enzyme-linked immunosorbent analysis signal amplification are reviewed. The reasons of using them are described. Both methods involve metal deposition onto surface of an already present metal nanoparticle. Therefore both methods are being used in highly sensitive immunoassay using atomic force microscopy as a detection method and in immunohistochemistry. The chemical basis of both methods is given. Numerous examples of their application are reviewed. Some unusual detection methods compatible with autometallography are described. The difficulties the researcher can face by using autometallography are predicted. The ways to solve the problems are recommended. The compatibility of both methods with other immunohistochemical procedures is depicted. Two variants of enzyme metallography are considered. The mechanism of enzyme metallography is analyzed. The experimental results obtained by different research groups are summarized. The methods aimed for further signal amplification are criticized.

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**Keywords:** autometallography, enzymatic metallography, enzyme metallography, peroxidase

Enzyme-linked immunosorbent analysis (ELISA) is a widely used analytical method thanks to simple operations, low equipment cost and at the same time its high sensitivity and selectivity. We have analyzed sensitivity of commercial ELISA kits and concluded that most kits have detection limit in the range 1–100 pM and the lowest detection limit nowadays is 100 fM.

Many proteins present in blood plasma have low concentration. One can say that only several tens of different proteins occur in the plasma at concentrations of  $10^{-3}$ – $10^{-4}$  M [1]. The lower the concentration, the greater is the diversity of proteins present in the plasma; there are more than 1000 proteins present at a concentration of  $10^{-15}$  M. The existing proteomic technologies enable detection and identification of up to 10–20% of the various protein species present in plasma. Therefore, decreasing detection limit even by 1–2 orders will significantly increase the possibilities of medical diagnostics. The application of signal amplification methods paves the way to overcome this problem.

### Autometallography

Autometallography which is also called electroless deposition is an amplification method based on non-enzymatic process of germinal particle growth as a result of deposition of metal from the solution onto its surface [2].

Small silver or gold nanoparticle is being used as a germ. Developing solution containing silver or gold salt is also needed. Under these conditions metal deposits onto existing crystallization centers. Hence they grow to the necessary size. The drawbacks of this method are high background, i.e. spontaneous silver crystal formation, and photosensitivity of the chemicals being used. The method allows using different metals such as silver, gold, nickel, platinum. Silver and gold enhancement meth-

ods also called silver and gold development are the most widespread. Autometallography can be used both for growth of metal nanoparticles and for obtaining lengthy structures called nanowires [3–6].

Silver enhancement was initially used as a method of photographic development. The first biological application of this method was the detection of minute amounts of metals, including gold, in tissue sections [7]. Combination of immunogold method which is widely used in electron microscopy with silver enhancement lead to appearance of new highly sensitive type of immunoassay [8–9]. The method is of much enhanced sensitivity (up to 200-fold) as compared with peroxidase-antiperoxidase method and is compatible with common immunohistochemical procedures. It gives higher contrast and does not require using carcinogenic chemicals. The techniques used can be automatized. Metal silver which is a product of the reaction cannot diffuse, the cost of silver salts being multiply compensated thanks to decrease of antibodies due to their possible dilution [8–10]. Since autometallography gives maximal demonstration using concentrations of primary antisera well beyond the range of sensitivity of the peroxidase-antiperoxidase method, it is possible to use primary antisera raised in the same species for double immunolabeling, provided autometallography is performed first [8]. Sample antigenicity keeps safe after silver enhancement. In case of using silver enhancement in conjunction with enzymatic labeling silver enhancement should be completed before the application of the enzymatic probe. If the enzymatic probe is applied first, the substrate can act as a nucleating agent during autometallographic enhancement and give nonspecific background staining [10]. The method allows determination of antigens in whole blood without decrease of sensitivity compared to the analysis of serum [11].

Autometallography may be used for correlative microscopy: it is possible to carry out a single labeling experiment to label both at the electron microscopy and light microscopy level because identical nanoparticles can be grown to different sizes and thus to provide direct correlation between the two [2].

Autometallography may be used in double labeling experiments, so that two labels can be visualized together. For electron microscopy, two strategies are as follows. The first strategy is to silver enhance nanoparticles but make them distinguishable from some standard colloidal gold sizes. The second strategy is to silver develop the first target gold particle to larger size, then label the second target with gold and apply a second silver enhancement. Since the first gold particles will then have been developed twice, they become distinguishably larger than the second label [2].

The 1.4 nm particles are the smallest gold clusters that can be seen directly under a conventional electron microscope, allowing a spatial resolution of about 7 nm when covalently attached to antibody fragments. The visibility of the clusters can be improved by silver enhancement step for use in electron or light microscopy for histological purposes, or to detect picogram amount of antigens in immunoblots [12]. Sometimes the enlarged nanoparticle labels can be detected even by the naked eye [4].

Silver enhancement has also been applied for DNA analysis using conventional flatbed scanner as a reader. Labeling oligonucleotide targets with nanoparticle rather than fluorophore probes substantially alters the melting profiles of the targets from an array substrate. This difference permits the discrimination of an oligonucleotide sequence from targets with single nucleotide mismatches with a selectivity that is over three times that observed for fluorophore labeled targets. When coupled with silver enhancement, the sensitivity of this scanometric array detection system exceeds that of the analogous fluorophore system by two orders of magnitude [13].

Not only electron microscopy permits to see nanoparticles directly but also atomic force microscopy does. The distance between nanoparticles just separated in the optical image can be measured with nanometer resolution by atomic force microscopy. For surface densities below 10 particles/ $\mu\text{m}^{-2}$ , a linear dependency of the surface density on the concentration was found [14]. However, this method has several drawbacks. It is very slow (minutes per image), it can only visualize a limited region of about 100  $\mu\text{m}^2$  at a time, and it needs equipment not available in standard biological laboratories. The application of autometallography allows sometimes doing with optical images [14].

The application of silver enhancement as a stage of sandwich immunoassay on the surface of an ultrasensitive microgravimetric biosensor based on quartz crystal microbalance result in ca. two orders of magnitude improvement in human IgG quantification [15]. Moreover, for DNA detection by analogous biosensor using gold enhancement detection limit was  $\sim 1 \cdot 10^{-15}$  M [16].

Silver enhancement has been applied as a stage of sandwich immunoassay on a compact disc surface. The measured C-reactive protein concentration value corresponded well with that obtained from the same assays performed on glass slides [17].

Silver enhancement has been used as a part of POCKET immunoassay. This method includes antigen adsorption onto the surface of a transparent polystyrene plate which is followed by addition of antibodies conjugated to 10 nm gold colloids and subsequent silver enhancement. The resultant silver film, whose opacity is a function of the concentration of the analyte, partially blocks the transmission of light through the polystyrene plate allowing quantitative antigen determination using an optical integrated circuit as a photodetector. This circuit contains a photodiode, an amplifier, and a voltage regulator. The analytical performance of this assay approaches that of ELISA using relatively expensive bench-top equipment. The method is low-cost and portable, and therefore is appropriate for use in the field [18].

Gold enhancement has a number of advantages over silver enhancement. In addition to higher contrast in the electron microscope, greatly increased backscatter signal (for scanning electron microscopy), and resistance to osmium etching, gold enhancement gives a longer time between full development and auto-nucleation. Unlike silver, gold is not precipitated by chloride, and therefore gold enhancement can be conducted in the presence of physiological buffers containing saline. Compared with silver enhancement, lower backgrounds have been reported for some immunohistochemical experiments using gold enhancement. Unlike silver enhancement, which frequently requires pH 3.5, gold enhancement is being conducted at pH near 7 [10].

The silver reaction can still change even after thorough water wash. Therefore, strong light should be avoided after silver enhancement. Sodium thiosulfate (1% aqueous solution, freshly made) is a good stop reagent for both silver and gold enhancement. However, caution should be exercised with this procedure when using gold enhancement. In some experiments treatment with sodium thiosulfate has been found to reduce signal. Other solutions used for stopping autometallography include acetic acid, sodium chloride, and

photographic fixers. Successive treating a sample with several solutions is also used. When using acetic acid further decrease of background can be achieved by adding glucose to the solution.

In some procedures little or no development has been found upon autometallography. Results may be improved in these systems by changing from commercial silver enhancement reagents to freshly-prepared solutions made by yourself or by substituting formaldehyde for glutaraldehyde in postfixation [10]. If aldehyde-containing reagents have been used for fixation, these must be quenched before labeling. This may be achieved by incubating the specimens in glycine solution in phosphate buffered saline; ammonium chloride or sodium borohydride in phosphate buffered saline may be used instead of glycine [2].

Silver enhancers tend to be divided into two types. The first is often based on silver lactate, which includes a thickening agent or protective colloid, usually gum Arabic, although gelatin and polyethylene glycol (carbowax) have also been used, and is light sensitive. These may consist of three or more components, and are usually preferred for electron microscopy because they produce enhanced particles of a more uniform size and shape and allow improved preservation of ultrastructural morphology. The second type is usually not highly light sensitive, although strong illumination does have an effect, and the formulation is often based on silver acetate, although other silver salts have been used. These are simpler to use, usually consisting of two components that are mixed immediately before development and are preferred for light microscopy and blotting because development can be visually monitored. Use of a safelight is recommended for these developers, but development under a box to exclude direct light in a normally lit room is acceptable [10].

After treating samples after silver enhancement with complicated composition solutions containing complexes of ferric or cupric ions with organic ligands sample colouring occurs. The resulting colour depends on the solution used. This method allows using less amount of deposited silver for optical visualization of the label than in the case of direct silver determination using its black colour [19–20].

In the optical image, particle pairs in different states regarding their shapes can be distinguished. When the interparticle distance becomes smaller, the originally separated two particles touch each other in the optical image, resulting in an '8'-shaped outline. For even smaller distances, this outline shifts to a more elliptical shape [14]. The smallest distance allowing distinguishing the particles with the help of the optical system was about 400 nm.

Gold nanoparticles conjugated with oligonucleotides can bind to the surface of silver deposited on analogous conjugates by silver enhancement and serve as crystallization centers at the second silver enhancement stage. Unbound conjugates can be washed out with water to prevent additional background increase. Sample drying with air does not influence specificity of the consequent silver enhancement. The process may be repeated as often as desired to further enhance the amount of deposited silver and the darkness of the spot. With this amplification method, one can readily observe a dark silver spot for an assay using 25  $\mu$ M target concentration. With two cycles of the new nanoparticle-silver sandwich procedure, 1 fM target solutions can be recognized, and with three cycles, 0,1 fM solutions give positive though weak spots. The method is compatible with using commercial silver enhancement kits [21].

The control that covalent labeling provides over probe architecture and configuration has led to the development of combined fluorescent and gold probes. Selective coupling of the gold cluster to a unique site in an antibody fragment, such as a hinge thiol, allows the attachment of a fluorescent label elsewhere on the antibody via a second cross-linking reaction to yield a probe with both fluorescent and gold labels. These probes can be used for correlative fluorescence and electron microscopy or for checking labeling by fluorescence microscopy before undertaking electron microscopy processing [2].

An important consideration when designing such probes is fluorescence resonance energy transfer. Calculations with the gold cluster which is 1,4 nm in diameter yield a Förster distance of approximately 6 nm, allowing usable fluorescence when both labels to be linked to a single antibody. However, Förster distances increase significantly for larger colloidal gold particles. Conjugation of the fluorescent label to a second antibody which binds to the gold-conjugated one increases the gold-fluorophore separation to 10–20 nm; although quenching is still present, sufficient fluorescence is restored for observation by CCD camera [2].

### Enzyme metallography

Enzyme metallography (enzymatic metallography, EnzMet™) deals with precipitation of metals such as silver, gold, iron, mercury, nickel, copper, platinum, palladium, cobalt and iridium from solution as a result of enzymatic reduction [2, 22–24]. Enzyme metallography is a promising method for medical diagnostics particularly because of its possibility to determine single antigenic determinants. It is a widespread method for determination

of oncomarkers [22]. Enzyme metallography results in formation of dark dense metal precipitates. There are three main types of enzyme metallography.

#### **The precipitation of metal nanoparticles by means of polymeric matrices**

This type of enzyme metallography deals with metal nanoparticles bound to the molecules of substrate which enzymatically forms precipitate. Nanoparticles are also being incorporated into this precipitate. Gold nanoparticles which are 1–3 nm in diameter and functionalized by different ligands (4-hydroxythiophenol, 3,3'-diaminobenzidine, glutathione) in presence of 0,03–0,06% hydrogen peroxide form precipitate as a result of the reaction catalyzed by horseradish peroxidase (HRP). For precipitation of nanoparticles stabilized by thioglucose extra 0.25% hydroquinone is needed. The method is patented (Hainfeld et al., USA) [25–27].

#### **Enzymatic generation of metal ions reducing agent**

This type of enzyme metallography deals with enzymatic generation of active reducing agent from an inactive precursor. The product being formed near enzyme molecules reduces silver or gold ions in solution. The method is patented (Bieniarz et al., USA) [28–30].

Enzymatic generation of reducing agent has been applied for DNA determination. This approach deals with hybridization of target DNA with one immobilized on the electrode surface and subsequent hybridization with biotinylated DNA. After hybridization avidin conjugated alkaline phosphatase was added, which binds to the exposed biotin group on the detection probes and converts *p*-aminophenylphosphate to *p*-aminophenol, a reducing agent that reduces silver ions. The extent of hybridization was measured electrochemically by the magnitude of anodic current because the precipitation of silver on the electrode surface increases its surface area. The precipitation of silver on electrode surface was proved by quartz crystal microbalance. Compared with the results obtained by in situ surface plasmon resonance, this method gave 3-fold improvement in the hybridization detection [31].

#### **Enzymatic reduction of metal**

This type of enzymatic metallography deals with change of reaction specificity of horseradish peroxidase with the result that the enzyme catalyzes the reduction of different metals from a solution. The method is patented (Hainfeld et al., USA) [25–27].

It is known that horseradish peroxidase exhibits NADH oxidase [32–33], NADPH oxidase

and thioloxidase activity [34] besides its normal peroxidase activity. In thiol oxidation oxygen is the oxidizing agent [34]. As for NADH and NADPH oxidation, oxygen and hydrogen peroxide both are oxidizing agents [35].

When oxygen is introduced continuously into a solution of NADH and horseradish peroxidase the oscillatory consumption of oxygen can be observed. Under suitable experimental conditions the aerobic oxidation of NADH catalyzed by horseradish peroxidase occurs in four characteristic phases: initial burst, induction phase, steady state and termination. A trace amount of hydrogen peroxide present in the NADH solution is enough to bring about initial burst [32–33].

In the presence of ethylenediaminetetraacetic acid (EDTA) the enzyme exhibits also reductase activity [36]. Oxidation and reduction reactions catalyzed by horseradish peroxidase have different pH optima. They are pH 3.5 for peroxidase activity and pH 6 for reductase activity [37].

Spectroscopic studies have shown that horseradish peroxidase substrates can be divided into two classes on the basis of the difference spectra observed when they bind to the enzyme [38]. Normal peroxidase substrates such as phenol, *p*-cresol, hydroquinone and aniline are in the first class. Guaiacol and resorcinol are in the second class. The physical basis for this spectroscopic classification is obscure [38].

It was found that lignin peroxidase also displays resembling activity. This enzyme also catalyzes the reduction of different electron acceptors such as cytochrome *c*, nitro blue tetrazolium, ferric ion and molecular oxygen in a reaction mixture containing iodide, hydrogen peroxide and EDTA [39]. The activity observed using iodide as a mediator was comparable to that obtained using other free radical mediators, such as veratryl alcohol and a variety of methoxybenzenes. Other peroxidases, such as horseradish peroxidase, lactoperoxidase, myeloperoxidase and gastric peroxidase, were also found to catalyze the same reactions. Chloroperoxidase catalyzes the same reaction at a relatively higher rate than horseradish peroxidase. Lactoperoxidase also possesses the same property but requires higher EDTA concentration. Despite of its more complex protein and heme structure its reductase activity resembles that of horseradish peroxidase, however, the mechanisms are somewhat different [40]. Peroxidases use not only iodide but bromide too, myeloperoxidase using also chloride. The results for horseradish peroxidase were analogous [39, 41]. However, the behaviour of lignin peroxidase and horseradish peroxidase under identical conditions is highly different [42].

Hemoglobin and cytochrome c also catalyze the reaction but at a much slower rate, possibly due to their pseudoperoxidase activity. Albumin does not possess the property, indicating that the intact heme part bound to the protein is necessary for the reaction.

EDTA in concentration 4 mM blocks horseradish peroxidase catalyzed  $I^-$  oxidation to  $I_3^-$  that is shown by lack of increase of solution absorption at 353 nm. At the same time 2 mM EDTA while blocking direct reaction causes reverse reaction, i.e.  $I_3^-$  reduction that is shown in turn by decrease of solution absorption at 353 nm. Both enzymatically obtained (before EDTA addition) and chemically obtained  $I_3^-$  as well as iodine or  $I^+$  can be reduced. Turnover number determination showed that  $I^+$  or  $I_2$  reduction is significantly more efficient than  $I_3^-$  reduction. Thus positively charged or non-polar oxidized substrates appear to be better than negatively charged  $I_3^-$ . Iodide present in this complex appears to modulate reductase activity of horseradish peroxidase [37]. In addition, hydrogen peroxide is being oxidized to oxygen (pseudocatalytic reaction). Reversibility of the effect caused by EDTA shows that enzyme inactivation does not proceed. Both direct and reverse reactions are being inhibited by azide which is an irreversible peroxidase inhibitor [36].

Horseradish peroxidase contains two  $Ca^{2+}$  ions per enzyme molecule. Only one tightly bound  $Ca^{2+}$  could be removed by very drastic treatment such as incubation with EDTA or [ethylenebis(oxyethylenenitrilo)]tetraacetic acid in the presence of guanidinium chloride, as this  $Ca^{2+}$  is essential for maintaining the protein structure in the haem cavity for enzyme activity. The observed inhibition is not due to removal of this intramolecular  $Ca^{2+}$  by EDTA as the drastic conditions required to obtain  $Ca^{2+}$ -free enzyme were not used. Insensitivity to [ethylenebis(oxyethylenenitrilo)]tetraacetic acid also supports this view. Moreover, the effect of EDTA is not reversed by addition of  $Ca^{2+}$ , suggesting that this  $Ca^{2+}$  is not chelated by EDTA [42].

In order to get an idea of which part of the EDTA structure is essential for the induction of catalytic conversion of iodine to iodide, the effects of various EDTA analogues were investigated [42–43]. N, N, N', N'-tetramethylethylenediamine shows very close resemblance to the structure of EDTA and was 80% as active as EDTA. It appears that the  $CH_2COOH$  groups of EDTA are not necessary as the same effect could be obtained when they are replaced by the methyl groups. However, a possible role of the carboxy groups of EDTA in the electrostatic interaction with some positively charged groups at the haem distal pocket cannot be excluded [42].

EDTA inhibition is reversed by presence of equimolar concentrations of  $Zn^{2+}$ ,  $Ga^{2+}$ , and

$Cd^{2+}$  which are chelated via the lone pairs of electrons on the nitrogens, and not by  $Ca^{2+}$  or  $Mg^{2+}$ , which are chelated through the carboxy groups [36, 42–43]. This indicates that although the  $COOH$  groups of EDTA are not necessary, the two nitrogens appear to be essential. A fixed chain length between the two nitrogens also appears to be essential. An increase in the chain length by the glycol group reduces the effect by 90%. Ethylenediamine, a secondary amine having a chain length similar to EDTA, is absolutely ineffective, suggesting that the structure in the tertiary amines like EDTA or N, N, N', N'-tetramethylethylenediamine is suitable for interaction with the enzyme. Although triethylamine is a tertiary amine, the absence of another nitrogen atom in its structure makes it ineffective. Ethylenediaminediacetic acid, which resembles EDTA but has two carboxyl groups less, is 62% as effective as EDTA [42].

Based on absorption and circular dichroism spectra of compound I in the presence of EDTA as well as iodide displacement from its complex with peroxidase by EDTA the authors of [43] concluded that the interaction of EDTA at the iodide-binding site leads to a change in heme conformation associated with the modification of the catalytic activity of the enzyme.

It was shown that the inhibition constant value for EDTA inhibition of iodide oxidation by the catalytically active lactoperoxidase at its optimum pH is smaller than the binding constant value for the binding of EDTA to the native enzyme at the same pH. This indicates that the catalytically active lactoperoxidase (compound I and II) binds EDTA at higher affinity than the native enzyme presumably due to higher oxidation-reduction potential between the active enzyme and EDTA, which attracts EDTA for interacting at the active site. Similar explanation has been given in case of iodide oxidation and iodide binding by horseradish peroxidase [40].

Cyanide binds irreversibly to haem iron. Based on spectral data the authors of [37] concluded that EDTA binds to this complex. The binding constant value for the binding of EDTA to the HRP-CN complex is close to that obtained for the binding of EDTA to the native enzyme. Thus EDTA appears to bind away from the haem iron centre.

The binding of EDTA to horseradish peroxidase is weaker than that of cyanide. It was shown that EDTA binding significantly decreases in the presence of iodide, nitrite or thiocyanate. According to the authors of [37] this effect can be explained by their competition for the same binding site. High iodide concentrations reverse the EDTA-induced block of iodine oxidation and at the same time inhibit the iodine reductase activity. Thiocyanate could

not be used as it reduces iodine non-enzymatically. This is not a non-specific effect of high salt concentration as nitrate has no such effect under identical conditions.

A plot of  $\log K_D$  for the HRP-EDTA complex against pH produced a sigmoidal curve. The binding constant value in the near-saturation field indicates that an ionizable group on the enzyme with a  $pK_a$  of 5.8 is responsible for controlling the binding of EDTA to the enzyme and this is presumably the distal histidine [37]. In the case of lactoperoxidase the possible role of the distal histidine in binding of iodide and thiocyanate and subsequent electron transfer to the heme ferryl group has been suggested [40].

To determine different horseradish peroxidase substrate binding sites and oxidation mechanism details  $\delta$ -meso-ethylheme-reconstituted peroxidase was used [38]. It was shown that two-electron oxidation of thioanisoles to the corresponding sulfoxides catalyzed by horseradish peroxidase proceeds with considerable enantioselectivity. The electronic properties of the substrate do not significantly contribute to the reaction enantioselectivity. Racemic sulphoxides can be formed up to 4% of the enzymatic rate by direct reaction with hydrogen peroxide. The modified peroxidase is inactive toward guaiacol oxidation despite the fact that it appears to react with hydrogen peroxide. A  $\delta$ -meso-ethyl group also virtually blocks iodide oxidation but actually increases sulfogenase activity. However the reconstituted enzyme is far less stereoselective.

Reconstitution of the enzyme with hemin did not result in loss of stereoselectivity, so that the loss observed with  $\delta$ -meso-ethylheme is unlikely to be an artifact of the reconstitution process.

Heat-denatured horseradish peroxidase retained 3% of its ability to stimulate guaiacol oxidation and 15% of its ability to catalyze sulfoxidation, but the resulting sulfoxide product is racemic. Control incubations with no enzyme did not support guaiacol peroxidation but did support slow oxidation of thioanisole to racemic sulfoxide. The oxygen incorporated into the sulfoxide in the horseradish peroxidase-catalyzed oxidation of thioanisoles derives primarily from the peroxide. The values obtained for the incorporation of  $H_2^{18}O_2$  oxygen into the sulfoxide when the reaction was catalyzed by native and  $\delta$ -meso-ethylheme-reconstituted horseradish peroxidase were exactly the same. This provides clear evidence that the mechanisms of the sulfoxidation reactions catalyzed by native and modified peroxidase are also the same [38].

All heme proteins with an accessible iron atom react with phenyldiazene to form a spectroscopically detectable phenyl-iron complex.

The fact that horseradish peroxidase does not form such a complex is one of the pieces of evidence that argues that its iron atom is not accessible to substrates. Spectroscopic examination of the reaction of  $\delta$ -meso-ethylheme-reconstituted horseradish peroxidase with a large excess of phenyldiazene shows that the modified enzyme also does not form a phenyl-iron complex. The  $\delta$ -meso substituent therefore does not perturb the active site structure sufficiently to make the heme iron available to phenyldiazene.

The reaction of phenylhydrazine or phenyldiazene with horseradish peroxidase results in covalent binding of two phenyl residues to the protein and loss of guaiacol oxidizing activity. The loss of these activities correlates with protein modification rather than with the minor degree of  $\delta$ -meso-phenyl heme substitution that also occurs. Phenylhydrazine-modified horseradish peroxidase is also inactive toward the oxidation of iodide but is considerably more active, although less enantioselective, toward thioanisole sulfoxidation than native horseradish peroxidase. Phenylhydrazine treatment also does not inactivate the porphobilinogen oxygenase activity of horseradish peroxidase.

Absorption spectra show that guaiacol binds to modified peroxidase even if it is not being oxidized.  $\delta$ -meso-Methylheme-reconstituted horseradish peroxidase retains guaiacol oxidizing activity but is more sensitive to peroxide-dependent inactivation. In contrast to guaiacol oxidation, which is slightly stimulated by a  $\delta$ -meso-methyl substituent, iodide oxidation and thioanisole sulfoxidation are partially inhibited. The lower activity with the  $\delta$ -meso-methylheme may be due to the lower stability of the enzyme reconstituted with this prosthetic group and the relatively long incubation times required for sulfoxidation. This explanation is supported by the fact that the chromophore of the  $\delta$ -meso-methyl substituted enzyme is lost more rapidly than that of the  $\delta$ -meso-ethyl substituted enzyme. The sulfoxidation enantioselectivity, however, is decreased by the  $\delta$ -meso-methyl as well as  $\delta$ -meso-ethyl groups [38].

Kinetic data clearly indicate that iodide does not inhibit guaiacol oxidation by competing for a common binding site. Inhibition of guaiacol and iodide oxidation by thioanisole is also unlikely to result from competition. These conclusions were confirmed by absorption spectra. EDTA inhibits oxidation of both iodine and guaiacol competitively [42].

$I^+$  binding in the HRP-CN complex indicates that its site is away from the heme iron center.  $I^+$  binding remains unaltered by guaiacol or vice versa, suggesting that  $I^+$  binds away from the aromatic donor binding site. A plot of

$\log K_D$  of  $I^+$  binding against various pHs shows the involvement of an ionizable group on the enzyme having  $pK_a = 4.8$ , contributed by an acidic group, deprotonation of which favors  $I^+$  binding. As  $I^+$  reduction occurs at a saturating concentration of EDTA,  $I^+$  binding at the EDTA site could be excluded [44].

However, in the case of lactoperoxidase EDTA binds close to the iodide binding site but it significantly alters the aromatic donor binding also. This indicates that either iodide and aromatic binding sites are very close to each other so that binding to iodide site disturbs the aromatic donor binding or EDTA binds in between the iodide and aromatic donor sites. In both cases, however, these sites should be very close at the heme edge [40]. NMR experiments suggest that iodide and thiocyanate bind to a common site roughly equidistant from the 1 and 8 heme methyl groups and approximately 6-10 Å from the iron atom [38].

ESR studies showed the presence of EDTA radical in the reaction mixture. This radical is a product of EDTA oxidation by iodide radical [41] or directly by the peroxidase only [42]. This radical can reduce iodine. The authors of [41] insist that EDTA radical can reduce cytochrome c to ferrocytochrome c and molecular oxygen to  $O_2^-$ , while these results were not confirmed in the article [42]. The inhibition of reduction activity at high concentrations of iodide might be due to the combination of iodide radicals to form iodine, which forms a stable triiodide complex in the presence of excess iodide [41]. However, the evidence for the formation of the iodine radical is lacking [42].

It was found that in the reaction mixture containing radiolabeled [acetic- $1-^{14}C$ ]EDTA, iodide and hydrogen peroxide EDTA decarboxylation by hypiodite proceeds. Some EDTA was also decarboxylated in the absence of the enzyme as the reaction mixture contained hydrogen peroxide and iodide, which can generate hypiodite. It was shown that chemically synthesized hypiodite also causes EDTA decarboxylation. Both iodide and hydrogen peroxide can reduce hypiodite [43]. It is supposed that hypiodite is a product of iodide oxidation by compound I [39]. In the case of horseradish peroxidase EDTA decarboxylation is not evident, and EDTA concentration remains the same throughout the reactions [44].

The participation of superoxide as an intermediate in the mechanism is supposed [45]. Potassium superoxide or a biochemical superoxide generating system can reduce iodine to iodide. Superoxide can be a product of hydrogen peroxide oxidation by compound I in the presence of EDTA or that of compound III dissociation. Superoxide dependent iodine reduction can be direct or mediated by EDTA-Fe complexes.

EDTA-Fe(III) complex mediates reactions between active oxygen species and can be reduced by superoxide. EDTA-Fe(II) complex can reduce iodine and form triiodide. It is known that EDTA preparations contain trace amounts of iron [45].

The alternative iodine reduction mechanism without superoxide radical participation has been suggested [44]. In the presence of  $I^+$  a ternary complex of compound I- $I^+$ -EDTA is formed, which generates compound II-I complex and both nitrogen-centered dication radical ( $N^+-N^+$ ) through intermolecular electron transfer from EDTA nitrogens. Compound II-I complex is further reduced similarly by another molecule of EDTA to form ferric enzyme, iodide ion and EDTA dication radical. The dication radical may be released from the active site and, being more reactive, oxidizes hydrogen peroxide to oxygen at a faster rate to regenerate EDTA. The existence of dication radical is suggested from the similarity of its ESR signal with that of single nitrogen-centered monocation radical [44].

The authors of [46] have obtained horseradish peroxidase redox intermediates in crystal state. They have obtained their X-ray images and presented the mechanism of bound oxygen reduction by X-ray irradiation catalyzed by peroxidase.

#### The application of enzyme metallography

The main examples of possibilities of enzyme metallography were connected with onco-markers and their genes determination. In spite of that enzyme metallography can be applied in many other fields of biochemical analysis.

Enzyme metallography has significant advantages when compared to conventional peroxidase-diaminobenzidine system forming colored polymeric precipitates. Unlike this system, enzyme metallography leads to extremely low diffusion of dense reaction products, which can be easily determined. Therefore, it gives possibility to distinguish cell compartments with high resolution. High density of silver precipitated allows much more distinct cell structure visualization and permits evaluation of core immunophenotype at a relatively low magnification, allowing more tissue to be screened in an efficient manner [47]. Besides, it is the most precise quantitative method having simple experimental protocols and because of it being suitable for automatization. Enzyme metallography procedures do not influence results obtained using *fast red K* dye [22]. The detection system is applicable to either bright field in situ hybridization or immunohistochemistry [47]. The only disadvantage of the method is impossibility to visualize cell structures using several colours.



The combination of determination of gene and protein encoded by this gene by enzyme metallography (EnzMet GenePro) was applied to determination of oncoprotein HER2 gene amplification [48]. This approach had a sensitivity of 82,9%, a specificity of 100%, and an accuracy of 92,6% according to FDA guidelines. The actual scoring of the slides was done without the use of oil immersion microscopy. Correlation between immunohistochemical component of the assay and the HER2 gene amplification status of the assay had agreement in 98% of the cases. Moreover, the single gene copies are distinctly identified as black signals. This fact allows us to conclude that enzyme metallography permits to visualize single molecules.

The method has also been applied to in situ DNA hybridization. The paper [49] deals with biotinylated DNA determination by hybridization with DNA immobilized between electrodes followed by streptavidin-peroxidase addition and enzyme metallography. The method permits to detect single mismatches. Unlike silver enhancement, it has extremely low background [24, 49–50] which can be decreased further by preliminary washing samples with sodium periodate, 1% sodium thiosulfate or Lugol's iodine.

There is a possibility of further signal amplification by autometallography on silver or gold germs obtained by enzyme metallography [49]. However, this approach leads to increased background. Therefore, additional enzyme metallography stage after washing appears to be more promising. The drying stage after washing must be excluded to prevent enzyme inactivation.

### References

1. Archakov A.I., Ivanov Y.D., Lisitsa A.V., Zgoda V.G. AFM fishing nanotechnology is the way to reverse the Avogadro number in proteomics // *Proteomics*. – 2007. – Vol. 7. – P. 4–9.
2. Hainfeld J.F., Powell R.D. Gold cluster labels and related technologies in molecular morphology // *Advances in pathology, microscopy, and molecular morphology series: Molecular morphology in human tissues: techniques and applications*. – Vol. 2. Chapter 4. – CRC Press LLC, 2004.
3. Weizmann Y., Patolsky F., Popov I., Willner I. Telomerase-Generated Templates for the Growing of Metal Nanowires // *Nanoletters*. – 2004. – Vol. 4(5). – P. 787–792.
4. Katz E., Willner I. Integrated Nanoparticle-Biomolecule Hybrid Systems: Synthesis, Properties, and Applications. *Angew Chem Int. Ed.* – 2004. – Vol. 43. – P. 6042–6108.
5. Alivisatos A.P., Johnsson K.P., Peng X., Wilson T.E., Loweth C.J., Bruchez M.P., Schultz P.G. Organization of 'nanocrystal molecules' using DNA // *Nature*. – 1996. – Vol. 382. – P. 609–611.
6. Mirkin C.A., Letsinger R.L., Mucic R.C., Storhoff J.J. A DNA-based method for rationally assembling nanoparticles into macroscopic materials // *Nature*. – 1996. – Vol. 382. – P. 607–609.
7. Lackie P.M., Hennessy R.J., Hacker G.W., Polak J.M. Investigation of immunogold-silver staining by electron microscopy // *Histochemistry*. – 1985. – Vol. 83. – P. 545–550.
8. Holgate C.S., Jackson P., Cowen P.N., and Bird C.C. Immunogold-Silver Staining: New Method of Immunostaining with Enhanced Sensitivity // *J. Histochem. & Cytochem.* – 1983. – Vol. 31(7). – P. 938–944.
9. Springall D.R., Hacker G.W., Grimelius L., and Polak J.M. The potential of the immunogold-silver staining method for paraffin sections // *Histochemistry*. – 1984. – Vol. 81. – P. 603–608.
10. Hainfeld J.F., Powell R.D. Silver- and gold-based autometallography of Nanogold // In: *Gold and Silver Staining: Techniques in Molecular Morphology* (G.W. Hacker and J. Gu, Eds.) Eaton Publishing, 2000.
11. Rocks B.F., Bailey M.P., and Bertram V.M., US Patent № 91/01003 (24 January 1991).
12. Niemeyer C.M. Nanoparticles, Proteins, and Nucleic Acids: Biotechnology Meets Materials Science. *Angew Chem Int. Ed.* – 2001. – Vol. 40. – P. 4128–4158.
13. Taton T.A., Mirkin C.A., Letsinger R.L. Scanometric DNA Array Detection with Nanoparticle Probes // *Science*. – 2000. – Vol. 289. – P. 1757–1760.
14. Csáki A., Kaplanek P., Möller R., Fritzsche W. The optical detection of individual DNA-conjugated gold nanoparticle labels after metal enhancement // *Nanotechnology*. – 2003. – Vol. 14. – P. 1262–1268.
15. Su X., Li S.F.Y., O'Shea S.J. Au nanoparticle- and silver-enhancement reaction-amplified microgravimetric biosensor // *Chem. Commun.* – 2001. – P. 755–756.
16. Weizmann Y., Patolsky F., Willner I. Amplified detection of DNA and analysis of single-base mismatches by the catalyzed deposition of gold on Au-nanoparticles // *Analyst*. – 2001. – Vol. 126. – P. 1502–1504.
17. Lange S.A., Roth G., Wittemann S., Lacoste T., Vetter A., Grässle J., Kopta S., Kolleck M., Breiting B., Wick M., Hörber J.K.H., Dübel S., Bernard A. // Measuring Biomolecular Binding Events with a Compact Disc Player Device. *Angew. Chem.*, 2006. Vol. 118. P. 276–279.
18. Sia S.K., Linder V., Parviz B.A., Siegel A., Whitesides G.M. An Integrated Approach to a Portable and Low-Cost Immunoassay for Resource-Poor Settings // *Angew. Chem. Int. Ed.* – 2004. – Vol. 43. – P. 498–502.
19. Boston D.R. Silver image enhancement composition and process for use thereof. US Patent № 4,603,100 (29 June 1986).
20. Boston D.R., European Patent № EP0198575 (22 November 1986).
21. Letsinger R.L. and Garimella V., European Patent № 1360318 B1 (26 April 2006).
22. Powell R.D., Pettay J.D., Powell W.C., Roche P.C., Grogan T.M., Hainfeld J.F., Tubbs R.R. Metallographic in situ hybridization // *Human Pathology*. – 2007. – Vol. 38. – P. 1145–1159.
23. Hainfeld J.F., Eisen R.N., Tubbs R.R., and Powell R.D. // *Enzymatic Metallography: A Simple New Staining Method*. In: Voekl E., Piston D., Gauvin R., Lockley A.J., Bailey G.W., and McKernan S. *Microsc. Microanal.*, 8, Suppl. 2: Proceedings. – Cambridge University Press, New York, 2002. – P. 916CD.
24. Tubbs R., Pettay J., Hicks D., Skacel M., Powell R., Grogan T., and Hainfeld J. Novel bright field molecular morphology methods for detection of HER2 gene amplification // *J. Mol. Histol.* – 2004. – Vol. 35(6). – P. 589–594.
25. Hainfeld J.F., US Patent № 6,670,113 (30 December 2003).
26. Hainfeld J.F., US Patent № 2007/0122833 (31 May 2007).
27. Hainfeld J.F. and Liu W., US Patent № 2007/0224625 (27 September 2007).
28. Bieniarz C., Kernag C.A., Kosmeder J.W., Rodgers P.M., Wong J., US Patent № 2004/0265922 A1 (30 December 2004).
29. Bieniarz C., Farrell M., US Patent No. 2005/0100976 A1 (12 May 2005).

30. Bieniarz C., Kernag C.A., Kosmeder J.W., Rodgers P.M., Wong J., US Patent № WO 2005/003777 A2 (13 January 2005).
31. Hwang S., Kim E., Kwak J. Electrochemical Detection of DNA Hybridization Using Biometallization // *Anal. Chem.* – 2005. – Vol. 77(2). – P. 579–584.
32. Yokota K.-N., and Yamazaki I. Analysis and Computer Simulation of Aerobic Oxidation of Reduced Nicotinamide Adenine Dinucleotide Catalyzed by Horseradish Peroxidase // *Biochemistry.* – 1977. – Vol. 16(9). – P. 1913–1920.
33. Yamazaki I., and Yokota K.-N. Analysis of the conditions causing the oscillatory oxidation of reduced nicotinamide-adenine dinucleotide by horseradish peroxidase // *Biochimica et Biophysica Acta.* – 1967. – Vol. 132(2). – P. 310–320.
34. Olsen J., Davis L. The oxidation of dithiothreitol by peroxidases and oxygen // *Biochimica et Biophysica Acta – Enzymology.* – 1976. – Vol. 45(2). – P. 324–329.
35. De Sandro V., Dupuy C., Kaniewski J., Ohayon R., Dème D., Virion A. and Pommier J. Mechanism of NADPH oxidation by horse-radish peroxidase and 2,4-diacetyl-[2H] heme-substituted horse-radish peroxidase // *Eur. J. Biochem.* – 1991. – Vol. 201. – P. 507–513.
36. Banerjee R.K., De S.K., Bose A.K., Datta A.G. Horseradish Peroxidase-catalyzed Conversion of Iodine to Iodide in Presence of EDTA and H<sub>2</sub>O<sub>2</sub> // *J. Biol. Chem.* – 1986. – Vol. 261(23). – P. 10592–10597.
37. Bhattacharyya D.K., Bandyopadhyay U., Chatterjee R., Banerjee R.K. Iodide modulation of the EDTA-induced iodine reductase activity of horseradish peroxidase by interaction at or near the EDTA-binding site // *Biochem. J.* – 1993. – Vol. 289. – P. 575–580.
38. Harris R.J., Newmyer S.L., Ortiz de Montellano P.R. Horseradish Peroxidase-catalyzed Two-electron Oxidations // *J. Biol. Chem.* – 1993. – Vol. 268(3). – P. 1637–1645.
39. Shah M.M., Aust S.D. Oxidation of Halides by Peroxidases and Their Subsequent Reductions // *J. Biochem. and Biophys.* – 1993. – Vol. 300(1). – P. 253–257.
40. Bhattacharyya D.K., Bandyopadhyay U., Banerjee R.K. EDTA inhibits lactoperoxidase-catalyzed iodide oxidation by acting as an electron-donor and interacting near the iodide binding site // *Mol. Cell. Biochem.* – 1996. – Vol. 162. – P. 105–111.
41. Shah M.M., Aust S.D. Iodide as the Mediator for the Reductive Reactions of Peroxidases // *J. Biol. Chem.* – 1993. – Vol. 268(12). – P. 8503–8506.
42. Bhattacharyya D.K., Adak S., Bandyopadhyay U., Banerjee R.K. Mechanism of inhibition of horseradish peroxidase-catalyzed iodide oxidation by EDTA // *Biochem. J.* – 1994. – Vol. 298. – P. 281–288.
43. Banerjee R.K. Mechanism of Horseradish Peroxidase-catalyzed Conversion of Iodine to Iodide in the Presence of EDTA and H<sub>2</sub>O<sub>2</sub> // *J. Biol. Chem.* – 1989. – Vol. 264(16). – P. 9188–9194.
44. Adak S., Bhattacharyya D.K., Mazumder A., Bandyopadhyay U., and Banerjee R.K. Concurrent Reduction of Iodine and Oxidation of EDTA at the Active Site of Horseradish Peroxidase: Probing the Iodine Binding Site by Optical Difference Spectroscopy and Steady State Kinetic Analysis for the Formation of Active Enzyme-I+-EDTA Ternary Complex for Iodine Reductase Activity // *Biochemistry.* – 1995. – Vol. 34. – P. 12998–13006.
45. Chang H.A., Bumpus J.A. Iodide Oxidation and Iodine Reduction Mediated by Horseradish Peroxidase in the Presence of Ethylenediaminetetraacetic Acid (EDTA): the Superoxide Effect. Proceedings of the Natural Science Council, Republic of China // Part B: Life Sciences. – 2001. – Vol. 25(2). – P. 82–89.
46. Berglund G.I., Carlsson G.H., Smith A.K., Szöke H., Henriksen A., Hajdu J. The catalytic pathway of horseradish peroxidase at high resolution // *Nature.* – 2002. – Vol. 417. – P. 463–468.
47. Tubbs R., Pettay J., Powell R., Hicks D.G., Roche P., Powell W., Grogan T., Hainfeld J.F. High-Resolution Immunophenotyping of Subcellular Compartments in Tissue Microarrays by Enzyme Metallography // *Appl. Immunohistochem. Mol. Morphol.* – 2005. – Vol. 13. – P. 371–375.
48. Downs-Kelly E., Pettay J., Hicks D., Skacel M., Yoder B., Rybicki L., Myles J., Sreenan J., Roche P., Powell R., Hainfeld J., Grogan T., Tubbs R. Analytical Validation and Interobserver Reproducibility of EnzMet GenePro. A Second-Generation Bright-Field Metallography Assay for Concomitant Detection of HER2 Gene Status and Protein Expression in Invasive Carcinoma of the Breast // *Am. J. Surg. Pathol.* – 2005. – Vol. 29(11). – P. 1505–1511.
49. Möller R., Powell R.D., Hainfeld J.F., Fritzsche W. Enzymatic Control of Metal Deposition as Key Step for a Low-Background Electrical Detection for DNA Chips // *Nanoleters.* – 2005. – Vol. 5(7). – P. 1475–1482.
50. Furuya F.R., Joshi V.N., Hainfeld J.F., Powell R.D., and Takvorian P.M. Enzymatic Metallography as a Correlative Light and Electron Microscopy Method. In: Anderson I.M., Price R., Hall E., Clark E., and McKernan S. *Microsc. Microanal.*, 10, Suppl. 2: Proceedings. // Cambridge University Press, New York, p. 1210CD. 2004.

## STUDY OF ADAPTOGENIC PROPERTIES AND CHRONIC TOXICITY OF EXTRACT OF RHODIOLA HETERODONTA

Yunuskhodjaev A.N., Iskandarova S.F., Kurmukov A., Saidov S.A.

*Tashkent Pharmaceutical Institute, Tashkent, e-mail: yunuskhodjaev@pharmi.uz, ssaidamir@yandex.ru, iskandarova.shahkhista@mail.ru*

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The adaptogenic properties and chronic toxicity of *Rhodiola heterodonta* extract were studied. In particular, analgesic and hypothermic activity, as well as chronic toxicity were the aim of the research, which also included analysis of body weight change and histomorphology of internal organs of experimental animals influenced by the *Rhodiola heterodonta* extract. The research showed that the extract of *Rhodiola heterodonta* has moderate adaptogenic effect and may be used as adaptogen. Also, histomorphological analysis of internal organs demonstrated low toxicity of *Rhodiola heterodonta* preparations.

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**Keywords:** extract of *Rhodiola heterodonta*, adaptogenic properties, analgesic activity, hypothermic influence, chronic toxicity, change of body weight, histomorphology of internal organs

Daily life of contemporary human, especially the ones living in big cities and megapolises, is full of distressing situations and conditions related, in particular, to environment, nutrition, work and rest conditions, bad habits, low physical activity. All these reduces compensatory capacity of organism and leads initially to functional and then to organic changes of various organs and systems [8, 9]. Abovementioned factors has major effect on young organism of teenagers, at times resulting in irreversible health damage of younger generation and to a certain degree of gene pool of the nation.

Thereby in prevention of diseases significance of adaptogens and dietary supplements of various brands is increasing [1, 9]. Elaboration of preparation of this group produced from local raw materials and determination of the most effective one is an actual task [3, 8]. An example of plant which can be used as raw material for effective dietary supplement is *Rhodiola heterodonta* – perennial plant growing in Uzbekistan and seen in most mountainous regions of Central Asia. Roots and rootstocks of this plant contain polyphenols and in particular proanthocyanidines [5, 6]. The research showed that extracts obtained from roots of *Rhodiola heterodonta* demonstrate adaptogenic effect and increase resistance of organism to stress-factors. The research also indicated low toxicity of preparations obtained from this raw material [7].

There are other types of allied species showing tonic, adaptogenic and other valuable properties. The most common type is *Rhodiola Rosa* [7, 10]. Unfortunately, significant side effects and contraindications limit its application. The extract of *Rhodiola heterodonta* may be an alternative to a certain degree [2, 6].

**Aim of the research** is the study of adaptogenic properties and chronic toxicity of extract of *Rhodiola heterodonta*.

### Materials and methods of research

To study the properties of *Rhodiola heterodonta* 75% ethanol has been used. This is a dry powder with pleasant odor.

Analgesic activity was studied – method of tail compression with air bulb until squeal appears during pressure measurement in mm Hg.

Hypothermic effect of *Rhodiola heterodonta* on mice weighing 18–22 gm was studied by measuring body temperature in 30, 60, 120, 180 min and in 24 hours after introducing 50 mg/kg of the extract. In control group a simple distilled water in equal amount has been used orally (group 1), whereas comparison group was given oral acetylsalicylic acid 50 mg/kg (group 2). Experimental group was given the extract of *Rhodiola heterodonta* 50 mg/kg also orally (group 3).

Study of change of body weight under the influence of *Rhodiola heterodonta*: experiments were performed on 30 rats of both sexes with initial body weight being 175–195 g. The rats were divided into four equal groups: group 1 (control) were administered equal amount of distilled water; group 2 were administered 20 mg/kg dry extract orally obtained from the roots of *Rhodiola heterodonta*. Group 3 – 50 mg/kg and group 4 – 200 mg/kg. The preparation has been administered for 90 days. During the experiment body weight of the animals was measured 4 times: control measurement, day 9, 30 and 60 [3].

Chronic toxicity was studied on white outbred mice (does and bucks) weighing 18–22 grams. For experiment *Rhodiola heterodonta* was used in the form of 1–4% spirit solution (15% spirit) or in the form of 1–4% water emulsion (emulsifier – apricot resin).

Influence of the *Rhodiola heterodonta* preparation (chronic toxicity) was studied on white outbred rats of both sexes weighing 160–180 grams. The animals were divided into 4 groups. Group 1 was administered 20 mg/kg; group 2 – 50 mg/kg and group 3 – 200 mg/kg. Group 4 was administered water in equal amount. The preparation was administered daily during one month orally. At the end of experiment the rats were killed under ether anesthesia by decapitation. Samples of organs such as stomach, small and large intestine, liver, kidneys, adrenals, spleen, lungs, heart, pancreas, aorta and brain were extracted [1]. At the end of administration period (preparation in experimental group and distilled water in control group) 3 rats of each group were killed on the next day. The organs and tissues of these rats were taken and placed into formalin. The remaining rats (3 in each group) were killed in 7 days after administration of the preparation was stopped – period required for regeneration of reversible (functional) changes caused by the preparation. All the organs and tissues in formalin were further investigated histomorphologically.

Tissue samples were processed with conventional histological methods, the sections were stained with hematoxyline-eosine and examined under the "Leica-Biomed" microscope.

Obtained digital data were statistically processed in Excel with Student criteria. Significance value was  $P \leq 0,05$ .

### Results of research and their discussion

In control group pain sensation expressed as a squeal appeared in 30 min after administration of the preparation when pressure reached 93 mmHg; in 90 min with pressure 253 mmHg ( $P = 0,000$ ), i.e. pain sensation became 126 and 153 % less respectively.

In the control group "pain summation" model demonstrated that animals jump out in  $4,5 \pm 1,04$  sec 30 min after administration of distilled water; in  $34,2 \pm 20,55$  sec after intraperitoneal administration of 10 mg/kg of the extract of *Rhodiola heterodonta* ( $P < 0,05$ ). In the control group animals jump out in  $2,8 \pm 1,16$  sec 3,5 hours after administration of the preparation; in the experimental group the jump out period consisted of  $8,8 \pm 6,9$  sec ( $P = 0,06$ ).

The extract of *Rhodiola heterodonta* demonstrates reliable analgesic effect when used in 100 mg/kg dose.

Body temperature of experimental mice (weighing 18,0–22,0) in 30, 120, 180 min and in 24 hours after administration of the extract of *Rhodiola heterodonta* was 0,3, 0,7, 0,9 and 0,7°C lower then after administration of acetylsalicylic acid. In comparison to animals taking distilled water after administration of the extract of *Rhodiola heterodonta* in 30, 60, 120, 180 min and in 24 hours body temperature was 1,6, 1,3, 1,1, 1,3 and 0,4°C lower (Table 1). The experimental group demonstrated temperatures 2,1, 1,5, 1,3, 1,6 and 1,2°C lower in 30, 60, 120, 180 min and in 24 hours respectively compared to the initial level. The body temperatures were 1,5, 1,3°C lower then the initial level in 30, 60 min after administration of acetylsalicylic acid. In 120, 180 min and in 24 hours observed changes were insignificant. The obtained data suggests presence of hypothermic effect of extract of *Rhodiola heterodonta*. This hypothermic effect is not inferior to the effect of conventional antipyrogenic preparations.

Influence of *Rhodiola heterodonta* on rat body weight (Table 2). In control group daily introduction of purified water showed little decrease of body weight: 3% (5,1 g) in 10 days, 4,4% (8 g) in 30 days, 3,6% (7,2 g) in 60 days and on day 90 of the experiment body weight of the rats increased the control level and reached 236 g, i.e. increased 30,5% (55,2 g).

Change of body weight in experimental and control groups is different. Weight reduction in samples taking 20 mg/kg of preparation

in 10 days was equal to control group and consisted of 3,4% (5,1 g). However, the weight increased 4,5% (+ 8,2 g,  $P < 0,05$ ) in 30 days; 12% (+ 21 g,  $P < 0,05$ ) in 60 days and 24% (+ 43g,  $P < 0,05$ ) in 90 days after administration of the preparation. This groups has a reliable increase in body weight as compared to control group. The group taking 50 mg/kg of the preparation showed similar weight gain patter as the group taking 20 mg/kg. Nevertheless, the effect was more pronounced on day 60.

The group taking 200 mg/kg of the preparation did not demonstrate any weight gain which is probably related to early toxicity at this dose. Taking into account equal conditions of breed and nutrition, the reason for weight loss of the rats in the control group is related to stress caused by the daily process of introduction through the catheter to stomach. The rats taking 20 and 50 mg/kg revealed significant antissessor effect of these dosages. Weight gain lag in the rats taking 200 mg/kg may be related to early toxic effect of the preparation at this dose.

The study of chronic toxicity revealed that in control group body weight of rats reduced: 3% (5,1 g) in 10 days, 4,4% (8 g) in 30 days, 3,6% (7,2 g) in 60 days and on day 90 of the experiment body weight of the rats increased the control level and reached 236 g, i.e. increased 30,5% (55,2 g) (Table 2).

Change of body weight in experimental and control groups is different. Weight reduction in samples taking 20 mg/kg of preparation in 10 days was equal to control group and consisted of 3,4% (5,1 g). However, the weight increased 4,5% (+ 8,2 g,  $P < 0,05$ ) in 30 days; 12% (+ 21 g,  $P < 0,05$ ) in 60 days and 24% (+ 43g,  $P < 0,05$ ) in 90 days after administration of the preparation. This groups has a reliable increase in body weight as compared to control group.

Comparative analysis of morphology of internal organs of all the groups having taken the *Rhodiola heterodonta* preparation at 20; 50 and 200 mg/kg dose indicates that the histological structure of internal organs is similar to the control group.

Stomach mucosa is well preserved, glandular cells are without specific changes. The section shows all the layers of stomach being well preserved. The mucosa is well defined due to numerous prolonged tubelike structures – fundal glands of stomach. The integumentary epithelium is formed by a single layer of glandular epithelium. This epithelium forms stomach pits which close up with glands. At the cellular level the body and fundus of stomach is composed of numerous parietal cells. Hysitomorphological analysis of stomach of experimental animals that were administered 20–50 and 200 mg/kg of the preparation shows that the tissues are

comparable morphologically to control animals, and that *Rhodiola heterodonta* preparation does not cause any dystrophic changes.

Small intestine has pronounced villi and crypts, and enterocytes with a rim. The crypts of large intestine are deep, layered with mucoid cells, rift of the crypts is distended and filled with mucoid secretion. Enterocytes have cy-

lindrical form and bright pink cytoplasm, elongated nuclei located basally. Comparative study of histomorphology of small intestine of experimental animals that received *Rhodiola heterodonta* preparation at the 20–50 mg/kg and 200 mg/kg dose and of control animals revealed that they have common structure and we did not detect any significant variations.

**Table 1**  
Influence of extract of *Rhodiola heterodonta* on body temperature of mice ( $M \pm m$ ).

Group number (number of mice in group)	Preparation, dose (mg/kg)	Initial body temperature	Time after administration of preparation				
			30 min	60 min	120 min	180 min	24 hrs
I ( $n = 8$ )	Control group (distilled water)	$38,5 \pm 0,37$	$38,3 \pm 0,14$	$38,6 \pm 0,36$	$38,6 \pm 0,13$	$38,5 \pm 0,29$	$38,0 \pm 0,58$
II ( $n = 5$ )	Acetylsalicylic acid 50 mg/kg, (per os)	$38,5 \pm 0,41$	$37,0 \pm 0,24$ $-1,5 > 0,002^\circ\text{C}$	$37,2 \pm 0,07$ $-1,3 > 0,002^\circ\text{C}$	$38,2 \pm 0,31$ $-0, > 0,053^\circ\text{C}$	$38,1 \pm 0,39$ $-0,4 < 0,1^\circ\text{C}$	$38,3 \pm 0,33$ $-0,2 > 0,01^\circ\text{C}$
III ( $n = 5$ )	<i>Rhodiola heterodonta</i> 50 mg/kg, (per os)	$38,8 \pm 0,7$	$36,7 \pm 0,87$ $-2,1 < 0,001^\circ\text{C}$	$37,3 \pm 1,0$ $-1,5 < 0,002^\circ\text{C}$	$37,5 \pm 1,3$ $-1,3 < 0,05^\circ\text{C}$	$37,2 \pm 1,8$ $-1,6 < 0,05$	$37,6 \pm 1,6$ $-1,2 > 0,05^\circ\text{C}$

Note: \* – reliability of difference ( $p < 0,05$ ) when compared with the results obtained in group 1; ^ – reliability of difference ( $p < 0,05$ ) when compared with the results obtained in group 2.

**Table 2**  
Change of body weight under the influence of various doses of experimental preparation during the study of chronic toxicity ( $M \pm m$ )

Groups, ( $n = 6$ )	Administered substance	Dose, mg/kg	Body weight, g				
			Day 0	Day 9	Month 1	Month 2	Month 3
Group 1	Distilled water	–	$180,8 \pm 11,14$	$175,7 \pm 13,5$	$172,8 \pm 6,32$	$190,8 \pm 24,9$	$236,0 \pm 15,2$
Group 2	Extract of <i>Rhodiola heterodonta</i>	20	$182,0 \pm 6,46$	$175,7 \pm 17,53$	$190,2 \pm 4,26^*$	$203,5 \pm 12,8$	$225,0 \pm 2,6$
Group 3		50	$178,0 \pm 7,45$	$186,2 \pm 4,99$	$192 \pm 6,63^*$	$217,7 \pm 17,7^*$	$217,0 \pm 20,0$
Group 4		200	$186,7 \pm 9,3$	$186,8 \pm 17,7$	$181,5 \pm 20,14$	$205,5 \pm 14,82$	$204,0 \pm 13$

Note: \* – reliability of difference ( $p < 0,05$ ) when compared with the results obtained in group 1; ^ – reliability of difference ( $p < 0,05$ ) when compared with the results obtained in group 2; # – reliability of difference ( $p < 0,05$ ) when compared with the results obtained in group 3.

Liver of experimental animals did not show any noticeable morphological changes, hepatic plate and hepatocytes are well preserved, many binucleated hepatocytes, sinusoid hemocapillaries are moderately distended, stellate reticuloendotheliocytes have usual structure. Renal corpuscle, proximal and distal parts of Henle's loop did not have any change.

Thereby the results of the research indicated that the extract of *Rhodiola heterodonta* has hypothermic and analgesic effect which may suggest presence of adaptogenic properties.

The results of chronic toxicity study also show that prolonged administration of the preparation of *Rhodiola heterodonta* does

not adversely affect body weight of animals which may suggest presence of antistressor influence. Moreover, chronic toxicity study did not reveal significant morphological changes of structure in the studied organs. Based on the research results and on the fact that low toxicity is confirmed by other publications, suggested preparation may be considered safe therapeutic measure and be recommended for clinical application.

### Conclusions

1. The extract of *Rhodiola heterodonta* show moderate adaptogenic influence and may be used as adaptogen.

2. Histomorphological picture of internal organs obtained during the study confirms low toxicity of the *Rhodiola heterodonta* preparation.

### References

1. Drozd G.A., Lischuk N.G. Safe use of medicinal plant raw material // Development, study and marketing of new pharmaceutical product: collected articles – Pyatigorsk: Pyatigorsk GFA. – 2007. – Vol. 62. – P. 467–468.
2. Korsun V.F. Medicinal plants in the management of multiple sclerosis: guidebook / V.F. Korsun, E.V. Korsun. – M., 2006. – P. 8.
3. Mashkovskiy, M.D. Medicines / M.D. Mashkovskiy. – M.: Izdatelstvo “Novaya Volna”, 2005. – P. 1200.
4. Saratikov A.S., *Rhodiola rosa* (golden root) / A.S. Saratikov, E.A. Krasnov. – Tomsk: Tomsk publishing house, 2004. – P. 292.
5. Temirbulatova A.M. Development of ingredients, technology and quality standards for adaptogenic dietary supplements with extract of *Rhodiola rosa*.: Autoref. of dis. ... doctor of pharmaceutical science. Pyatigorsk 2007, Pyatigorsk state pharm. academy of Federal agency for health and Social development.
6. Tutelyan V.A. Phytogetic dietary supplements. Phenolic acids: prevalence, nutritional sources, bioavailability / V.A. Tutelyan, N.V. Lashneva // Nutritional issues. – 2008. – T. 77. – № 1. – P. 4–19.
6. Grace M.H. et al. Phytochemical characterization and antihypoxic efficacy of an active extract of *Rhodiola heterodonta* // Phytochemical Analysis in press. – 2008. – P. 10–23.
7. Korsun V.F. Medicinal plants in the management of multiple sclerosis: guidebook / V.F. Korsun, E.V. Korsun. – M., 2006. – P. 8.
8. Korsun V.F. Phytotherapy of diseases of musculoskeletal system: guidebook / V.F. Korsun, S.M. Nikolaev. – M., 2006. – P. 7.

## INTERRELATION AND INTERFERENCE OF THE COMPETENCE COMPONENTS IN INNOVATIVE ENGINEERING ACTIVITY

Naumkin N.I., Grosheva E.P., Kupryashkin V.F., Panyushkina E.N.

National research Mordovian state University named N.P. Ogarev, Saransk, e-mail: [naumn@yandex.ru](mailto:naumn@yandex.ru)

Competence of innovative engineering activity as the interconnected set of knowledge, ability, motivation and activity components is considered. Each component is given a characteristic and the components are structured. The set of competences of the activity component, which defines student's innovative activity competence, is explored.

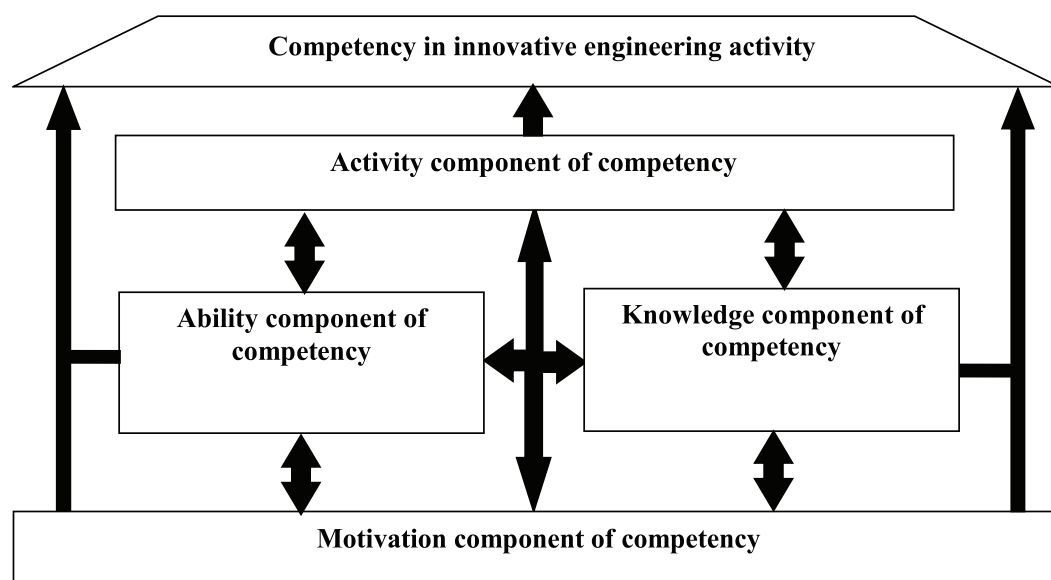
**Keywords:** competence, competency, innovative engineering activities, National Research University, the components of competence

In this study the concepts of “competency” and “competence” are concretized and structured. It was done within a research carried out at Ogarev Mordovian state university; the students of national research universities are being studied on competence of innovative engineering activity formation (CIEA).

Nowadays there are many definitions of “competence” and “competency” [1], in relation to our research, the most acceptable definition of competency was given by Yu.G. Tatur [1]: “Competency is an integrated trait of personality, that characterizes its aspiration and capability (readiness) to realize the potential (knowledge, abilities, experience, personal features etc.) for successful activity in a certain area”. And competence was given the following definition [1]: “Competence is a set

of the interconnected internal means of activity of the subject (knowledge, abilities, skills, specific abilities, methods of decision-making and ways of activity), subjects set in relation to a certain circle and processes, necessary for high-quality activity in relation to them”. We will adhere further to these definitions.

Taking into account the above-mentioned and on the basis of the researches [5, 6, 7, 8], carried out by the authors while training national research universities students for the innovative activity (IA) [3, 2], competency of innovative engineering activity is presented as a set of components: knowledge, activity, motivation (person's needs and society's needs), psychological (development of abilities). These components are structured in the form of the scheme presented in Figure.



The integration of competency components in innovative engineering activity

According to the scheme, first, all these components are in close integration; secondly the motivation component is the basis of abil-

ity, knowledge and activity components formation; thirdly, the activity component is a realization tool for motivation, knowledge, ability

components; fourthly, all these components form CIEA. Their short characteristics will be stated.

CIEA motivational component. For CIEA formation the following actions are necessary:

- 1) ensuring motivation;
- 2) determination of a set of requirements of IID;
- 3) formulation of the purpose which needs to be reached as a result of activity;
- 4) identification of the object, which is the activity to be carried out on;
- 5) formulation of activity structure and requirements to its implementation;
- 6) choosing external technical means and application of internal means acquired by the subject.

The motivation is defined by psychologists, sociologists, philosophers and other researchers differently. The motivation for innovative activity, from our point of view [1, 2, 4] is a set of motives causing activity of the subject, production or society in a certain direction. The set of motives we will consider as:

- 1) person's needs that brings a subject to a condition of activity;
- 2) requirements of society – social values and ideals;
- 3) incentive – the means that strengthen power of motives;
- 4) interest – appeal of IEA.

The motivation can be internal and external, positive and negative.

The interest is an emotional state which motivates research activity, by special attention to an object of research. The appeal of innovative engineering activity causes interest in NRU students as it is capable to satisfy all needs of a person and the society, moreover it has political and economic support.

The knowledge component of CIEA includes the knowledge gained at studying the following cycles of disciplines: the science; the interdisciplinary; all-technical, defining the width of vocational training; special, forming knowledge in a certain area and defining depth of vocational training; others – humanitarian, social, economic, legal.

The psychological component of CIEA. This component is defined by the main properties of nervous system and abilities of a student (intelligence, trainability, inclination, the attitude towards the teacher, creativity, communicativeness). We will consider these characteristics of the psychological component.

Intelligence is ability to apply the knowledge and the solution of tasks on the basis of the available knowledge, promoting successful activity. The intelligence is a set of all informative functions of a personality: from feeling and perception to thinking and imagination. J. Gilford [9] introduced concepts of convergent and divergent thinking, as intelligence

components. Convergent thinking is ability to find the only right solution correctly and quickly. Divergent thinking is a process of promotion of various and equally correct concerning the same object.

The trainability is ability to acquire new knowledge and skills fast and easily, which promote successful activity. Success of trainability is influenced greatly by a motivational component (interest, incentive, etc.) and intelligence. High I.Q. without motivation doesn't guarantee successful trainability; often not a bright student reaches tops in scientific activity in future. However people with intelligence below an average are never among advanced students [10].

The inclination is the aspiration, the increased inquisitiveness, inclination of the person to a certain kind of activity (invention, commercialization, etc.), that is a guarantee of their abilities development in this activity. However, not always an inclination is true, sometimes an inclination is a result of a suggestion or auto-suggestion; without potential opportunities, it is called false or is called a hobby. A true inclination is distinguished by fast achievement of considerable results [9].

The attitude towards the teacher is a subjective opinion of the student which consists of qualities of the student: ideals, moral principles, background; and the teacher: morals, social status, and professionalism. Unfortunately, recently the social status of teachers has worsened considerably; partly it has caused the disrespect for teachers. The attitude towards the teacher influences the trainability of students greatly. If the teacher has authority over students, progress considerably increases. In this regard the teacher has to be an active subject of innovative system.

The creativity [10] is ability to transform available knowledge, i.e. ability to the creativity. It is characterized by ability to find a solution of tasks in an uncommon way, imagination, and achievement of the purpose. The American psychologist J. Gilford became the founder in the field of creativity; he distinguished 16 mental abilities characterizing creativity, as: fluency (an amount of the ideas arising within a unit of time); flexibility (ability to switch from one idea to another); originality of thinking (ability to produce the ideas which differ from conventional ones); inquisitiveness (hyper sensibility to the problems not causing interest in others); irrelevancy (logical independence of reactions from incentives).

The communicativeness [10] is a characteristic of a personality defining possibilities of communication, and corresponding manifestations of the personality (sociability, isolation). Communicativeness assumes an exchange of thoughts, information, feelings. Communica-



tive abilities in the sphere of business communication demand social experience, knowledge of cultural norms and rules, traditions, etiquette in the communication sphere, and following them. Communicativeness is formed of the following qualities of the personality: readiness to perceive new, tolerance, the benevolent attitude towards people, erudition, self-confidence, oratorical skills, ability to persuade, physical appearance, sense of humor, etc.

The activity component of CIEA. The knowledge, psychological and motivational components of competence of IEA find practical application in an activity component which is presented by competences of IEA as a set common cultural (CC) and the professional competence (PC) which have been marked out below.

The presented structure of competency of innovative engineering activity, the competence presented in the Federal educational standard, and also the previous researches [1–7] conducted by authors allowed to mark out the following competences necessary for NRU students of NIU to form the competency of IEA, within the activity component:

- 1) ability to use normative legal documents;
- 2) ability to allocate a problem;
- 3) ability to set a task;
- 4) ability to synthesize the solution, to invent;
- 5) ability to visualize (to use the imagination);
- 6) ability to operate results of intellectual activity;
- 7) ability to master the off-the-shelf solution, new equipment and technologies on a legal basis;
- 8) ability to work with patent and non-patent information;
- 9) ability of the analysis of a technological level of object (goods: a product, work, services);
- 10) ability to analyze novelty of an object (goods: a product, work, services);
- 11) ability to define the tendencies of an object development (goods: a product, work, services);

12) ability to define the conditions of the competition in a certain market;

13) ability to organize team work;

14) ability of business communication;

15) ability to commercialize an off-the-shelf solution. Further researches of NRU students training in innovative activity have to be directed on effective formation of these competences.

#### References

1. Grosheva E.P. Competence in innovative engineering / E.P. Grosheva, N.I. Naumkin, N.N. Shekshaeva // *Innovative obrazovanie*. 2013. – № 1 (3). – P. 33–46. URL: <http://inobr.mrsu.ru/index.php/1-3-2013>
2. Naumkin N.I. Features prepare students for national research universities to innovative engineering / N.I. Naumkin, E.P. Grosheva, N.N. Shekshaeva, V.F. Kupryashkin // *Integration of education*. – 2013. – № 4. – P. 4–143.
3. Grosheva E.P. Motivation of innovative activity / E.P. Grosheva, N.I. Naumkin // *International journal of applied and fundamental research*. – № 2. – 2013. URL: [www.Science-sd.com/451-240441\(15.07.2013\)](http://www.Science-sd.com/451-240441(15.07.2013)).
4. Naumkin N.I., 2013. Integrated Technology of Competence Staged Formation in Innovation Through Pedagogy of Cooperation / N.I. Naumkin, V.F. Kupryashkin, E.P. Grosheva, N.N. Shekshaeva, E.N. Panjushkina // *World Applied Sciences Journal*. Date Views 16.12.13. – P. 935–938. URL: [http://www.idosi.org/wasj/wasj27\(7\)13/21.pdf](http://www.idosi.org/wasj/wasj27(7)13/21.pdf); <http://www.idosi.org/wasj/wasj27%287%292013.htm>.
5. Naumkin N.I. Preparing students for national research universities for innovation in learning technical creativity / N.I. Naumkin, E.P. Grosheva, V.F. Kupryashkin, ed. P.V. Senin, L.Yu. Hotuntseva; Mosk. ped. Reg. Univ. – Saransk Univ muzzle. University Press, 2010. – 120 p.
6. Naumkin N.I. Methodical system of formation of students of technical colleges ability to innovate engineering activities in the learning process of technical disciplines: dis. dr.... ped. Sciences. – M., 2009. – 499 p.
7. Grosheva E.P. Methodical system of training students of technical colleges to innovate in teaching engineering creativity and patenting dis.... cand. ped. Science. – M., 2010. – 331 p.
8. Kurileva N.L. Developing technical skills of students in teaching physics in secondary school: dis.... Cand. ped. Science. – M., 2007. – 236 p.
9. Druginyn V.N. Psychology general abilities. – St. Petersburg.: Peter, 1999. – 356 p.
10. Bleicher L.F., Burlachuk V.M. Psychological diagnostics of intelligence and personality. – Kiev: Visha School, 1978. – 140 p.

## PROBLEM OF COMPREHENSIVE STUDY OF PSYCHOLOGICAL RISKS TO CHILDREN ON THE INTERNET

Pazukhina S.V., Filippova S.A.

*Tula State Lev Tolstoy Pedagogical University, Tula, e-mail: pazuhina@mail.ru*

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In the article it is considered the necessity of comprehensive study of psychological risks to children on the Internet. The authors identify the following risks of virtual environments that are dangerous for the coming generation: risks to personal safety; risks of social and personal deformations; risks of disorders of psychological children health; risks of educational-cognitive activity distortion etc. There are proposed such directions of the problem solution such as prevention and early detection of children psychological distress signs due to the negative impacts of the virtual space, parents' education about the potential psychological risks of the Internet space and their instructing about technologies of maintenance of school children Internet safety, formation of the future teachers and psychologists preparedness to the competent use of Internet resources.

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**Keywords:** psychological risks, children, Internet, virtual environments

The Internet has become an indispensable part of modern human life. The first child's knowledge of a computer currently tends to occur in the preschool or early school age. At the same time parents being experienced Internet users are often incompetent in terms of the child encounter with web opportunities opening for the children audience. Having bought a computer game or a CD, they often leave the child alone with the problem of self-study of the Internet resources' content and functionality; they keep from the joint and active exploration of the Internet without fully realizing how dangerous the lonely unsupervised "journey" of a child across the Network expanses can be.

Children who are often more confident Web users rather than adults around them due to some the age and psychological peculiarities (naivety, trustfulness, curiosity, the inability to predict the coming of negative consequences, lack of life experience, etc.), can easily become victims of risks which the Internet carries. One of such risks is the accessibility of information of dubious moral content distorting the teen formation of ideas about gender relations and moral norms. Sources of the danger are sites with pornographic content, possibility of anonymous purchase of goods in online shops "sex shop"; widespread web-resources that provide information about the intimate services in various cities of Russia. Access to such sites is formally limited for under-age persons; however, it is impossible to monitor the implementation of this condition. Moreover, widespread virtual communication allows individuals with paedophilic inclinations quickly to find potential "victims" in social networks and carry out with impunity activities that threaten mental health and psychological well-being of children and adolescents. The Internet is a potential escalator of younger generation neurotization, a source of various kinds of addictions and deviances. This type of threat carries unlimited access to online games including gambling. Network games that are so popular now among young people, abound in violence, develop ha-

ted, sadism and pursuit of death and provoke the development of such negative mental phenomena such as game and Internet addiction, gadget mania. Information about drugs, traumatic games is in the open access. The reality of the modern Internet is advocating suicidal behavior sites. Adults who admit unsupervised children's surfing the Net are not able to protect them both from the actions of intruders and from contact with information that is not intended for children's perception.

It is necessary to consider the fact that schoolchild interaction with the Internet influences the nature of learning activities. In this context, the risks are caused by the possibility of unimpeded obtaining ready results of educational activity via the Net – answers to problems, essays and compositions, etc., as well as access to information that requires remembering – dictionaries, translation software, encyclopedias, etc. Plagiarism instead of one's own intellectual creative efforts and obtaining information on the Internet instead of remembering considerably reduce the quality of training activities, which in its turn leads to a decrease in indices of mental development of schoolchildren. Controlling function of teachers and parents in relation to the inadequate use of web-resources by a schoolchild and the use of Antiplagiat systems allow to correct learning outcomes in each individual case. However, there are currently no technologies allowing implementing the prevention of educational activity deformations under conditions of school training informatization.

Thus, along with the positive possibilities, the virtual environment contains many psychological risks that could adversely affect the mental, psychological, physical health and social well-being of users, cause irreversible adverse effects in personal and social development of the younger generation, determine a number of socially significant diseases such as Internet addiction, hikikomori, autism, mental deprivation, reduced mental development, etc. The impact of the Internet on the immature personality of preschool and primary school age

children is particularly dangerous when a child's first encounter with a computer comes.

Nowadays in science and technology various parental control programs are developed and implemented, however, none of the currently existing measures provides continuous monitoring of the child's pastime on the Internet. We believe that an alternative as well as a complement to existing programs should be the study of psychological risks of virtual environment and the development of measures to prevent their occurrence.

Analysis of the theoretical sources on the research subject allows us to speak of a special relevance at the present time of such trends in solving young users' security problems in the Internet environment as the problem of early detection, prevention of psychological risks and the prevention of negative psychological consequences of the children interactions with the Internet, the problem of competence formation in this sphere at persons responsible for the psychological well-being of children (parents, teachers, psychologists). Significance of the study is determined by insufficient development of issues relating to the classification of modern psychological risks of the virtual environment; the technology for early detection of the facts of negative psychological consequences of the child's interaction with the Internet; development of scientific and methodological support to form preparedness of the future teachers, psychologists and parents to share the interaction in the field of the Internet safety of children.

The novelty of our work consists in a comprehensive approach to the study of psychological risks that threaten the safety of children on the Internet. Comprehensive study presupposes examination of the phenomenon from different angles, involvement of experts from various fields, use of mutually supportive methods. It is planned development of classification of psychological risks to children in cyberspace, systematization of ideas about the negative psychological effects and the conditions caused by the impact of the Web, content model development of competence of persons responsible for the psychological well-being of children in the interaction with the Internet, improvement of vocational training of higher pedagogical educational institutions students taking into account the processes of informatization of modern society.

Analysis of the current state of knowledge of the problem suggests that some aspects of human interaction with the Internet are the subject of a number of authors. By now specific areas of research related to this topic have been formed. Internet addiction problem are well studied: in the works of scholars and practitioners there are discussed causes, mechanisms of formation, peculiarities of impact on the personality, measures of prevention, correction and treatment of gambling addiction, Internet addiction, and relatively

recently emerged form of addiction – addiction to the means of access to the Internet and games (gadget mania) (A.V. Gogoleva, M.S. Ivanov, A.V. Kotlyarov, B.R. Mandel' and others). Specialized literature reflects issues of Internet communication: features and effects of virtual communication are studied. A large number of studies is devoted to the negative phenomena of the Internet communication: aggressive forms of behavior via the Net are studied (such as cyberbullying, trolling, mobbing); the phenomenon of the real aspects of social interaction by virtual counterparts replacement is investigated. The problem of formation of ethical behavior among users in the network – cyberethics, is formulated and studied (K. Gamelink, A.I. Naftul'yev, V.M. Ruf, G.T. Tavani, U. Shvartau and others). A number of studies are devoted to the issues of Internet security of users (Yu.I. Bogatyryova, S.V. Pazukhina, A.N. Privalov, etc.) [1].

In this connection, it should be emphasized that today the concept of Internet security is associated not only with the protection of personal information against unauthorized access, but also with the protection of the personality against the potential risks related to the presence in the network causing socially significant diseases (Yu. D. Babaeva, A.Ye. Voyskunsky, G.V. Grachev, V.P. Solomin, O.V. Shatrova, etc.). In the scientific researches of recent years such issues are discussed as ones concerning the impact of information technology on the child's personality formation and development that takes place in the context of global informatization; the peculiarities of moral norms formation and the specifics of the intellectual sphere development are investigated, the phenomenon of hacking and software piracy is studied; another aspect of the research is the psychological effects associated with the spread of users' personal information via the Internet, mass social phenomena determined by the impact of the Internet on the consciousness of the rising generation (D. Bell, O.V. Doronina, G.N. Mustaf'yeva, O.V. Smyslova, S.V. Pazukhina, etc.) [2]. The data of theoretical and empirical researches form the basis focused on the comprehensive study of various aspects of human interaction with the information environment.

At the same time, our analysis of the scientific literature shows that there is still no common approach to the classification of the negative effects of the Internet impact on the psychological, mental and social well-being of the individual. Existing methodological developments in the field of psychological safety of children and adolescents in the interaction with the Internet at this stage do not allow solving the problem raised in our work in full as they are mainly focused on the prevention and elimination of Internet addictions and the negative effects of the Internet communication. There is no formed idea of the interrelated conditions complex of children Internet security, of crite-

ria, content and structure of the competence of those responsible for the safety of children when they are online. There is no holistic model of the Internet competence formation of future teachers and psychologists at the training stage at the University in the field of ensuring psychological Internet safety of children. All this testifies the relevance of our research in the chosen area.

At present we distinguish the following groups of risks of the virtual environment: risks to personal safety; risks of social and personal deformations; risks of infringement of psychological children's health; risks of educational and cognitive activity distortion, etc.

Among the psychological risks of the virtual environment which have a serious impact on the psyche of the child and which are planned to study deeper in the framework of our research, we single out the following:

1) potential risk of forming of the children Internet addiction and other neurotic disorders as a result of pathological computer interest;

2) potential risk of becoming a victim of the negative effects of the Internet communication (cyberbullying, trolling, sexual harassment, fraud, user's personal information getting into the Net, etc.);

3) risks of infringement of psychological well-being of children as a result of the access to Internet resources that contain information of a sexual nature, demonstrate violence, incline to suicide and form a distorted view of properties of the body, etc.;

4) risks associated with the negative impact of the Internet on the process of learning activities, etc.

We plan to explore other influences of the virtual space that have a negative impact on the human psyche on an unconscious level, to assess the number of sites in order to identify these negative factors. It is supposed to create a classification built on the basis of the specific psychological risks influence of the Internet environment on social, personal and physical development of schoolchildren, their psychological, mental and physical health.

A pilot survey of groups of schoolchildren aged 8 to 16 years we conducted showed that one in four of them daily spends on the computer more than three hours a day. During the weekend the percentage of children replacing leisure activities by the Internet increases significantly and reaches 45%. Over the past five years the number of students working on the computer for at least three hours a day has quadrupled (from 6 to 24%). More than 80% of the interviewed students indicated that they have access to the Internet at any desired time without any restrictions from parents. About 30% of students consider the virtual world as a way of escaping from problems. Here they find a way out for such negative emotions and feelings as anger, rage, hatred, guilt, feelings of

loneliness, hopelessness, stress, depression, etc. About 10% of children during the anonymous survey confessed that they have been attacked by pedophiles in chat rooms, social networks, have received letters with threats and invitations to sexual contacts by e-mail. It is established that at the moment the first encounter with pornographic information usually happens at the age of 11 years. 90% of children watch pornographic films while doing their homework. 80% of students admit that they have repeatedly observed scenes of sexual violence on the Internet.

One in six schoolchildren shows signs of Internet addiction. About 5% of students have symptoms of addiction to computer games. One in three spends more time on the Internet than it is originally planned. Losing control of the time they stay in the virtual space, students resort to lies in relationships with close people, family members in order to hide the amount of time they spend on the computer. Becoming Internet-dependent, children begin to consider the virtual world as an important part of their lives and they run the danger of narrowing, distortion of normal relationships with friends, family and reducing of the importance of study and other activities, etc.

According to our survey, more than 30% of parents don't stay with their children when those spend their time on the computer without limiting their use of the Internet, and don't monitor the time of their staying on the Internet. Only one tenth of parents take rather strict position in this matter. Such parents are interested in what their children do on the Internet, which sites are visited, whom they communicate with; the parents use special supervisory programs.

We suppose that pedagogs and psychologists of a new generation should play the leading role in forming children skills of safe using on the Net, parents educating on potential psychological risks of the cyberspace and their training to technologies of ensuring Internet safety of schoolchildren. In this regard, we plan to conduct a study on the future teachers and psychologists preparedness to such activities, to develop formative program built on the basis of the use of interactive practical works, psychological workshops, trainings of parental competence in the field of early signs of psychological distress of children associated with the negative effects of the virtual space as well as to ensure their Internet security and which involves the formation of a competent use of network resources.

#### References

1. Organization of secure information space for students on the Internet: handbook for bachelors and masters of the 050100 "Pedagogical education" direction of teachers, students and their parents / Yu.I. Bogatyryova, S.V. Pazukhina, A.N. Privalov. – Tula: TSU University Publishing house, 2013. – 96 p.
2. Pazuhina S.V. Psychological aspects of the formation of information and communication competence of future teachers in the development of educational Internet resources: Textbook. – Tula: TSPU Publishing house, 2007. – 72 p.

*Materials of Conferences***SAFETY OF THE ARCTIC MARINE  
TRANSPORT IN RUSSIA AND MEANS  
OF ITS SUPPORT**

Borisova L.F.

*Murmansk State Technical University (MSTU),  
Murmansk, e-mail: lfborisova@mail.ru*

The analysis of the safety problems of northern maritime transport has been fulfilled. It has been proposed to ensure safety of navigation in areas with intense traffic nym use MVTs – Mobile Vessel Traffic Services. Combined use of MVTs and VTS traditional will expand the functionality of opportunities VTS and remove the territorial limits of use.

**Introduction.** Regions close to the sea lanes, a special place in the organization of transport, since 90% of trade in the European Union with the rest of the world runs by shipping. The economic security of Russia is largely determined by the development of ports of the North-West and Euro-Arctic regions. Russia is interested in developing oil and gas resources of the Arctic shelf, the development of the Northern Sea Route and the ports of the Russian part of the Barents region. A central issue in the transportation of oil by sea is the environmental safety of transport.

**Safety analysis of the northern maritime transport and means of support.** Most of the world's new oil and gas resources are concentrated in the Arctic and the continental shelf. Russia has the longest shelf on the planet, which accounts for 85% of the Arctic sector. To harness the enormous natural wealth, concentrated in the Arctic and the continental shelf, and their transportation requires special care, because here we are faced with the sensitive environment and one of the most vulnerable ecosystems in the world. In the Arctic, oil spills are more likely, and the effects spill harder to eliminate than in other regions. This is due to the lack of natural light, low temperatures, the dynamics of ice cover, strong winds and poor visibility. Natural-climatic conditions of the Arctic seas do not effectively eliminate the effects of oil spills and contamination of other dangerous goods. Ice conditions make it difficult for shipping and slow down the restoration of contaminated ecosystems, low rate of dissolution of oil in cold waters has more negative effects on the environment. The oil spill is the most serious potential source of large-scale contamination during transportation of oil. Prevention of oil spills and the creation of mechanisms that regulate safely move cargo ships in the Arctic, is an important task aimed at ensuring maritime security.

One of the most dangerous types of accidents are collisions. Damage to vessels in the collisions leads to the loss of buoyancy and stability, disruption of other seaworthiness and may lead to loss of vessels, their crews, passengers and cargo. Collisions are of-

ten accompanied by fire, flooding a large number of compartments, vessels and other effects that hinder the effective conduct of rescue operations. Collisions indicate problems in the organization of movement, especially in coastal and offshore areas adjacent to the sea ports, which are characterized by increased intensity of shipping. Environmental risk is aggravated by the lack in the territorial waters of Russia special sea lanes for oil tankers – any vessel in the waters can collide with the tanker.

Increase of emergency cases of maritime transport, leading to catastrophic consequences, death, environmental disasters, as well as the increased threat of terrorism raises the problem of security in maritime transport to the rank of national security. Specific issues relating to maritime security are reflected in a number of legislative acts, such as: Naval Doctrine of the Russian Federation, the Merchant Shipping Code of RF, the Code of Inland Water Transport, defining public policy of the Russian Federation in the field of maritime activities. Adopted federal program identified a number of major structural transformations of the marine transport system of Russia. However, there are no effective tools for safety analysis of transportation systems, no clear structure and composition of the indicators, evaluation criteria, no clear methods of modeling. The management of traffic safety should be considered in risk assessments associated with the transport of dangerous goods, systems analysis, ship safety and recommend measures for the prevention, containment and elimination of consequences of accidents. It is necessary to develop models of security and development of the accident, as well as analytical modeling of the formation and spread of the damaging factors in accidents and the development of models for assessing potential consequences of accidents.

The most effective way to ensure safety when sailing near the coast is Vessel Traffic Services (VTS/SUDS-systems – control systems of movement of vessels), which controls ships, location and observance of ships' crews of the rules of navigation, as well as helps in case of emergency situations and the difficulties in determining the location. In RF VTS is part of the state system to ensure safety of navigation is created and operates in the waters of the sea ports and the approaches to them, in internal waters, territorial sea and contiguous zone of Russia. VTS is a complex set of fixed technical installations near shore services. The main disadvantage of modern VTS are limited coastline and coastal zones of the adjacent to the seaport, binding to the shore and shore-based services, inconvenience, complexity of procedures of governance that require expensive specialized equipment and infrastructure supply. Key measures to improve maritime safety in the offshore and coastal regions are aimed

at improving the technical equipment of the VTS that makes the system more costly and cumbersome. As a result the use of modern VTS is effective only in economically developed areas with sufficiently strong transport infrastructure of the port. The main function of operators in the management of the CFS Centre involves a great influence of human factors. Not enough attention is paid to improving information and technology security, which is an alternative to technology modernization. There are a number of specific problems in navigation, which are out of VTS activity and pose a real security problem: small size vessels, sports vessels, and other craft that are not under the control of marine register; outlying offshore and coastal regions of fisheries preventing navigation on the traditional transportation routes; areas of extraction of natural resources in the coastal shelf, where shipping is characterized by high degree of environmental risk and where the deployment of fixed VTS services is economically unreasonable or impossible, medium and small port areas with poorly developed industrial and economic infrastructure cannot maintain the efficiency of the VTS.

Solving such problems is proposed by using special localized geographically Mobile Vessel Traffic Services (MVTS – by analogy with the VTS/MSUDS-system – a mobile control system of movement of vessels) [1]. MVTS are characterized by locality area of service, efficiency, speed of deployment and termination, deep formalized management procedures based on the use of modern information technologies and means of implementation, which reduces the negative impact of human factors in decision making, ease of implementation, flexibility. MVTS do not demand technical resources and energy, are not critical to the area-based, ground or surface, and can ensure safety of navigation in any area with heavy shipping, including remote marine areas, which are act of control of stationary VTS. MVTS may be temporarily or permanently deployed in any location to service floating in the river or lake areas. To realize MVTS can be used standard technical resources of port, including equipment for monitoring and identification of ships and other floating equipment – AIS, radar, ARPA, physical channels and means to implement procedures for information exchange between system components – GMDSS, TV, radios, computational tools (computers) and software. Information for MVTS does not require any significant computational power [2] and can be implemented on the basis of small computers and affordable mobile telecommunications to the provision of mobile subscribers (ships) and the operators of the MVTS Centre and preserving access to the networks of GSM/GPRS, Internet and corporate networks (Intranet). MVTS Center can be placed in coastal areas or in conjunction with the VTS Center, as well as be waterbased, e.g. the flagship. Implementation of interaction services MVTS based on Reference Model Open Systems Interconnection (OSI) of

the International Organization for Standardization (ISO) using protocols and standards governing the normalized procedures for safety of navigation, as well as the interaction of system components at communication and transfer of management decisions (recommendations) provides accessibility of MVTS to interact with other systems in accordance with current standards.

#### Conclusion

Combined use of opportunities for both stationary and mobile VTC and future telecommunications and navigation technologies will expand the functionality of traditional VTS, remove the territorial limits of use, flexibility, mobility, to expand the range of services for the posting of various boats, to reduce the negative impact of human factors in navigation. Due to this, such systems can significantly improve the safety of navigation. VTS and MVTS should be considered as part of a multimodal associative transport system (MATS), seaport, providing efficient and safe navigation in the waters with heavy traffic of vessels. The use of such systems in areas of the Arctic shelf and the northern sea routes can be considered as a promising means of ensuring the safety of navigation in Arctic Russia.

#### References

1. Borisov L.F. a mobile control system of movement of vessels for navigation safety on the water area with intensive navigation: Dis. ... Cand. Tech. Sci.: 05.22.19 Murmansk, 2005 175 pages of RGB ODES, 61:06-5/207.
2. Program complex of interaction of network services of management of safe movement of vessels in the conditions of limited visibility: the certificate about official the register. computer programs № 2004610853, Russia / L.F. Borisova, K.A. Orlov; applicant of MGTU; заявл. 12.02.04; 07.04.04.

The work is submitted to the International Scientific Conference “Issues of science and education”, Moscow, May 20–23, 2014, came to the editorial office on 21.04.2014.

#### APPLICATIONS OF LASER-PARAMETRICAL TECHNOLOGIES FOR SEISMIC EXPLORATION OF PETROLEUM FIELDS

<sup>1</sup>Zapivalov N.P., <sup>2</sup>Bednarzhevskiy S.S.,  
<sup>2</sup>Smirnov G.I., <sup>2</sup>Josan D.A.

*1Institute of Petroleum Geology and  
Geophysics Siberian Department Russian  
Academy of Sciences, Novosibirsk;  
2Siberian Department of International Institute  
for Nonlinear Sciences of Russian Academy of Sciences,  
Novosibirsk, e-mail: sbed@mail.ru*

Among various innovative technologies for exploration and development of oil-and-gas fields, there are some ideas and projects not realized as yet. Nowadays when a technological breakthrough in oil-and-gas exploration and production is urgently needed, laser technology is supposed, in a long-term prospect, to make it possible to extract

almost all the oil from an oilfield with no environmental pollution.

In order to create ultra-high resolution means of seismoacoustic or electromagnetic location, capable of displaying details of smaller size than the probing wave length, the effects of nonlinear parametric interaction of wave fields should be used.

New possibilities in performing the main tasks of laser-parametric diagnostics as applied to seismic exploration of oilfields are based on detailed analysis of quickly changing interference pattern formed by scattered wave fields, through varying parameters of complicated probing signals such as frequencies, phases, intensity, polarization and the direction of propagation. These new possibilities use the present-day developments in the physics of nonlinear-wave parametric processes and in the theory of inverse scattering problem [1].

There is a large number of works devoted to diagnostics of weak vibrations with the use of various methods (see, for example, [1–5]).

Ultrahigh-resolution means of laser radiation allow interaction of laser impulses with objects smaller than the radiation wavelength; for this purpose, it is offered to use the effects of parametric interaction of waves. Thus, the resonance-parametric method for registration of vibrations in irradiated media makes it possible to classify them through measuring the vibration spectrum for various directions of irradiation, and to restore details of the scattering object with the resolution of the wavelength order and higher. This method is similar to laser-parametric method for registration of plasma vibrations.

Parametric satellite lines in laser irradiation can be used to impact vibrations with amplitudes much less than the radiation wavelength.

Thus, requirements for technical characteristics of parametric sources of laser radiation can be significantly weakened if differential methods are used for registration of various wave field parameters, as these methods make it possible to dismember the complicated pattern of nonlinear-wave interaction into separate details and to analyze their structures. The specific feature of these methods is measuring the differences in frequencies, phases, amplitudes, and polarizations of various components of laser radiation. Formally, these methods are similar to differential methods of analysis of nonlinear resonance in laser spectroscopy.

#### References

1. Antsiferov V.V., Smirnov G.I. Coherent radiation processes in plasma. – Cambridge: CISP, 1998. – 236 p.
2. Smirnov G.I., Bednarzhevskiy S.S., Josan D.A. Laser induction of photoelectric and subatomic processes in the hydrogen and helium isotopes // *Science prospects*. – 2013. – № 7. – P. 60–62.
3. Golubyatnikov V.P., Bednarzhevskiy S.S., Korol Zh.V., Smirnov G.I. Fundamental Problems of Innovative Nonlinear Nanotechnologies for Environmental and Analytical Diagnosis of Heterogeneous Systems Aimed to Upgrade and Improve the Efficiency of Oil and Gas Production // *Science prospects*. – 2013. – № 3. – P. 133–135.
4. Bednarzhevskaya A.S., Bednarzhevskiy S.S., Kuznetsov D.I. The device for the express analysis of solutions / Patent RUS 96980, 02.12.2009.
5. Bednarzhevskiy S.S., Zakhariyev E.S., Kuznetsov D.I., Mamedov R.M., Pushkarev N.S., Sokolov V.A., Suzdal'tsev V.A., Shevchenko N.G. Biotesting of water in regions of oil extraction // *Contemporary Problems of Ecology*. – 2009. – Vol. 2. – № 3. – P. 174–175.

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The work is submitted to the International Scientific Conference “Fundamental research”, Croatia (Istria), July 23 – 30 2014, came to the editorial office on 25.06.2014.

## Short Reports

**THE WIDELY – REGULABLE THYRISTOR CONVERTERS CALCULATION AND INCREASING POWER FACTOR**

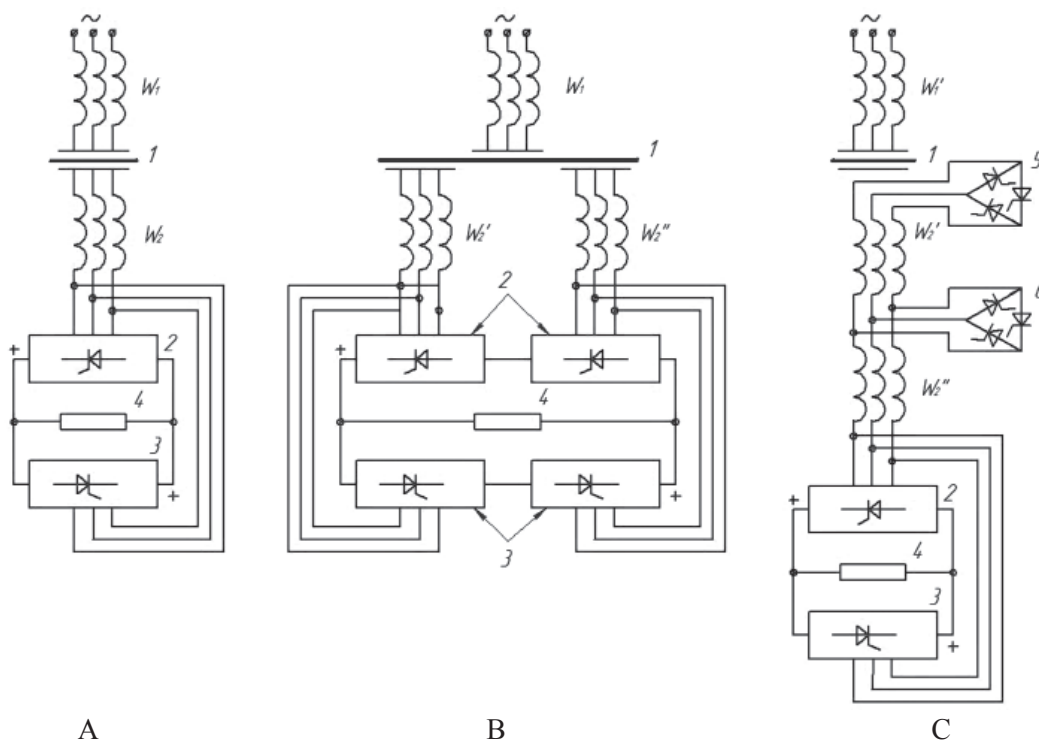
Magazinnik L.T.

The Ulyanovsk State Technical University, Ulyanovsk,  
e-mail: tai@ulstu.ru

About a third of the electric power, having produced in the country, is being converted into BC or the other frequency currents. So, in the large power plants (e.g. above 500 kWt), mainly, the thyristor converters (VT) are being used for all these purposes. Their efficiency is being reached 97%, however, the vulnerable spot is the low power factor ( $K_m$ ) at the wide regulation of the output co-ordinates (e.g. current, voltage). For example, the weight average  $K_m$

of the reversing rolling mills electric drives is not exceeded 0,4; and because of the change high rate of its reactive power compensation should be conducted in such facilities, either by the compensators commensurable rapid performance, or by the forced switching in the converters themselves [1, 2, 3].

When there is the natural commutation, the  $K_m$  increase is achieved, due to the control laws complication by the converters. So, from the thyristor bridges connected in series 2–3 has been found its practical application (e.g. for the reversible VT ones) (Figure, B). These bridges are usually powered by two identical matching transformer of the secondary matching 1, and the loose connections of the above – mentioned bridges are practically connected in the anti – parallel to the load 4.



A – symmetric control; B – serial; alternate; C – alternate with the voltages summation at the alternating current (AC) side;  $W_1$  and  $W_2$  – the primary and secondary windings of the matching transformers

We would note, that, as in sequence, or in the other well – known control laws, in the established practice:

$$C_p = \cos \alpha \approx Ed/Ed_0; \quad (1)$$

$$\cos \varphi_1 = \cos (\alpha + \gamma/2), \quad (2)$$

where  $\alpha$  – is the steering angle;  $\gamma$  – is the angle switching;  $Ed/Ed_0$  – is the degree of regulation ( $C_p$ );  $\varphi_1$  – is the shift angle of the first harmony power, relatively to the voltage.

The Equation (1) is ignored the fact, that practically any VT is usually the element of the closed system of the automatic control system (ACS), having maintained the output coordinates set constancy. For example,  $C_p = \text{const}$ . the load variations from the zero, to, at least, the nominal, at the voltage fluctuations mains supply (e.g. + 5...–10) %, and for the reversing VT (Figure) the energy inverting mode should also be ensured to the grid at the maximum allowable current VT and the load, that it is limited



$\alpha_{\max}$ . In connection with the foregoing, the following real  $\cos \varphi_1$ , and  $Km$  are defined, having taken into consideration of the above – mentioned requirements, referred to VT and to the load, at the both control laws (e.g. as the symmetric one, well as the alternate one), and it also is proposed the quite new scheme of the alternate control, which is more economical, and simple, in comparison with the already known one.

From the above – listed requirements, the most critical is appeared to be the conservation  $Cp = \text{const}$  at the acceptable power supply voltage variation, which it is quite obviously, that the equation (1) for the closed ACS should be replaced by:

$$Cp = Ud/Ud_0, \quad (3)$$

where  $Ud \leq 0,9Ud_0$ , as the necessary voltage supply is made up about 10%.

In the general case:

$$\overline{\cos \varphi_1} = \cos(\arctg \overline{Q}/n\overline{P}), \quad (4)$$

where  $n$  – is the number of the series – connected VT,  $\overline{Q}$  and  $\overline{P}$  – are the mathematical expectations of the reactive and active powers of one VT.

The calculations by the expressions (e.g. 3 and 4) are given for the symmetric control ( $n = 1$ ),  $\overline{\cos \varphi_1} = 0,45 (0,5)$ , for the alternate one (when  $n = 2$ ) –  $0,715 (0,755)$ . As it is well – known, the distortion coefficient of the three – phased bridge circuit is made up  $0,955$  (e.g. without switching). Then,  $Km = 0,43 (0,47)$  in the Scheme 1a, and it is equal to  $0,68 (0,72)$  in the Scheme 1b. Thus, for the clarity, the  $\overline{\cos \varphi_1}$  and  $Km$  are given, in the parentheses, at the calculation by the formula (1), having given the significant overestimation the  $\overline{\cos \varphi_1}$  and  $Km$ .

We note, that the derived data are also somewhat overstated on the basis (3, 4): the reduction  $\overline{\cos \varphi_1}$  is quite unspecified in the dynamic modes [4], as there is no correlation with the load, and also the stochastic oscillations of the current and voltage, having required for the theory attraction calculations of the stochastic processes, are not taken into account, that is quite beyond the scope of this paper.

Below (Figure, C), the new converter circuit is considered, which is quite identical by the energetic indicators for the same “ $n$ ” to the “classical” alternate control (Figure, B). So, the scheme is being operated the following way. In the idle status, the transducer switch is closed, that is, all its three thyristors are being switched on, and the steering angle is  $\alpha \geq \pi/2$  in the both bridges 2 and 3. Consequently, the  $W_2''$  winding is being connected into “the star” one, as the similar switching in the Figure, b. At the angle  $\alpha$  changing, for example, in the converter 2 from  $\pi/2$  to the zero, the voltage is appeared at the load 4, which is equal to  $0,5$  time of the rated voltage. So, this step is quite the similar to the first stage at the alternate control, the only difference is that, the load current is flowed only through one bridge, the one  $W_2''$  semi-winding, and the key 6.

The second stage of the algorithm, that is, the voltage rise to its normal value, is flowed in the following sequence: simultaneously, the bridge 2 (e.g. up to  $\alpha_{\max}$ ) is locked, and the unlocking control pulses are removed from the key 6; after the current decay, the key 5 is being switched on, and the steering angle  $\alpha$  by the bridge 2 is being decreased from  $\alpha_{\max}$  down to  $\alpha = \pi/3$ , that is, the  $0,5Ud_0$  voltage is being restored at the corresponding load. Subsequently, there is the regulation of the load voltage in the range of  $0,5Ud < Ud < 0,9Ud$ . So, the time described the switching is not practically exceeded  $0,02$  s, so the break in the voltage is not only affected on the powerful electric drives DC or the AC, but also to any other inertial load of the above – mentioned power range (e.g. the heating ovens, the different electro – technological installations and etc.).

Thus, the calculations obtained have been shown, that if to do not two, but three of the branch line ( $n = 3$ ) with outlets on three keys in the secondary winding, then  $\overline{\cos \varphi_1} = 0,86$ ,  $Km = 0,82$  and the installation are not almost required the reactive power compensation. For all this, the average current is made up about  $2/3$  transducer current with the “classic” alternate control (Figure, B), and the total number of thyristors 21, that is, at three less, than at the two – staged alternate control. The  $\overline{Cn}$  offset towards larger values is practically increased  $\overline{\cos \varphi_1}$  and  $Km$ .

#### Summary

1. The  $\overline{\cos \varphi_1}$  commonly – accepted definition, as the ratio of the EMF of the adjustable thyristor transducer to the EMF idling at the zero angle of the control does not consider, that the transducer – is the element of the closed system of the automatic control. To its turn, this is practically led to the  $\overline{\cos \varphi_1}$  actual overestimation against the actual one. So, the well – known alternate two – staged control of the thyristor transducers can be allowed to be increased the average power factor from  $0,43$  (e.g. at the symmetric control) up to  $0,68$ .

2. The new system of the alternate control has been suggested, that even in the three – staged option is quite simpler “classic” alternate control, and it, moreover, is practically provided the average power factor  $0,82$  in the range of the rectified voltage from the zero up to the nominal one. So, the system is recommended for the power variable voltage DC power inertial loads above  $500$  kW (e.g. the Electro-technology, the Electro-metallurgy, the Electric drive, and etc.).

#### References

1. Magazinnik G.G., Magazinnik L.T. The Rectifier with Forced Switching. A.S. USSR № 519832, published on 30.06.76. Bulletin, № 24.
2. The Transducer with the Artificial Valve Switching. A.S. USSR № 987759, published on 07.01.83. № 1. The Author G.G. Magazinnik.
3. Magazinnik L.T. The Frequency Electric Drive. The Russian Patent № 2407141. № 35. 20.10.2010.
4. Magazinnik G.G., Melnikov V.L. The Maximum Power Factor Controlled Rectifier. Proceedings of the Institute of Higher Education // Technical Electrodynamics. – 1984 – № 3. – P. 38–43.

*Materials of Conferences*

**CLASSIFICATION OF RELIGIOUS  
GOTHIC BUILDINGS OF SOUTHERN  
FRANCE (OCCITANIA) IN THE CONTEXT  
OF IDEOLOGICAL AND ARTISTIC  
PROGRAMS AS THEIR BASIS**

Orlov I.I.

*Russian Academy of Sciences and Arts, St. Petersburg;  
Lipetsk State Technical University, Lipetsk,  
e-mail: igorlov64@mail.ru*

In rich amendments to the article, the author describes social-ideological context of the period of church construction and its character. The author devoted to a cult Gothic style of Southern France (Languedoc).

The Gothic art of Occitania (Languedoc), which for a long time had been considered in foreign and native medievalism as the art of “invaders from Northern France”, is the manifestation of the creative genius of local architects and customers. It was the masters from Southern France who could find their own original “Gothic style” by way of creative revising the Parisian “radiant” Gothic which was fashionable at that time in Europe and which they used as their model. This style has been known in art studies as “eglise fortifiée” (church-fortress, fortified church). The monks of the new orders (first of all Dominicans and Franciscans) played the most important role in introducing the new “Parisian style” (Gothic). As these orders had to struggle with the heresy of Cathars (widespread in the region), so they were most interested in creating a new type of cult architecture called “predicatory Church”, which would be different from the classic Gothic of Île-de-France. Further, when the struggle with heretics became repressive (with the introduction of inquisitional tribunals), it was bishops from the Dominicans who initiated the development of the concept of religious Gothic structures in the style of “indestructible fortress of faith”; they were erected in the areas (Albi, towns of the Toulouse diocese) where the struggle with the Cathars was at its peak. And vice versa, where the heresy of the Cathars was completely extirpated either by repressions (Béziers) or by resettling the population infected by heresy from captured towns (Carcassonne, Narbonne), cathedrals were built as a mere imitation of the “Parisian Gothic”, which later caused such a dismissive attitude to the Gothic of Languedoc [3, p. 227].

Another important factor which in a most prominent way influenced the formation of peculiar ideological and artistic programs of Languedoc’s Gothic became the heritage of Rome’s ancient tradition, the latter achieving its further development in a wealth of images in the Romanesque architectural school of Languedoc and Provence. It is to this style of South that France and Europe owe the appearance of Gothic sculpture plastic, the beautiful images of which are exhibited nowadays in the Museum of Augustinians in Toulouse.

Besides, Lombard architectural school (partially Tuscan) influenced greatly the formation of Languedoc’s peculiar Gothic, because the towns of Languedoc and Lombard were connected by both trade and political, as well as religious ties (the Cathars doctrine). The architectural schools of Anjou (through its trade, political and dynastic ties), Burgundy and Auvergne (connected with Occitania from early Christian times) also had a great impact on the formation of Languedoc’s Gothic [1.]

On the whole, speaking about the religious Gothic of Languedoc of that time, we can point out some regional features. The architecture of cathedrals and churches is not so prevailing as of the “classic” cathedrals of northern France, because the outer wall preserves its massiveness and density specially accentuated by abutments adjoining tightly the wall. The shell of the wall seems to hide the chapels, and as a rule there is no transept. Thus, the wall plane gets back its rights despite the fact that it is profiled with orbs, mashiculi or round skylights (under the influence of the Lombard school). The volumes of buildings tend to greater cliquishness, removing systematically all “extra” protrusive details; it is typical for the 14<sup>th</sup> c. religious Gothic architecture of parish churches, influenced by mendicant religious orders. Chapels occupy the space indoors between buttresses and are an integral part of the whole. Sculpture tends to occupy the inner part of the interior, moving there from the outer space of Gothic portals. “The Bible for the illiterate” – church wall painting scenes devoted to Christ, Virgin and the saints – plays an important role in the creation of the mystical mood of parishioners along with traditional Gothic stained glass windows [4, p. 165]. The religious Languedoc Gothic has almost no example of the “classic” two-tower scheme of the western façade, with the exception of “imitative cathedrals” in Narbonne and Beziers. Western façades in the Languedoc Gothic style have a restrained, even austere, interpretation, and single bell towers similar to Italian campaniles directly adjoin the side of the building.

Thus, we can say that Languedoc’s Gothic was not of an obviously imitative character, as it was considered earlier; its peculiarity was conditioned by various ideological and artistic programs, the intersection and combination of which created such a variety of forms of religious Gothic constructions in a small enough region. It was the religious Languedoc’s Gothic that later exerted a material effect on the formation of the original Catalan Gothic of the Kingdom of Aragon and the peculiar Gothic of the Kingdom of Palma-Mallorca.

In his monographs “The religious Gothic of Languedoc” (Moscow Stroganov Academy, NPO Orius, 2010) [1] and “Anticatharistic fortresses of faith – the religious Gothic of Languedoc” (Lambert Academic Publishing, GmbH, 2012) [2] the

author suggests the following classification of the researched religious Gothic structures:

1. Monastic churches of mendicant orders (first of all those orders, whose creation had fighting the Cathars' heresy as their aim or the reason of foundation). To these orders, we should first of all pertain the order of "mendicant preachers", or the Dominican order, whose origination, organization and activities were connected with the Cathari doctrine. A wonderful model of Gothic "predicatory church" in a Dominican monastery in Toulouse is an evidence of it. The monographs contain a semantic analysis of the Gothic forms of the Jacobins church in Toulouse as an "anticatharistic" preaching in the material, through its architectural forms [6, p. 79].

Besides, the author analyses the architectural forms, composite solutions and conceptual iconographic programs of religious Gothic structures of the "predicatory" type. Apart from the church of a Dominican monastery, the author investigates the church of an Augustinian monastery (now the Augustin museum). The iconography of this church was greatly influenced by the ideological and artistic programs embodied in the Jacobins church. The Activities of the Augustinian missionary order was brought to life (even if indirectly) by the necessity to cleanse the Church through the promotion of the concept of "return to earlier simple life" of early Church, which was determined by the speeches of Albigensian preachers revealing the abuse of Catholic prelates of the South. Based on the above, the church of the Augustinian monastery can also be considered as a "Predicatory Church".

2. Churches of urban and rural parishes located in those regions, where the spread of the Cathar heresy, and therefore the intensity of the struggle against them were especially great. We also suggest the division of parish churches into two sub-groups according to the characteristics that stand out in one group or another.

– The first subgroup includes churches, whose ideological and artistic program was directly or indirectly influenced by the iconography of the churches of Toulouse "mendicant orders" and partly by the lofty Gothic of Northern France: Notre-Dame la Dalbade and Saint-Nicolaus in Toulouse, Saint-Michel in Carcassonne. That kind of churches was built in the regions where the anticatharistic preaching was carried out in word and deed (the Tribunal of the Inquisition), and, as a result, "the Dominican component" of the Jacobins church in Toulouse takes the leading place in the basis of ideological and artistic programs of these religious buildings. There are simple and strict external forms and a well thought-out semantic and iconographic scheme of the epic building in general.

– The second subgroup comprises churches, whose iconography reveals the typical features of Toulouse and Languedoc: Saint-Salvy in Albi and parish churches with west facade being of a decorative character, a kind of screen: Notre-Dame du Taur and Midi toulousain churches. The research of ideological and artistic programs of these religious buildings reveals the presence of a long-standing tradition of Romanesque Languedoc, i.e. the construction of single-nave buildings (originally without

the apse at times) spanned with simple bars. Later, a special type of parish churches was formed in connection with Albigensian wars and the necessity to conduct the anticatharistic preaching and under the influence of ideological and artistic programs of Dominican "predicatory" churches. Due to the peculiarities of financing the construction of parish churches, their western facades acquire an independent role of a front-screen, i.e. a façade that doesn't perform any constructive function (except, probably, a few bells, which, however, are mounted later).

3. Cathedral churches (churches which were built where there was an episcopal or archiepiscopal see) built in the towns where the spread of the Cathars' heresy and therefore their influence on city life and culture was so great that the Catholic church was forced to found there constant tribunals of the Holy Office for the extermination of heretics. So here the division into three sub-groups is appropriate.

– In the first sub-group there should be churches which were built "in accordance with the models of the French Kingdom", as Narbonne's canons would write, and which were built directly under the influence of the Parisian "radiant" style. Such are, first of all, the Saint-Nazaire cathedral church in Upper Carcassonne (the capital of the possessions of viscounts Trencavel). The reconstruction, while in fact the construction, of the church anew was caused by a wide spread of the Cathars' heresy in the region and, as a consequence, by complete expulsion of the citizens to Lower City (Bastida) after seizing Carcassonne. The new citizens (true Catholics) and the new regents (the king's seneschal) naturally aspired to confirm power of the King of France through ideological and artistic programs of the "radiant" Gothic, which by that time had become international. Taking into account the importance of strengthening his power in Languedoc, Saint Louis the King personally took the initiative in building the Saint-Nazaire cathedral. It is due to these reasons that the choir and the transept of the Saint-Nazaire cathedral in their Gothic part virtually reproduce the concept of the royal chapel of Sainte-Chapelle. The construction of the cathedral performed under the control of French kings Saint Luis and Phillip the Bold in 1269–1322, together with the double system of defensive walls of Carcassonne, was undoubtedly a realization of "the royal concept of the world" in Languedoc. That was why both specialists from the French kingdom and local masters were invited for the erection of a symbol of that power. Despite the fact that the building of the cathedral never finished, the ideological and artistic programs and constructive solutions which were applied during the erection of Saint-Nazaire had a big impact on the formation of the French-Occitan Gothic alliance in Languedoc architecture. In particular, the "radiant" Gothic of Carcassonne had an indubitable influence on religious Gothic constructions in the cities of Beziers (the cathedral of Saint-Nazaire) and Narbonne (the cathedral of Saint-Just-Saint-Pasteur).

– The second sub-group should include the cathedrals of the "transitional type"; during their con-

struction the new Gothic design of space and masses was based on the rich inheritance of the Romanesque architecture of Languedoc. Among them are, first of all, “the majestic Toulouse” (the capital of the Toulouse county) with the Saint-Etienne cathedral. The features of iconography due to which this religious building can be related to the “transitional” type first of all ride on the historical and cultural features of the city itself as the heart of Quatari heresy and the main center of the Occitan culture. It was in Toulouse, which until the final stages of the Albigensian wars was loyal to its suzerains (counts de Foix), that ideological and political resistance to Catholic clergy and French barons (and later to the king) prohibited erecting religious buildings in the classic Gothic style regarded as a symbol of the “occupying” power. That was why bishop Fulk (1206–1231), who initiated the reconstruction of the Saint-Etienne Cathedral, had to seek for the “architectural compromise” between the rich Toulouse’s Roman tradition and the new architectural outlook of the “French Kingdom”. Such was the original concept of the Saint-Etienne Cathedral’s erection in Toulouse (since a tense struggle with both Quataris and local clergy and patricians, partially sympathizing with them, was carried on during the construction period). Later, as this religious and political struggle was fading, the ideological and artistic scheme began to change. The materials given in Igor Orlov’s monographs clearly show that the Cathedral of a later (second) period (after 1272) was constructed according to the “classic” plan (possibly under the influence of the Narbonne Cathedral’s schemes). The bold attempt to combine the two ideological and artistic programs into one conceptual building, unfortunately, met no success. As a result, the construction of the Cathedral in Toulouse wasn’t completed till the French Revolution, that is why nowadays it demonstrates a wonderful phenomenon of mixing diverse ideological and artistic programs.

– Finally, cathedrals which most completely demonstrated the ideological and artistic programs of Languedoc’s religious Gothic and then influenced widely Gothic architecture in other regions are to be gathered into the third group. First of all, the Cathedral of Saint Cecilia in Albi should be referred to this class. In researching this type of Gothic constructions the author primarily notes the fact that the cathedrals which are considered to be classic examples of Languedoc’s Gothic were built in the cities where Catharists’ heresy was fought most heatedly and this contention lasted for a long time. Because of this opposition Dominican inquisitors are appointed local bishops. Surprisingly, it is to bishops-inquisitors that we owe the creation and the design of the ideological and artistic features of a Gothic cathedral of the “indestructible fortress of faith” type. The Cathedral of Saint Cecilia in Albi is the most typical example of Languedoc’s Gothic, which demonstrates the “sacramental hymn” in honor of victory over heretics and a formidable “indestructible fortress of faith”. If it comes to comparing this astonishing Languedoc’s Gothic construction with Carcassonne’s, Beziers’ or Narbonne’s cathe-

drals (which were erected according to the “classic” Gothic of Ile-de-France), it has to be noted that it has a peculiar ascetic and exalted beauty in it in contrast with the fervent dynamic of “radiant” style cathedrals. The oversimplification of configuration makes the Cathedral of Saint Cecilia look like a citadel, which produces an impression of sullen force, thus demonstrating the inevitability of judgment on heretics already here, on the Earth [5, p. 173].

Since the period of time considered in our research is the 13<sup>th</sup> and 14<sup>th</sup> centuries, the author regarded it necessary to apply in his monographs the general scholastic scheme of designing medieval treatises of the researched period (*secundum ordinem disciplinae*), so as to move step by step from one judgment to another, constantly informing the reader on the development of this logical process. Such methods, both simple and clear, applied to the classification of religious Gothic structures made it possible to investigate the “Occitan” Gothic knowing (or assuming) before the ideological and artistic programs which were initially stipulated by the place of an erected church in the suggested classification. As a proof to support the correctness of the suggested method, which our investigation followed, it would be appropriate to quote E. Panofsky as saying that “just as the scholastic movement prepared by the Benedictine doctrine and founded by Lanfranc and Anselm of Bec was carried on and perfected by Dominicans and Franciscans, the Gothic style prepared in Benedictine monasteries and founded by Suger in Saint-Denis climaxes in city churches. The main achievements in the Romanesque period were Benedictine abbeys, in High Gothic – cathedrals, while in Late Gothic they were parish churches” [7, p. 229].

#### References

1. Orlov I.I. cult gothic style of Languedoc. The anti-Qatar sermon in a stone or the requiem of the disappeared civilization. – M.: MGHPA of S.G. Stroganov – the ORIUS personal computer, 2010. – 375 p. of ISBN 978-5-87627-081-8.
2. Orlov I.I. Antikatarskiye of “the belief fortress” – a cult gothic style of Languedoc. LAM-BERT Academic Publishing GmbH, 2012. ISBN 978-3-8473-2675-5.
3. Orlov I.I. Oksitaniya’s cult architecture of “eglises fortifiees” of the XIII-XV centuries. Monograph. – Lipetsk: LGTU publishing house, 2013 – 338 p. ISBN 978-5-88247-587-0.
4. Orlov I. The Origin and Development of the Typology of Fortress – type Churches (Eglises – Fortifiees) In France // Scientific enquiry in the contemporary World: theoretical basics and Innovative approach / Research articles. L 10 “A person in the Modern World” / F.L. Titusville, USA, L&L Publishing, 2013. ISBN-13: 978-1481823159; ISBN-10: 1481823159.
5. Orlov I. The problems of complete approach to the Historiography of the cult Gothic Style. The tendencies of the General development of Medieval Studies // Science and World. International Scientific Journal. – 2013. – № 2 (2) October. – P. 172–175, ISSN 2308-4804.
6. Orlov I. The origin and development of the typology of fortress – type churches (eglises fortifiees) in France // A Person in Modern World. – B&M Publishing, San Francisco, California, USA, 2013. – P. 78–88 ISBN-13: 978-0-9887556-2-8; ISBN-10: 0988755629.
7. Panofsky E. Gothic Architecture and Scholasticism. Latrobe, Pennsylvania, 1951. – СII6.: “Alphabet-classics”, 2004. – P. 229.

The work is submitted to the International Scientific Conference “Modern high technologies”, Jordan, June 9–16, 2014, came to the editorial office on 08.04.2014.

*Materials of Conferences***TO THE ASSESSMENT OF ORGANISM  
AEROBIC RESERVES IN CONNECTION  
WITH MIGRATION**

Safronova N.S., Fomenko A.V.

*Taurida National V.I. Vernadsky University, Simferopol,  
e-mail: tnu-fr@rambler.ru*

Within the research of human adaptation to a change of permanent residence the assessment of migration impact on the migrants' health and aerobic organism reserves is of special interest. According to modern concepts the figure of maximal oxygen consumption (MOC) is an objective characteristic of human aerobic capacity. However, direct measurement of this parameter is quite time-consuming and not expedient. Moreover, during the physical working capacity test "to refusal" untrained people rarely reach the level of MOC and stop testing much earlier at the so-called symptom-limited MOC (SL-MOC). At the same time there are a number of methods that allow indirectly and quite accurately determine this figure, for example, by calculating  $PWC_{170}$  test results. Therefore, the ratio of oxygen ( $O_2$ ) consumption speed at the level of individual maximum endurable testing capacity, i.e. SL-MOC, to calculated value of MOC may act as one of the characteristics of aerobic organism reserves. Obviously, the higher the index is, the higher the individual reserves and capabilities to achieve aerobic

maximum are. In this context, the determined aim of this paper is to conduct a comparative analysis of organism aerobic reserves in groups of Crimean Tatars migrated to the Crimea and the ones have been living there since birth.

The research involved 45 Crimean Tatars aged 18–21. The first group consisted of 24 people, born and residing in the Crimea, the second one comprised of the ones who migrated to the peninsula at least 15–20 years. Research methods include working capacity testing, spirometry, Gas analyzer research. The results of the research showed that migrants' organism aerobic reserves, according to the ratio of MOC to SL-MOC, were more than 6% ( $p < 0,05$ ) reduced in comparison with the second group of examined. It is also interesting to note that the actual values of SL-MOC and MOC was also 16% ( $p < 0,05$ ) and 8% ( $p < 0,05$ ) accordingly reduced. Thus, there is a reason to believe that the impact of migration negatively affected aerobic reserves of examined. The results of the research can be further used in the diagnostics of health and in the development of individual health-preserving technologies for people who have changed their residence.

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The work is submitted to the International Scientific Conference "Ecology and health of the person", Mauritius, February, 17–24, 2014, came to the editorial office on 03.03.2014.

*Materials of Conferences***OPTIMIZATION OF PRECIPITATION MODIFICATION AIMED AT RAINFALL ENHANCEMENT AND HAIL PREVENTION**

Dinevich L.

*Tel-Aviv University, Ramat Aviv, Israel,  
e-mail: Dinevich@013.net*

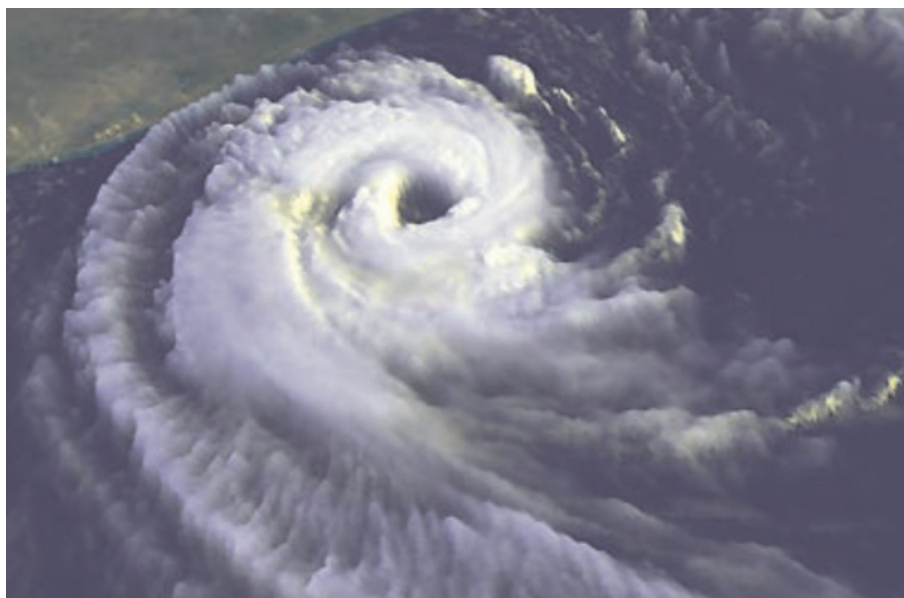
**Introduction.** Advantages and disadvantages of rocket cloud modification technology are analyzed, and optimization directions are outlined.

The proposed optimization techniques are based on:

– the author's personal long-term experience as the founder and director of research-production

organization engaged in solving multiple problems of active modification of meteorological processes (Moldova, 1965–1991)

The organization, established in 1965 by the Central Aerological Observatory the (city of Dolgoprudny) from its onset became the center of research and development of rocket cloud modification technology in the USSR. The technology is aimed at prevention of hail formation, enhancing rainfall from various cloud types in different seasons, as well as dissipation of super cooled fogs, prevention of light frosts, reduction of thunderstorm activity etc.



In the picture of Hurricane Katrina, which took place along the coast of Santa Catarina (Brazil) March 27, 2004. 13 dead

– The author's theoretical and experimental research works presented in numerous publications, the major of them given in the list below:

– Dinevich L., S. Dinevich, 1994. The Effect of Hail Suppression Seeding of Cumulonimbus Clouds on Precipitation Forming Process. Part I and Part 2. P. 16–22, 22–28. Proceedings of the Fifth national symposium with international participation "Physics-agriculture". Sofia, 23–24 November, 1994.

– Dinevich L., Dinevich S, Leskov B, 2008. Cloud Modification for Rain Enhancement. P. 105–153. Questions of physics of clouds. Moscow, Hydrometizdat.

– Dinevich L., Shalaveus S., 2008. Using Tracers in Studies of Agent Propagation in Convective

Cloud Modifications. P. 58–104. Questions of physics of clouds. Moscow, Hydrometizdat.

– Dinevich L., Ingel L., Khain A. 2011. Evaluations of vertical transport of ice-forming particles produced by ground-based generators // Journal "Scientific Israel-Technological Advantages" Vol. 13, № 1, P. 95–107, 2011.

– Dinevich L., Ingel L., Khain A. 2012. Forming particles produced by ground-based generators. (Some recommendations on practical applications) // Journal "Scientific Israel – Technological Advantages" Vol. 13, № 4.

– Dinevich L., Ingel L., Hain A. 2013 Using pipes to increase the efficiency of ground generators crystallizing reagent. Modern high technologies // number 11, 2013, P. 38–46.

- Dinevich L., Dinevich S., Leonov M., Seregin Ju., Berulev G. 1998. Precipitation Characteristics Variations Effected by Hail Protection Techniques, 1998, (296 p).
- Dinevich, L., Shilin V., 1983. Methodical Aid for Conducting of Hail Suppression Operations by Rocket Complexes Kishinev, Moldavian Research. Institute of Scientific Information, 1983, (86 p.)
- Dinevich L., Dinevich S., Kudlaev E., Leonov M. 1995. Physical and statistical investigations of influence of the hail prevention seeding of cumulus rain clouds on regime of precipitation. Review of Applied and Industrial Mathematics. Scientific Publishers “RTA”. Moscow, P. 253–287.

The work is submitted to the International Scientific Conference “Ecology and rational nature management”, Israel (tel Aviv), April 25 – May 2, 2014, came to the editorial office on 01.04.2014.

**USING MRL-5 RADAR FOR IDENTIFYING RADAR ECHO OF MIGRATING BIRDS AND PLOTTING RADAR ORNITHOLOGICAL CHARTS**

Dinevich L., Leshem Y.

*George S. Wise Faculty of Natural Sciences,  
Dept. of Zoology, Tel-Aviv University, Ramat Aviv,  
e-mail: dinevich@barak-online.net*

The computerized radar ornithological system based on MRL-5 meteorological radar enables to perform automatic 24-hour monitoring of bird

flights. The MRL-5 capacity of simultaneously obtaining both the meteorological and ornithological data made it possible to design an algorithm for plotting superposed weather and ornithological charts and to provide them every 15–20 min online to be used by air traffic control services.

**Introduction.** The progress of aviation, high density of aircraft over relatively small areas (especially in the vicinity of large airports), as well as striving for higher speeds using the lightest possible aircraft constructions – all these factors have inevitably created a conflict between the technological advancement and the nature. The most serious manifestation of this conflict is collisions between aircraft and birds (Ganja et al., 1991). The main routes of bird migration from Europe to Asia and Africa and back lie over Israel (Leshem and Yom-Tov, 1998). It was shown (Bruderer, 1992) that during the migration period the average number of birds over a cubic km of the air may exceed 500. As the airspace over Israel is also dense with aircraft, collisions are not rare during vigorous spring and autumn migrating bird flows, resulting in loss of bird life and sometimes human casualties (Bahat and Ovadia, 2005). Bird-aircraft collision are not rare in other regions (Thorpe, 2005). This situation calls for development of operational techniques aimed at assessment and control over the ornithological status in order to ensure air traffic safety.

**The main idea underlying the algorithm**

Tables 1 and 1(a) present the typical characteristics of migrating birds’ radar echoes.

**Table 1**

Typical characteristics of radar echoes of migrating birds

Typical characteristics of radar echo	Studies*
– relatively low power. Reflectance coefficient ( $Z < 30\text{dBZ}$ ), – forward and relatively linear movement – maximum amplitude fluctuations within the low frequency range (below 10 dB in 2–50 Hz frequency range). – MRL-measured $\sigma$ are greater on the 10 cm wave length than those on the 3 cm wavelength – polarization characteristics of the signal are typical of horizontally-oriented targets. Differential reflectance as the ratio of horizontally-oriented signal (with pulse horizontally polarized) to vertically-oriented signal (with pulse vertically polarized) exceeds the unity significantly ( $dP = P_{  }/P_{\perp} \gg 1$ ). For small droplets within clouds and precipitation this value is close to unity. – in the $\lambda$ wave-length range of 3 to 100 cm, $\sigma$ of both birds and insects decrease noticeably as the radar wavelength increases. At the same time, there is a distinct maximum of the $\sigma(\lambda)$ frequency dependency that occurs at $\lambda = 10$ cm wave-length. – high dispersion of experimental data at $\lambda = \text{const}$ (from few tens of $\text{cm}^2$ at $\lambda = 3$ cm to $\sigma = 10^{-1} \text{cm}^2$ at $\lambda = 100$ cm). $\sigma$ values for some bird species with wings folded are presented in Table 1(a). – the mean $\sigma$ -values of different bird species at the value of radar wavelength from less than $10 \text{cm}^2$ (Sparrow) up to $400 \text{cm}^2$ (Albatross). – $\sigma$ -values of birds are approximately by order of 2–3 greater than $\sigma$ -values of insects	Edwards, Houghton, 1959; Salman, Brilev, 1961; Schaefer, 1966; Chernikov and Schupjatsky, 1967; Skolnik, 1970; Chernikov, 1979; Bruderer and Joss, 1969; Bruderer, 1992; Ganja et al. 1991; Buurma, 1999; Larkin et al., 2002; Gudmundsson et al., 2002; Gauthreaux and Belser, 2003; Zavirucha et al., 1977; Zrnic and Ryzhkov, 1998.

Notes: \* – Table presents only a small part of the numerous studies of bird echo characteristics.  
 \*\* – ESA ( $\sigma$ ) – effective scattering area

Table 2

ESA ( $\sigma$ ) values for various bird species with wings folded and bodies set at different angles relative to the radar

Bird species	Dimensions of bird $\sigma$ (m <sup>2</sup> ) obtained at exposure to the radar at various angles		
	Side	Head	Tail
Rook	$2,5 \cdot 10^{-2}$	–	–
Pigeon	$1,0 \cdot 10^{-2}$	$1,1 \cdot 10^{-4}$	$1,0 \cdot 10^{-4}$
Starling	$2,5 \cdot 10^{-3}$	$1,8 \cdot 10^{-4}$	$1,3 \cdot 10^{-4}$
House sparrow	$7,0 \cdot 10^{-4}$	$2,5 \cdot 10^{-5}$	$1,8 \cdot 10^{-5}$

ESA parameters of the same bird may vary as much as by factor of 10 depending on its orientation relative to the radar (Houghton, 1964; Bruderer and Joss, 1969). According to a study where ESA was measured in an anechoic chamber at different angles relative to the radar beam (Zavirucha et al., 1977), the maximum echo values were found within the range of 65–115° relative to the beam, which corresponds to the bird's lateral exposure (while 0° corresponds to the radar beam directed at the bird's beak). In addition, ESA variations can be caused by the bird's wingbeat. In these cases, the ESA values may increase up to 10-fold or drop almost to zero, the frequency of the fluctuations reaching 2–24 Hz (Chernikov, 1979). Hence, ESA of a bird depends on its size, its orientation relative to the radar beam and on the instantaneous position of its beating wings. In the present study, we managed to establish a number of other characteristics typical of bird echoes.

Fig. 1 shows the echo field after computer processing of signals obtained from 18 scans, which has a distinct dot structure. Analysis of the photos shows that a major characteristic of a bird echo is movement, which leads to transforming the dot-made echoes into strips. The enlarged fragments of the strips (1, 2, 3, 4) demonstrate their straightforwardness. The increments to the strip length take place due to the transitional movement of an echo in time. A special software designed as part of our study enabled to analyze the structure of 270 randomly selected echo strips. Each experimental strip was obtained over summation of 8 scans at a fixed antenna vertical angle. The software enables to trace the process of strips' formation from scan to scan. The findings show that the recurrence of a bird echo at the same coordinate point (over 8 scans, the total duration of 80 s) in at least 90% of cases does not exceed two. This result is due not only to the pattern of a bird flight, but also to the technical parameters of the radar system, with its narrow pulse and the narrow symmetric beam. The recurrence of echoes from other reflectors (ground clutter, clouds and some kinds of atmospheric inhomogeneities) follow a different pattern, with their echoes usually reoccurring over all of or most of the scans, and thus are easily filtered out. The only exception is heavily fluctuating weak signals reflected from friable clouds and precipitations. In case the concen-

tration of such objects is relatively high, it creates an illusion of change in their spatial position, i.e. of a movement. At the same time, due to the origin and behavior of these objects, their typical feature is a chaotic character of the direction of adjacent echoes caused by the pseudo-movement. Hence, the vectors formed in the process are chaotically directed, in contrast to bird echoes.

The detailed description of the method for bird echo identification against the background of other types of atmospheric echoes, as well as the technique for designing and plotting ornithological charts can be found in other papers by the authors (Dinevich and Leshem, 2007; 2008; 2010; 2011). Examples of ornithological charts of different types are presented in Fig. 2–7. Fig. 8 shows the cloud echo chart. Fig. 9 features the external look of the radar and a group of school students who came to take a class in radar ornithology. Fig. 10 gives the internal view of the display booth of the radar ornithological station.

#### On the potential development and increasing the accuracy of the system

##### 1. The ratio of radar echo power at the two wavelengths

The ratio of radar echo power at the two wavelengths of MRL-5 radar depends entirely on the parameters of a target (Abshaev et al., 1980). Chernikov (1979) showed that the power of an insect echo at the 3 cm wavelength is twice as large as that at the 10-cm wavelength. This ratio is inverse for bird echo as well as for small-drop clouds and precipitation (Stepanenko, 1973). Therefore, the ratio of the two reflection coefficients at the two wavelengths ( $Z_{dBZ3,2sm}/Z_{dBZ10sm} > 1$  for "non-bird echo") can serve as an additional indication while identifying bird echoes and eliminating false vectors.

##### 2. Polarization parameters of a radar echo.

As was shown by Shupiyatsky (1959), the values of depolarization and differential polarization are functionally connected only to the shape of a target and its orientation in space and do not depend on any other parameters, including the dielectric conductivity of the target, signal attenuation along the track etc. Using the two polarization components  $\Delta Px$  and  $dP$ , one can calculate a bird's orientation in space as well as its shape, i.e. the ratio of its length to its width. The formula



for calculation of a bird's orientation in space is  $\text{tg}2\theta = 2dP^{1/2} \Delta P^{1/2} [dP^{1/2} - 1]$ , where  $\theta$  is the angle of the orientation. It is important that the differential reflexivity value makes it possible to identify birds against the background of various atmospheric inhomogeneities whose nature does not imply formation of visible hydrometeors and whose differential reflexivity value is close to unity. As the differential reflexivity values of bird echoes is much larger than unity, it means that this feature of

a reflected signal can be used for filtering out undesired signals. It was also shown (Dinevich et al., 1994) that differential reflexivity values of small drops are close to unity. Taking this into account, signals with parameters  $\leq 30$  dBZ and  $dP \approx 1$  are characteristic of small drop echoes, while signals with parameters  $\leq 30$  dBZ and  $dP \gg 1$ , in combination with other typical characteristics (fluctuation patterns, mobility in space etc.) are likely to be bird echoes.

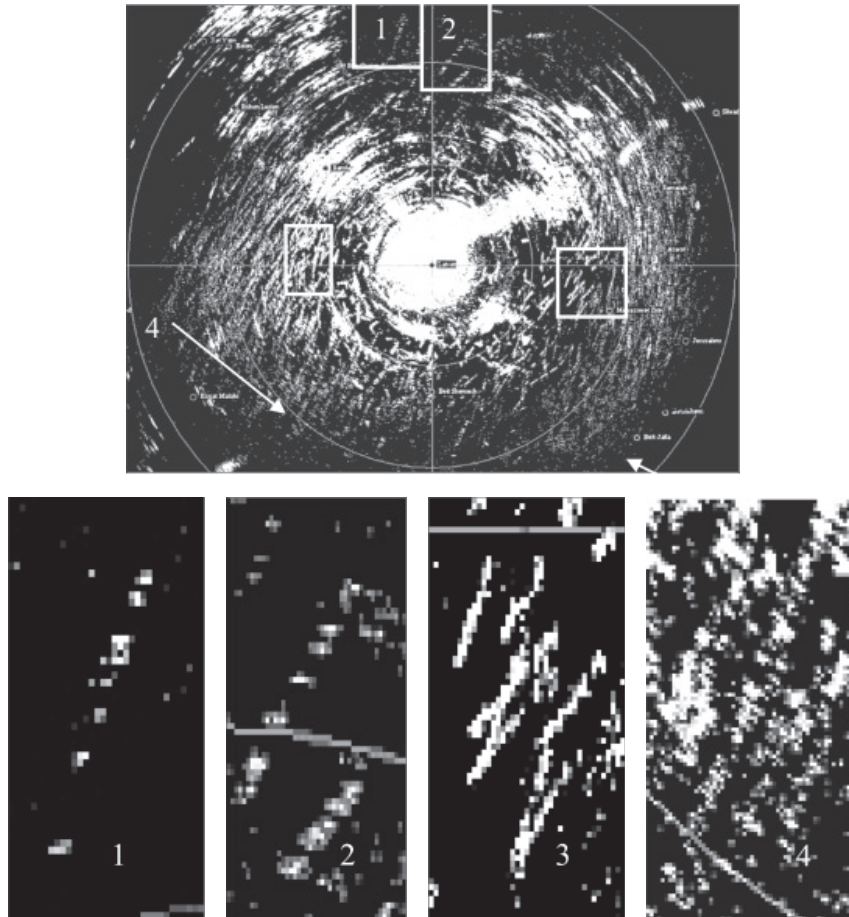


Fig. 1. The echo field after computer processing of signals obtained from 18 scans. 1,2,3 and 4 present enlarged fragments of the field

### 3. Fluctuation characteristics of echo from various target reflectors

On the basis of our research in fluctuation parameters of signals (Dinevich et al., 2004), a special device was designed that enables to analyze fluctuation characteristics. With the antenna in the "halt mode" and within the preset 200 m-long strobe, the device analyzes each pulse to isolate the signal of the maximum amplitude and to store it in memory, as well as to accumulate and plot the spectra of amplitude and frequency on the basis of 10–20 s samples. Given the frequency of MRL-5 sounding pulse (500 pulses per sec.), each sample contains

spectra of power changes and frequency of maxima repetitions for 5–10 thousand signals. A low-frequency filter that underwent special tuning enabled to separate fluctuation amplitude spectra into "bird/not bird" categories at the accuracy of at least 80%. In cases when the signal is reflected from a single bird the accuracy exceeds 95%.

#### Conclusions

– Radar echo parameters determined for various purposes were used as the basis for designing an algorithm that enables to identify bird echoes and to perform on-line plotting of vector fields that represent bird movements, including the height parameters.

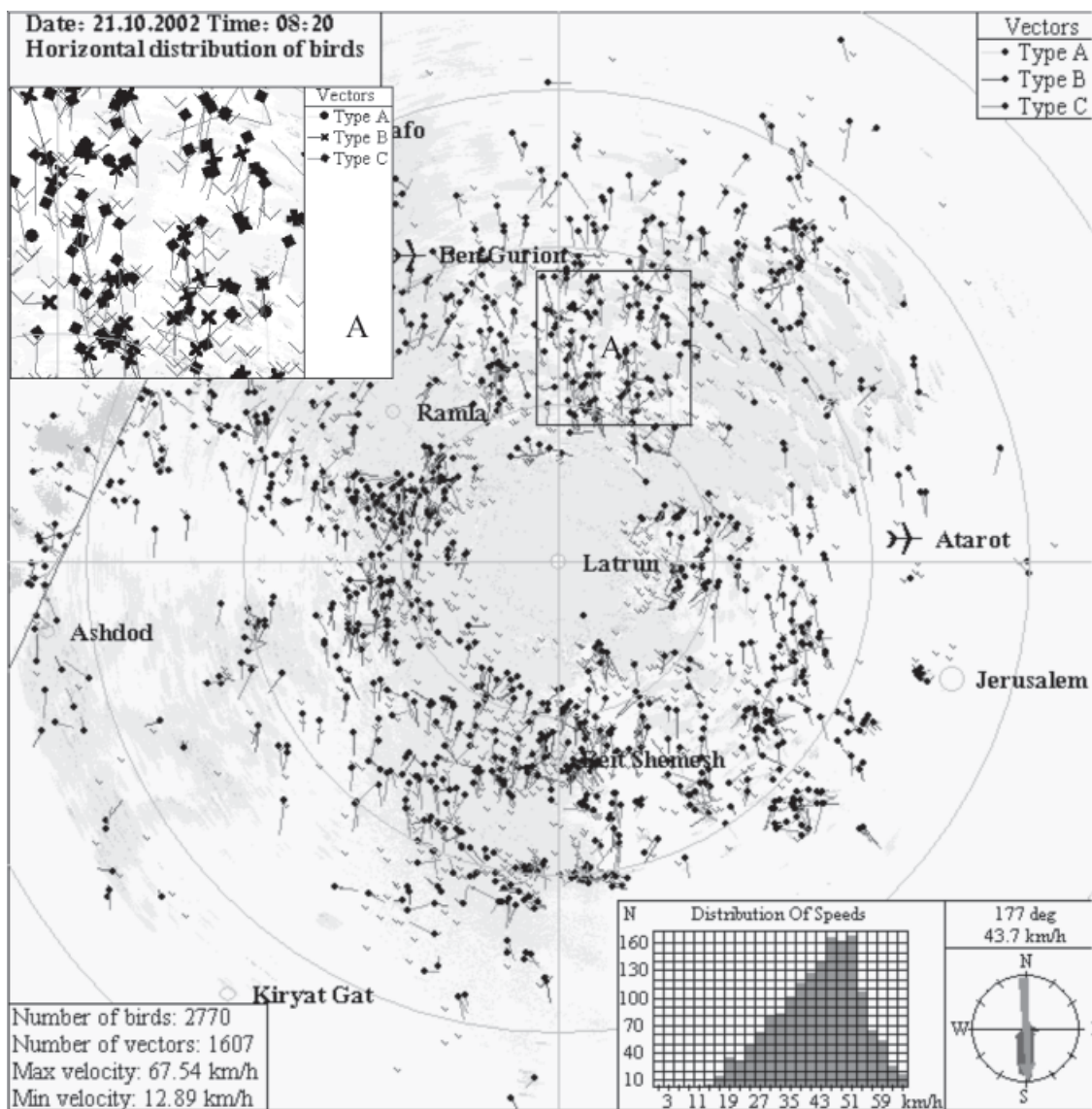


Fig. 2. Ornithological chart. Bird migration on October 21, 2002, 08.20 a.m. The actual charts are made in color. Vectors indicating the directions and velocities of bird flights (both single birds and flocks) are of three types and differ in colors. In the Figure, cloud and ground clutter reflections are colored pale gray (blue color in actual charts). Fragment A presents an enlargement where all the three types of vectors are distinctly seen, representing different patterns of flights for various bird species. Charts of this type, as well as charts of vector distribution over height and bird volume distribution during seasonal migration, are sent online to air traffic control operators every 15-20 min

– The technique of vector field plotting enables to classify birds, on the basis of their movement patterns, into several categories, among them birds flying with frequent shifts in flight direction (local birds), birds flying straightforwardly at steady velocities or at varying velocity, and those flying with repeating deviations from a straight line and at variable velocities.

– Radar ornithological charts plotted on the basis of the algorithm data enable to obtain the fol-

lowing information within the area of 60 km radius from the radar position, including:

- 1) the total quantity of birds;
- 2) distribution of birds' mass over height;
- 3) the spectra of flight directions and velocities, including the sum direction vector;
- 4) vector fields of bird movement juxtaposed with current meteorological status and local terrain;
- 5) bird distribution by the flight pattern (the degree of straightforwardness and velocity steadiness);

6) data on clouds, precipitation and visually unobservable atmospheric inhomogeneities and their parameters.

#### References

1. Abshayev M., Burtsev I., Vaksenburg S., Shevela G., 1980. Guide for use of the MRL-4, MRL5 and MRL-6 radars in urban protection systems. L., "Hydrometeoizdat".
2. Bahat O. and Ovidia O., 2005. Minimizing Bird-Aircraft Collisions Caused by Resident Raptors in Israel. IBSC 27th Meeting, Athens, Hellas, 23–27 May 2005. P. 178.
3. Bruderer B. and Joss, 1969. Zur Registrierung und Interpretation von Echosignaturen an einem 35 cm-Zielverfolgungsradar. Orn. Beob., Bd 66, 70–88.
4. Bruderer B., 1992. Radar studies on bird migration in the south of Israel. BSCE/21, Jerusalem, P. 269–280.
5. Buurma, L., 1999. The Royal Netherlands Air Force: Two Decades of Bird Strike Prevention "En Route". International Seminar on Birds and Flight Safety in the Middle East, Israel, April, 25 – 26, 1999. P. 71–83.
6. Chernikov A., 1979. Radar clear sky echoes. Leningrad, Hydrometeoizdat, P. 3–40.
7. Chernikov A., Schupjatsky A., 1967. Polarization characteristics of radar clear sky echoes. Transactions of USSR Academy of Sciences, atmosphere and ocean physics, Vol. 3, № 2, P. 136–143.
8. Dinevich L., Kapitalchuk I., Schupjatsky A., 1994. Use of the polarization selection of radar signals for remote sounding of clouds and precipitation. 34 th Israel Annual conference on Aerospace Science, P. 273–277.
9. Dinevich L., Leshem Y., Pinsky M., Sterkin A., 2004. Detecting Birds and Estimating their Velocity Vectors by Means of MRL-5 Meteorological Radar. J. The RING, 26 (2), P. 35–53.
10. Dinevich L., Leshem Y., 2007. Algorithmic System for Identifying Bird Radio-Echo and Plotting Radar Ornithological Charts. J. The RING 29, (1–2): 3–39.
11. Dinevich L., Leshem Y., 2008. Селекция радиоэхо перелётных птиц и построение орнитологических карт по данным радиолокатора МРЛ-5. Advances in modern radioelectronics, Russian Academy of Sciences, Inst. for radio engineering and radioelectronics, Vol. 3, P. 48–68. (RUS).
12. Dinevich, L., Leshem, Y., 2010. Radar monitoring of seasonal bird migration over Central Israel // J. The Ring. – Vol. 32 (1–2). – P. 31–53.
13. Dinevich, L., Leshem, Y., 2011. Accuracy and resolution capacity of MRL-5 (Is) radar ornithological station and its potential development // Journal "Scientific Israel-Technological 14. Advantages". – Vol. 13. – № 1. – P. 72–94.
14. Edwards J., Houghton E. W., 1959. Radar echoing area polar. Diagrams of birds // Nature. – 184. – № 4692.
15. Gauthreaux, S.A. and C.G. Belsler (2003). Radar ornithology and biological conservation. Auk 120(2), P. 266–277.
16. Ganja I., Zubkov M., Kotjazi M., 1991. Radar ornithology, Stiinza, 123–145.
17. Gudmundsson, G.A., Alerstam T., et al. (2002). Radar observations of Arctic bird migration at the Northwest Passage, Canada. Arctic 55(1), P. 21–43.
18. Larkin, R.P., W.R. Evans, et al. (2002). Nocturnal flight calls of Dickcissels and Doppler radar echoes over south Texas in spring // Journal of Field Ornithology, 73(1), P. 2–8.
19. Leshem, Y., Yom-Tov Y. 1998. Routes of migrating soaring birds. Ibis 140, P. 41–52.
20. Leshem, Y., Yom-Tov Y., 1996. The use of thermals by soaring migrants in Israel. Ibis 138, 667–674.
21. Salman E, Brylev G., 1961. Radar echo from dielectric inhomogeneities of thermal nature.. Proc. Main Geophysic Observatory, № 120, P. 37–44.
22. Skolnik, M., 1970. Radar Handbook. McGraw-Hill Book Company, 1970.
23. Schaefer G., 1966. The study of birds echo using a tracking radar. Proc. 14<sup>th</sup> Int. Ornith. Cjngress. Oxford.
24. Shupiyatsky A., 1959. Radar dispersion by means of nonspherical particles. Pros of CAO, 30, pp. 39–52. (RUS).
25. Stepanenko V., 1973.. Radar in meteorology. Hydrometeoizdat, Leningrad (RUS).
26. Thorpe J., 2005. Fatalities and Destroyed Civil Aircraft Due to Bird Strikes, 2002 to 2004 (with an Addendum of Animal Strikes). IBSC 27<sup>th</sup> Meeting, Athens, Hellas, 23–27 May 2005. pp. 17–24.
27. Zavirucha V., Saricev V., Stepanenko V, Shepkin U., 1977. Study of the dispersion characteristics of the meteorological and ornithological objects in echo-free cameras. Proc. Main Geophysic Observatory, № 395, P. 40–45. (RUS)
28. Zrnic D.S. and Ryzhkov A.V. (1998). Observations of insects and birds with a polarimetric radar. Transactions on Geoscience and Remote Sensing, 36(2).

The work is submitted to the International Scientific Conference "Ecology and rational nature management", Israel (tel Aviv), April 25 – May 2, 2014, came to the editorial office on 01.04.2014.

*Materials of Conferences***DECISION SUPPORT SYSTEM IN ESTIMATION OF THE ECONOMIC EFFICIENCY FOR THE CHEMICAL INDUSTRY**

Frolova T.A., Tulyakov D.S., Frolov S.V.

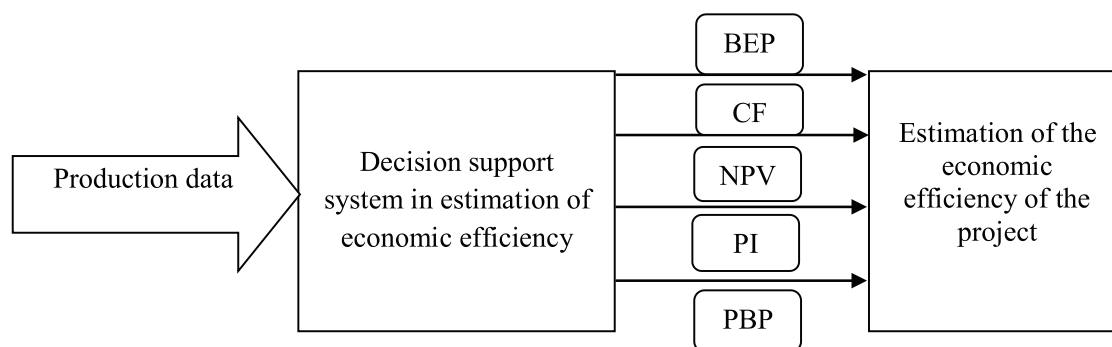
*Tambov State Technical University, Tambov,  
e-mail: frolova@mail.gaps.tstu.ru*

In a modern market economy, leaderships of enterprises of multipurpose specialty chemical production choose which product needs to make in order to maximize profit.

For this purpose we have proposed a decision support system in estimation of the economic efficiency for chemical industry.

Decision Support System (DSS) takes input data for the production of various projects. These data are processed for use in calculations of estimation of the economic efficiency of projects and the output of DSS obtains a set of criteria by which to estimate the attractiveness of investment projects (Figure).

This DSS is required at the initial stage of the decision to launch production.



DSS (BEP – break-even point, CF – Cash Flow, NPV – Net Present Value, PI – Profitability Index, PBP – Pay-Back Period)

A user of this system contributes to the database information on the production. Not all data might have the exact values, if such data are called uncertain. There are several approaches to the disclosure of uncertainties. We propose an approach in which the information about the uncertainty of a parameter is specified as interval numbers. Further information from the database is used for lumpsum costs, current charges and calculation efficiency criteria. Information is displayed to a user on projects and he decides on further consideration of a production.

Thus, the implementation of such decision support system will help the decision maker in evaluating the economic efficiency of a production. The result of using such a DSS can become more effective fiscal policy and the distribution of cash flows.

The work is submitted to the International Scientific Conference “Modern high technologies”, Spain-France, (Barcelona–Nice–Monaco–Monte-Carlo–San Remo–Cannes), on 26 July – 3 August 2014, came to the editorial office on 15.05.2014.

**INFORMATIONAL AND ANALYTICAL SUPPORT BUSINESS PLANNING TASKS**

Medvedev A.V.

*Moscow State University of Economics, Statistics and Informatics, Moscow, e-mail: alexm\_62@mail.ru*

In today’s information society development relevance of decision support systems of business planning, oriented on business analyst, entrepreneur, businessman, is no doubt. Important properties of the informational analytical base business planning must be, on the one hand, the minimal set of these characteristics, and on the other, it is sufficient to receive income and expenditure flows of financial and economic activities in accordance with the specified algorithms, conceptually relevant accepted accounting rules in the country for these streams. Below are given the features of financial and economic activity, as well as the internal and external economic environment of investment project.

1. The characteristics of the basic production assets (quantity, value, performance and service life

of production equipment, real estate, etc.), including the intangible (intellectual property, etc.).

2. Information on the products and/or services of their production (costs, demand, the share of revenues from the sale used to pay, payment, working capital, etc.).

3. The characteristics of the external economic environment: a discount rate, including inflation, the investor's claims and other risks, taxes, loans, specific planning horizons, the maximum amount of investment, subsidies, demand for products or services, etc.

Information on the internal and external characteristics of the business environment to benefit from available in the network of economic and statistical information, through, inter alia, the provisional statistical and analytical processing: averaging, ag-

gregation, ranking, inter- and extrapolation, etc. Using this approach allowed to develop a number of investment projects which have been successfully tested in practice [1, 2].

#### References

1. Medvedev A.V. An optimization-simulation concept of socio-economic systems modeling // *International Journal of Applied and Fundamental Research*. – 2013. – № 7. – P. 21–25.

2. Medvedev A.V. An optimization-simulation concept of business planning // *International Journal of Applied and Fundamental Research*. – 2014. – № 1(2). – P. 198–201.

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The work is submitted to the International Scientific Conference “Research Graduate School in priority areas of science and technology”, Switzerland (Zurich-Bern), April 27 – May 3, 2014, came to the editorial office on 13.04.2014.

*Materials of Conferences***ON THE RELATIONSHIP BETWEEN INTERNATIONAL LAW AND DOMESTIC LAW IN THE SPHERE OF HUMAN SCIENCES**

Almenov B.A.

*e-mail: sdisadin@mail.ru*

On the basis of general notions concerning the relationship between international law and domestic law we can consider the specific features of these relations in the human rights sphere reflected in the activities of treaty bodies. One of the peculiarities of international treaty provisions regulating domestic relations, in particular, in the human rights sphere is that reference rules of domestic law are not enough for the enforcement of those provisions [1].

A lot of international treaty provisions in the human rights sphere are not self-executable, as they only set the general standards and minimal requirements in the human rights sphere and do not fully describe the essence of human rights and freedoms, their guarantees, the mechanisms of their insurance and the ways of their protection.

The international legal acts in the human rights sphere were developed during “the war” and the countries with opposite social systems deliberately did not specify the contents of a number of categories under discussion [2]. At present, when there no longer exists a global opposition of two socio-economic systems, serious conflicts between different countries concerning certain human rights issues prevent the lawyers from formulating the provisions of international human rights agreements in such a way that they be self-executable.

R.A. Müllerson cited the decision of the Italian Constitutional Court concerning the application of certain provisions of the Covenant on Civil and Political Rights as an example of acknowledging that certain provisions of the agreements in the human rights protection sphere are not self-executable. The Italian legislation enforced that Covenant as a law. But the Italian Constitutional Court refused to enforce the corresponding provisions of that Covenant because the Law only implemented the self-executing Covenant provisions [3].

It is often impossible to implement international law in the human rights sphere without adopting specifying domestic acts because, as a rule, international human rights treaties do not contain any provisions concerning the mechanisms of human rights realization and the methods of their protection. Besides, the essence of these subjective rights is often specified only in a generalized manner. In addition to the above, the omission of corresponding provisions in international treaties often seems justified as the introduction of corresponding amendments is in the sphere of governments.

Such provisions are implemented by the second implementation method that is an incorporation performed by issuing domestic laws and regulations

which define the provisions of international treaties, usually by means of laws, which is testified by the experience of different countries.

The necessity of issuing legislative acts is proved by the text of international human rights treaties themselves. In accordance with Article 2, clause 2 of the International Covenant on Civil and Political Rights each state participating in the Covenant shall use the required efforts for taking legal and other actions which might be necessary for exercising the rights acknowledged by the Covenant. *Similar regulations can be found in other universal human rights treaties.*

In spite of the fact that the above Covenant Article does not contain the requirement concerning the inclusion of its provisions in the national legal system the participating states in accordance with the Covenant shall “respect and secure” the rights acknowledged in the Covenant (Article 2, clause 1), as well as guarantee the possibility of enjoying those rights to all persons under their jurisdiction. Moreover, Article 2, clause 3 of the Covenant contains the requirement that the states shall provide effective remedy for any person whose rights and freedoms acknowledged by the Covenant have been infringed on.

In addition to the above, certain provisions of universal conventions in the sphere of human rights protection are self-executable and, consequently, in order to be executed no extra regulations are required from the countries which acknowledge international law (international agreements) as part of domestic law or the national legal system. In our opinion, such provisions include prohibition of torture, non-discrimination on grounds of race, color of skin, sex, language and religion. However, in certain countries, for example in those strictly separating between international and domestic law the provisions of international human rights agreements are beyond direct applicability without adopting implementing acts.

That said, legal measures are often insufficient for the state in order to perform the provisions of conventions, especially when we talk about economic, social and cultural rights. As V.A. Kartashkin points out, the practical value of providing a legislative framework for rights and freedoms only means the possibility of exercising those rights, but that possibility can become real only under certain conditions, in particular, if the state pursues a deliberate policy [4].

With regard to certain CIS countries one can single out the following peculiarities of implementing international law regulations in the human rights sphere. The constitutions of those countries define the generally accepted principles and regulations of international law as the integral part of their legal systems. If an international treaty specifies the rules which are different from the rules envisaged by the law, the international treaty rules apply.

In accordance with the laws of certain CIS countries “On International Treaties of Certain CIS Countries” the provisions of officially issued inter-

national treaties of those countries, not requiring the publication of domestic acts for their application, in order to perform the other provisions of international treaties of those countries the corresponding legal acts shall be adopted.

The legislation of certain CIS countries regularizes the immediate effect principle of self-executing international treaties of those countries under the condition of their publication.

It does not directly follow from the law of some CIS countries "On International Treaties of Certain CIS Countries" that domestic acts shall be applied directly without their publication. It would be better if it specified the procedures, methods and other issues concerning the execution of international obligations. At present the Constitutional Courts of those countries have no essential practice with regard to international treaties. The Constitutional Courts of certain CIS countries practically failed to solve the cases on the merits with regard to the compliance of international treaties with the Constitutions of those countries, while those treaties or their particular provisions did not come into operation for certain CIS countries [5].

At the same time, Plenum of the Supreme Court brought some explanations concerning the application of international law by the courts ("On application by the regular courts of the generally accepted principles and norms of international law and international treaties in those countries"). According to these explanations and Constitutions of some CIS countries human rights and freedoms in accordance with the generally accepted principles and norms of international law and international treaties in those countries are directly applicable in the jurisdiction of those countries.

At first sight, that provision directly means that the generally accepted principles and norms of international law and international treaties of those countries in terms of establishment and securing human rights and freedoms apply directly within the jurisdiction of some CIS countries and accordingly they are self-executable.

However, this conclusion is not quite true for several reasons. First, a careful examination of the text of that act shows that it describes the direct effect of human rights and freedoms but not norms of international law, which is not the same, because the Supreme Court of those countries justifies the thesis of the direct effect of human rights and freedoms by not only the norms of international law but also by the provisions of Constitution of those countries, such as ensuring judicial protection of rights and freedoms, which concretize the provisions of international treaties essentially. Second, as mentioned above, a significant part of the norms contained in international human rights treaties, by its nature, cannot act directly within the jurisdiction of some CIS countries because the relevant provisions of treaties require their specification by issuing domestic act. It should be a separate deal with the issue regarding the application of generally accepted principles and norms of international law in some CIS countries. The view that the implementation of generally accepted principles and international law do not require the adoption of

domestic legal acts found significant support in the science of international law [6]. One can agree with this opinion since the experience shows that as a rule generally accepted principles and norms of international law operate and are executed directly at the national level but domestic legal acts specifying them are issued quite rarely.

Thus, we can speak about a self-executability of generally accepted principles and norms of international law including the principle of universal respect for human rights and the principle of good-faith fulfillment of international obligations referred to in the mentioned act of the Plenum of the Supreme Court in some CIS countries.

At the same time it is indicated in that act that during the judicial consideration of the civil, criminal or administrative cases such an international treaty of some CIS countries is applied directly as entered into force and became binding on those countries and the provisions of which do not require the issuance of internal regulations for their application and are able to create rights and obligations for subjects of national law. According to the Plenum's opinion, features that confirm the impossibility of direct application of the international treaty provisions include, in particular, the agreement provisions for the participating state obligations to amend the national legislation of that state [6].

Based on the above mentioned it can be concluded that the said act cannot be interpreted from the position that it as a general rule suggests a direct effect of international law on human rights and freedoms, in other words, a self-executability of such norms within the jurisdiction of those countries. Taking into account the characteristics of the international human rights, it is logical to say that most of international human rights are not self-executable.

As a lawyer and as a member of society I believe that in order to change the situation we need a strong and professional society. Then the laws will be discussed and accepted by society. The higher the society life level is, the stronger the state and the higher the society culture are.

#### References

1. Kartashkin V.A. Human Rights in International and Domestic Law. – M., 1995. – P. 33.
2. Kartashkin V.A. International Protection of Human Rights. – M., 1976. – P. 49.
3. Mullerson R.A. Relationship Between International Law and Domestic Law. – M., 1982. – P. 65.
4. Kartashkin V.A., Human Rights in International Law and Domestic Law. – M., 1995. – P. 34–35.
5. Ignatenko G.V., Marochkin S.Y., Suvorova V.Y. Federal Law on International Treaties of the Russian Federation // Russian Law Journal. – 1995. – № 4. – P. 13–27.
6. Gavrillov V.V. Theories of Transformation and Implementation of Norms of International Law in the Domestic Legal Doctrine // Moscow journal of international law. – 2001. – № 2.

The work is submitted to the International Scientific Conference "Issues of science and education", Moscow, May, 20–23, 2014, came to the editorial office on 16.04.2014.

*Materials of Conferences***THERMODYNAMICAL PRINCIPLE  
OF INVESTIGATION OF PROPERTIES  
OF SOME REFRACTORY METALS**

Dubas L.G.

*Deedowsk, Istra, RICN, RAAS,  
e-mail: sudarih@gmail.com*

Development of refractory metals leads to a technology problem of obtaining composite materials with demand of a system of physical and chemical properties. Perfection of the engineering intended for service conditions at heating in aggressive and erosive environments, supposes creation of technologies for their manufacturing.

Combination of unique properties of refractory metals [1, 2], such as high hardness and a high working temperature, became the basis for its intensive application at manufacturing of elements of flight vehicles and of details of power installations. In many industries the titan, either zirconium, or a hafnium and their alloys have an essential value. The hardness of materials decreases at the raised temperatures. Therefore there are problems of hardening of maintained details and knots of gears. Protective and strengthening covers are for this purpose intended.

For the purposes of protection of a surface and improvement of operational characteristics of refractory metals, and their alloys they are covered with protective materials [3]. Protective firm solutions increase wear resistance, strength and hardness of a surface of materials, raise their corrosion firmness, heat resistance and high-temperature strength, and thus do not weaken mechanical properties of materials.

Besides firm solutions in intermediate alloys intermetallic phases take place. Feature of intermediate phases is that they do not store crystal structure of metal, and have own crystal structure. Considerable influences on mechanical and physical properties of alloys renders an essential amount of intermediate phases, with a various chemical compound and structure.

The research problems and hypothetical purposes consist in an investigation of features of formation of covers films on the basis of metal alloy with niobium or molybdenum. Following problems according to a research subject in view should be solved:

1. To reveal temperature intervals and formation times for intermetallic phases and their radiance flux and thermal stability.

2. To investigate results of an ionic irradiation on structure of the laminas and to consider a capability of ionic modification of covers.

3. To determine the induced diffusive structural transformations into covers films on the basis of alloy, received by beam techniques.

4. To study structures of phase transformations depending on physical structure and a chemical compound of the initial basis.

5. To reveal growth rates of diffusive laminas, which are various and are determined by temperature and by time interval.

6. To investigate the processes induced by formation of covers films.

7. To establish the natural statistical laws of structural transformations in alloy in the course of a homogenizing annealing.

8. To study consecutive processes of phase transformations in alloy at annealing.

9. To compare expert evaluations of mobility of atoms in an alloy.

10. To investigate the dynamics of structure transformations on the basis of alloy of niobium or molybdenum, which depend on the basic metals of chemical elements, for example, Ti or Zr, so and from technology of their obtaining.

11. To find out the formations of alloy of Nb or Mo with a material of the basis and further in the course of an annealing formation of a layer on the basis of connections  $\text{Metal}_x\text{Nb}_y$  or  $\text{Metal}_x\text{Mo}_y$ .

12. To study metastable conditions on the basis of alloy of niobium or molybdenum, arising at various heat treatments and to establish their influence on formation of a microstructure of alloy.

Hypothetically additional combinations with actuating of other components based according to the hypothetical proposal of other chemical elements, for example, C or B, can be possible.

Created structures may not be having thermodynamical stability. For obtaining a new result it is necessary to solve some of natural problems in which the thermodynamics of the laminas lies.

With influence applicative at strong action fields of force the laminas will be reformatting itself. In **the successful results** their metaphysics of laminas metaphase **may be able to stabilise**.

**References**

1. Mamta Chauhan, Dinesh C. Gupta. Structural, electronic, mechanical and thermo-physical properties of TMN (TM = Ti, Zr and Hf) under high pressures: A first-principle study // Int. Journal of Refractory Metals and Hard Materials. Vol. 42 (2014). P. 77–90. URL: <http://www.sciencedirect.com/science/journal/02634368/42> (ref.: 14.02.2014).

2. Dubas L.G. Quark mass unit // European journal of natural history. – 2013. – № 3 – P. 77–78. URL: [www.world-science.ru/euro/495-33149](http://www.world-science.ru/euro/495-33149) (ref.: 14.02.2014).

3. Peng Y., Du Y., Zhou P., Zhang W., etc. A thermodynamic database for multicomponent cemented carbides. // Int. Journal of Refractory Metals and Hard Materials. Vol. 42 (2014). P. 57–70. URL: <http://www.sciencedirect.com/science/journal/02634368/42> (ref.: 14.02.2014).

The work is submitted to the International Scientific Conference “Research on the priority of higher education on-directions of science and technology”, Austria (Vienna-Salzburg), June 22 – July 1, 2014, came to the editorial office on 23.06.2014.



### ELECTROMAGNETIC MASS OF AN ELECTRON

Dubas L.G.

*Deedowsk, Istra, RICN RAAS,  
e-mail: sudarih@gmail.com*

The concept of electromagnetic mass of an electron guesses idealized judgment that all mass of an electron is equivalent to not quantum electromagnetic energy of an electron.

Let's guess a hypothesis that the part of mass of an electron is equivalent to electromagnetic energy of an electron.

In article [1] the factor of the relation of a natural electrical charge to an elemental electrical charge is used.

$$q_n/q_e = \sqrt{1/2\alpha} = 8,275\ 999\ 990 \pm 0,000\ 000\ 0014,$$

where  $\alpha$  – is fine-structure constant [2].

In representations of article [1] about electromagnetic mass of an electron is used.

$$m_e = q_n/q_e \cdot m_n,$$

where  $m_n$  – is electromagnetic mass of an electron;  $m_e$  – electron mass.

In representation of article [1] about use of the semi multiple quantity equal 39,5, for definition of a quark mass unit which approximately is supposed to be related to least quantity of mass of a quark, are given.

$$m_q = 39,5 m_n,$$

where  $m_q$  – it is mass of a quark unit.

Let's present one of effects of article [1] in the form of hypothetical analogue of the periodic table of D. Mendeleev, with use of analogy of periods, groups and blocks of a periodic table taking into account a mass unit of a quark, spotted as 39,5 electromagnetic masses of an electron.

${}^2_1\text{down}$			${}^1_2\text{up}$
${}^{39}_3\text{strange}$	${}^{523}_4\text{charm}$	${}^{1714}_5\text{bottom}$	${}^{71152}_6\text{top}$

#### References

1. Dubas L.G. Quark mass unit// European journal of natural history. – 2013. – № 3. – P. 77–78. URL: [www.world-science.ru/euro/495-33149](http://www.world-science.ru/euro/495-33149), (ref: 2014.05.29).

2. Fine-structure constant, National Institute of Standards and Technology. USA. URL: [www.physics.nist.gov/cgi-bin/cuu/Value?alpha|search\\_for=abbr\\_in!](http://www.physics.nist.gov/cgi-bin/cuu/Value?alpha|search_for=abbr_in!), (ref: 2014.05.29).

The work is submitted to the International Scientific Conference “Research on the priority of higher education on-directions of science and technology”, Austria (Vienna-Salzburg), June 22 – July 1, 2014, came to the editorial office on 29.05.2014.

*Materials of Conferences*

**TURKMEN-RUSSIAN  
PHRASEOLOGICALLY PARALLELS:  
EXISTENCE OF FACTORS**

Evdokimova A.G., Baltaeva V.T.

*SBEI HPE "The Kazan State Medical University"  
Ministry of Public Health of the Russian Federation,  
Kazan, e-mail: g-alba67@mail.ru, b-vnera@mail.ru*

The phraseology of any language in most cases has a national identity, reflecting features of everyday life of people. Many idioms carry emotionally expressive, stylistic load.

National identity phraseology does not exclude common elements, which are expressed primarily in the existence of interlanguage phraseological parallels. We refer to them idioms, in varying degrees, coinciding in comparable languages in semantic and formal relations.

Comparative analysis of the phraseology of the Turkmen and Russian languages shows that the number of idioms is in relations of parallelism. There are the most productive areas on the basis of which are grouped phraseological parallels. These areas are mainly related to such topics as the nature, the animal world, the mental state of the people, household items, religious and superstitious ideas, part of the human body and other.

Most often match the idioms that are created in the image of the phenomena of nature. It such names as the *asman* – sky, *ýer* – earth, *gün* – sun, *aý* – moon, *ýagş* – rain, *ýel* – the wind and so on, which people had representation from the ancient time. Phraseological units are created for the images, in most cases based on the same properties. For example, in a basis of creation of idioms with the word **snow** in two languages lay perception of its color: **gar ýaly** – **as snow** meaning “white, snow-white”. This nature have also phraseological parallels **gökden düşen ýaly** – **like fell from the sky**, **ýer bilen gök ýaly** – **as heaven and earth**, **egnimden dag aýrylan ýaly** – **like a weight from my shoulder had fallen** etc.

Parallelism can be observed in the same rethinking of phraseologisms containing in their composition the names of animals, birds, insects, etc., because the habits, behavior of many domestic and wild animals, birds equally associated in people’s minds.

According to the fair remark E.M. Solodukho, “association of the many names of animals with the same or close characters from different language groups is explained by the centuries-old experience and people communicate with animals, the significant role that they play in human life”. So, for example, the stubbornness of man in the Turkmen and Russian languages is associated through the image of a donkey: **eşek ýaly ketjal** – **stubborn as a mule**; a state of fear, suspicion in some animals accompanied by preload tail (for instance, in dogs, wolves), which are transported in the content of the phraseological units of **guýrugyny ýamzyna gysmak** – **turning**

**tail (squeeze)** with a value of “being afraid of something, to become less self-confident, silenced”.

In many languages, the cat and the dog are described as two irreconcilable animals. Such characteristics can be seen on the materials of the Turkmen and Russian languages. The behavior of these animals was the basis of education parallelism between phraseology **it bilen pişik ýaly** – **like cat and dog** with the value “in constant quarrel, hostility”. Idiom **peşeden pil ýasamak** – **make a mountain out of a molehill**, **ary öýjügi** – **hornet’s nest**, **siňek uçsa bildirjek (eşidilýär)** – **heard a fly flies** and other evidence of the same personification of animals, insects in people’s minds.

Parallelism is formed in those cases where there is transfer of the same actions of animals, birds on people’s actions. For example, extremely aggressive conditions are compared in Turkmen and Russian languages with a mad dog, on the basis of what appeared phraseologism **guduzlan it ýaly** – **like a mad dog**.

Often phraseological units on the basis of the characteristic properties of animals equally symbolized by the consciousness of people. So, symbolizing the qualities of the lion as bravery and courage in Turkmen and Russian phraseological parallels arise **arşlan ýürek** – **lion heart**, and vice versa, cowardly people associated in the mind with the image of a rabbit – **towşan ýürek** – **hare soul**, etc.

Idiom **ezilen towuga dönmek** – **like a wet chicken** in Turkmen and Russian languages have different meanings. In the Turkmen language idiom is set to “strongly wet, wet to the skin”, hence, in the minds of people, this idiom is associated with image of a wet hen in the truest sense. In the Russian language the meaning of this phraseologism somewhat different from Turkmen. As is known, wet chicken has depressed, miserable. On this basis, in our opinion, in the minds of people are rethinking this idiom meaning “man having pathetic, depressed, upset”, the second value – gutless, spineless people. Idiom **gurt ýaly** – **like a wolf** in the Turkmen language is set to “combat, agile man”, and in Russian – “hungry, tired”. Therefore, in parallel phraseological units may be completely different reinterpretation, whereby it is possible to assume the occurrence of interlanguage phraseological homonyms.

If the match is partial metaphors may occur the so-called incomplete parallel. For example, **gatyr ýaly işlemek** – **to work like an ox**. In Russian this idiom means “work hard”, and Turkmen in the same meaning may be used several names: *gatyr* (mule), *eşek* (ass), etc.

Thus, the coincidence of the phraseological units with the name of animals and birds due to the nature of the comparisons that in both languages based on the most typical behaviors of animals and birds.

The similarity of household articles and parts thereof may also cause phraseological parallels: *tor* – net, *elek* – sieve, *iňne* – needle, etc. For example, **aýna ýaly** – **as glass**, **elek bilen suw**

**daşamak – draw water in a sieve, tora düşmek – fall into the network**, and so etc.

Parallelism of phraseologisms of the two languages can be generated by the coincidence of the basic functions of the human body: crazy, calm, death, patience, sickness, sleep, work, etc. For example, **depe saç düýrükdi – hair stood on end, bilini ýazman – not straightening his back, sabyr käsäm doldy – patience has snapped**, etc.

Parallelism idioms of languages with two different systems can be generated by the coincidence of the basic functions of the human body: **dabanyň ýalamak – to wheedle, burnuny sokmak – to poke his nose, baş goýmak – lay down his head, bogazyň ýyrtmak – to bawl** and so etc.

Turkmen-Russian phraseological parallelism is observed between numerally phraseological units. For example, iki ädimlikde – two steps, ýedi gat hamyny sypymak – after seven skins, ýedi puşduna çenli – to the seventh generation, and so etc.

V.M. Makienko said: “Despite the seeming national specificity, “identity” models tautological, they are actively disseminated in multiple languages”. So, some idioms-tautologizmy Turkmen and Russian languages form parallelism: **elden-ele – from hands in hands, ýanma-ýan – side by side, ýüzbe-ýüz – face to face, egin-egne berip – shoulder to shoulder**, etc.

Parallelism in phraseology arises not only due to accidental coincidence, but by tracing. It should in this regard, to emphasize the difficulty of determining causes of phraseological parallelisms.

Tracing is the result of language contact, translation of literary works from one language to another, etc. Phraseological tracing – collocations is incurred “as a result of a literal, i.e., foreign language word translation turnover. In view of the differences caused by rates of interest mapped languages, grammatical structure combinations modelled after idioms may be different. In Turkmen writing frequently used expressions: **doganlyk elini uzatmak, oda-suwa urmak, Amerikany açmak, üns merkezinde durmak** which literally means: **a fraternal hand to reach into the fire and into the water to discover America, to be the center of attention**, and so etc.

“And from myself and on behalf of a fraternal **hand stretched out to you**”. (Leo Tolstoy. “War and Peace”). – **Öz tarapyndan-da, olaryň adyndan-da size özümiň doganlyk elimi uzadýaryn**.

“He felt that one of the words of this man depended on the fact that all this mass ... would go **through fire and water**, crime, death, or the greatest heroism ...” (ibid.). – Bu ummasyz kän mähelläniň... özüni oda-suwa urmagynyň, jenaýata, ölüme gitmeginiň ýada inňän beýik gahrymanlyga gitmeginiň bu adamyň ýekeje sözüne baglydygyny Rostow duýýardy...

When transferring Russian phraseological the Turkmen language by tracing possible deviations from the prototype. In some cases, there and paste in the tracing components missing in the prototype.

“He will **make the water dirty** – and to the side, and us again to disentangle” (Mikhail Sholokhov “Virgin soil upturned”). – **Ola dury suwy bulandyrarda hol Seýlek aýrylar, şol bulanyk suwy bolsa ýene biz içmeli bolarys**.

“The peasant women themselves will fire, **water will not pour**” (Ibid.). – **Bir görsen heleýler öz aralarynda jenjel turuzýarlar, üstlerine suw guýubam aýryşdyryp bolanok**.

It should be noted that most of the Turkmen phraseological cripples encountered in works of art, are not widely common parlance in the Turkmen language. For example:

“Oh, how you frightened me. What was wrong with them, **the soul were fainting**” (N. Chernyshevsky. “What to do?”). – **Sen meni nähili gorkuzdyň. Şeýtmegem bolarmy? Janym dabanyma gitdi**.

“You can live, but requires the brain and greater agility to immediately **into a puddle did not sit down**”. (M. Gorky. “Mother”). – Emma birden batga batmazlyk üçin, paýhaslylyk hem ilgeziklik gerek.

“... Both spouses gladly felt that, despite the fact that there was only one guest, the evening had begun very well, and that evening **was like two drops of water** like every other evening with conversation, tea and candles”. (Leo Tolstoy. “War and Peace”). – ... Är-heleýiň ikisi-de meýlis aňşamy gowy başlandy we bu meýlis aňşamy gürrüňli, gaýly we ýanyp duran şemli başga her bir meýlis aňşamyna, edil iki sany suw damjasynyň biri-birine meňzeşligi ýaly meňzesh diýip hezil edýärdiler.

There are cases, when also calcium and semantics of phraseological: “Write, Michael Grigorich, order and lie at the dawn. In six it is necessary that you were **on the feet**” (M. Sholokhov. “The Quiet Don”). – **Mihaýlo Grigoriç buýruk ýaz-da, ýatyp ukyny al.sagat altyda aýak üstünde bol**. Idiom **on the feet** has several meanings, namely, “upright”, “awake, rising from sleep”, “in troubles, worries, at work, on the move, without sitting down, while staying”, “healthy, not sick”, “not getting into bed, without bed rest (to transfer the disease)”. In this context the Turkmen parallel copied second value of Russian phraseological.

“Something they’re all **on the defensive**, angry, as if everyone wants to feel something ...” (Leo Tolstoy. “Anna Karenina”) – **Näme üçindir olar aýyň(n) bolmasa çarpaýa galýarlar, misli nämedir bir zada görkezjek bolýan ýaly bolup, gaharlanýarlar – diýip, ol jogap berdi**. In this example, the Russian phraseologism “dramatically manifest disagreement, protest, resist” was trace the Turkmen language.

Thus, the formation of phraseological parallels associated with various fields of cultural and social life of peoples, with the phenomena of nature, wild-life, etc., which is the foundation of education extralinguistic phraseological parallels.

#### References

1. Mokienko C.M. Slavonic phraseology. – M., 1980. – P. 143.
2. Soloduchko E.M. internationalization Problems of phraseology. – Kazan: Publishing house of Univ Kazan.un-ta, 1982. – P. 17.
3. Shan N.M. Phraseology of modern Russian language. – M., 1969. – P. 140.

The work is submitted to the International Scientific Conference “Problems of quality education”, Morocco, May, 20–23, 2014, came to the editorial office on 08.04.2014.

## Short Reports

**MODERN CONDITION OF LANDSCAPES  
IN VICINITIES OF THE RIVER SARMA AT  
COAST OF LAKE OF BAIKAL**

<sup>1</sup>Belozertseva I.A., <sup>1</sup>Kichigina N.V.,  
<sup>1</sup>Abalakov A.D., <sup>2</sup>Drokov V.V., <sup>1,2</sup>Maryshkin D.I.

*1V.B. Sochava Institute of Geography SB RAS,  
Irkutsk; 2Irkutsk State University, Irkutsk,  
e-mail: belozia@mail.ru*

Natural and primarily bioclimatic conditions in the area of Middle Baikal in Preolkhonye are contrasting. In Preolkhon plateau the ancient “pre-baikal” geomorphological landscape with synchronous intermittent cover of wind-blown rocks that formed under subtropical conditions of the Late Cretaceous and Early Paleogene era are preserved. Ancient relief of the plateau is poorly preserved in modified form because of the dry climate and a more or less stable position of Preolkhon tectonic block, sandwiched between raised and lowered shoulder of Baikal Rift – Pribaikalsky range and Baikal depression. Here the crystalline schist, gneiss, marble and other metamorphic rocks are common [1]. Quaternary clastic weathering crust and their derivatives are widely represented. The remains of ancient clay and red-mottled weathering crusts are locally found. The weathering crust is covered by subaerial sediments from Neogene and Quaternary.

The shore of Lake Baikal near the Sarma river is included in the taiga and steppe zone, where light coniferous larch and pine forests coexist with steppe areas. On rock outcrops and rocky sections of the coast cryoxerophytic fescue thyme steppe groups are common, in intermanic depressions – complexes of *Artemisia absinthium*, *Festuca valesiaca*, *Calamagrostis sylvatica*, *Stipa* and Siberian wheatgrass, all merit special protection. There are endemic and relict plants here: *Primula officinalis*, Trifoliate oxytrope – relict species, whose age is about 15 million years, and other. As well as other rare medicinal plants under protection, for example: *Caragana jubata* (Pallas) Poiret; *Rhodiola rosea* L.

The characteristic elements of foothill trails vegetation of Malomorskoye coast are sparse steppe herbal larch. Lowlands are occupied by pine and larch- pine rhododendron and *duschekia*, cranberry and forb forests and secondary birch and pine and birch forests.

Endemic shrubs e.g. *Cotoneaster brilliant* Popov and *Crataegus maximowiczii* grow in the middle of the slopes of the Primorskiy range. Dark coniferous taiga (pine forests involving conifer, spruce and larch) is presented in fragments – in shaded ravines of the Primorskiy range. Under their canopy relics of the Tertiary deciduous forests are preserved, which were distributed in the region 15–20 million years ago: *Anemone altaica* and *Anemone jenssenensis*, *Viburnum opulus*, *Menispermum dauricum* and others.

In the fragmentary expressed subalpine zone of subgoletz elfin wood formation and mountain tundra of the Primorskiy range gravelly mountain tundra in conjunction with wastelands and sparse elfin cedar thickets are dominated.

In Preolkhonye soils of dry foothill steppes are widespread [2]. Formation of dry steppe landscape with chestnut soils is caused by the arid mountain zonation (position in the rain shadow). Associated soils are black soil and sod steppe soil. Lack of atmospheric humidity is compounded here by water conductivity of loamy and crushed stony soils. Consequence of extreme soil and climatic conditions is low biological productivity.

In summer of 2013 the authors conducted a landscape-geochemical work on the coast of Lake Baikal near the Sarma river, the Laninsky brook and other watercourses formed in the foothills of the Primorskiy Range near Sarminskiye goletz. Soils and surface waters of different origins have been sampled. Chemical analyzes of water and soil were conducted by conventional methods in a licensed chemical-analytical center of the Sochava Institute of Geography. Analyzes on the content of macro- and microelements were conducted by quantitative spectrometric methods with devices DFS-8 and atomic emission Optima 2000DV. The watercourses under consideration are popular recreation and tourism facilities, within their watersheds the tourist routes (Laninskaya and Sarminskaya trails) are scheduled. The river flow is formed in the foothills of the western slope of the Primorskiy Range. Annual rainfall in the steppe regions does not exceed 200–300 mm, increasing in the mountain taiga belt to 350–450 mm. Most of the heavy rain that falls occurs during the months of July and August. It is revealed, that the waters here are poor mineralized, the amount of ions in the water of the most sampled rivers varies from 40 to 128 dm<sup>3</sup>. The sum of ions in the water from the flood ice and the bog of the Laninskiy brook is 54 and 33 dm<sup>3</sup>, respectively. Mineralization of water increases in the area from the source to the mouth (40 to 71 dm<sup>3</sup>). By the time the mineralization in the sector line of the Laninskiy brook varies as follows: 71 mg/12 dm<sup>3</sup> on June, 12, 128 mg/dm<sup>3</sup> on June, 26 and 112 mg/dm<sup>3</sup> on July, 14. In the anions we observed pronounced predominance of HCO<sub>3</sub><sup>-</sup> – 30–45% eq. to (18–83 dm<sup>3</sup>). In the cations – the predominance of Ca<sup>2+</sup> – 24–34% eq. to (4,5–8,7 dm<sup>3</sup>). Mg<sup>2+</sup> content is in all samples below Ca<sup>2+</sup> and makes 10–20% eq. to (3,8–4,8 dm<sup>3</sup>). The chloride content in the rivers of the study area varies from 5,1 to 16,5% eq. to (5,3–5,6 dm<sup>3</sup>). Number of SO<sub>4</sub><sup>2-</sup> in waterways varies from 0,1–0,6% eq. to (0,1–0,3 dm<sup>3</sup>). The concentration of Na<sup>+</sup> ions in streams is 2,5–5,6% eq. to (1,2–3,6 dm<sup>3</sup>), and K<sup>+</sup> – 0,4–2,1% eq. to (0,4–2,3 dm<sup>3</sup>).

According to the ionic composition the river waters of the area under consideration are related

to the waters of calcium bicarbonate class group of type III. An exception is the sample from the Laninskiy brook from June 26, this water belongs to the first class. We noted an increased content of Fe and Al in the waters of bogs and at the source of the Laninskiy brook exceeding MPC (for drinking water) at 5 and 10 times, respectively, due to the hydrous and kaolinite, which are dominated among clay minerals of the parent rocks.

According to the results of chemical analysis of soils sampled from the profile of Sarminskiy goletz on the Primorskiy range to Lake Baikal it is revealed that the content of Mn (0,6%), Ni (128 mg/kg), Co (59 mg/kg), and Cr (137 mg/kg) in soils near

the tourist centers on the shore of Lake Baikal exceeds the maximum permissible limits in 4,2, 1,2, 1,4 – fold, respectively, due to the bedrock. Elevated concentrations of Pb (61 mg/kg) are found in podzolic soils near Sarminskiy goletz on the Laninskaya tourist trail that exceed the MPC twofold, which is associated with the parent rocks (Table).

Recently, the antropogenous pressure on landscapes of Preolkhonye increases significantly. There are many tourist facilities on the shore of Lake Baikal. Unregulated tourism is also developed. In order to prevent deterioration of the environment in the Olkhon there is a need in the complex analysis of the environment and regular monitoring of water and soil.

Macro- and microelements in soils of the Preolkhonye

Number	Vegetation	Soil	Floors	%						mg/kg							
				Fe	Ca	Mg	Ti	Mn	Ba	Sr	Cu	Ni	Co	Cr	V	Pb	
1	Pinus pumila and Bétula nána	Podzols	AY	4,1	0,6	0,6	6,1	0,10	575	214	54	55	9	82	75	61	
			E	3,6	0,2	0,4	7,5	0,07	330	168	12	33	4	63	63	14	
			Bfe	6,2	0,2	0,5	9,9	0,07	458	198	21	55	6	83	100	14	
2	Larch forest with Bétula nána Lédum palústre , ledun and Anophyte	Peety humic clay	Th	4,7	0,3	1,0	3,9	0,11	1159	147	105	62	19	61	61	13	
			Bg	7,1	0,5	0,2	5,5	0,16	1349	164	126	64	22	103	115	11	
3	Spruce forest with green moos	Peety humic	T	3,9	6,1	0,1	3,6	0,17	829	233	41	78	29	116	41	32	
4	Steppes with Artemisia absinthium, Festuca valesiaca, Calamagrostis sylvatica,	Chestnut	AY	1,9	1,6	0,8	3,3	0,11	331	174	13	20	5	55	37	23	
5	Volga fescue and Thymus	Chernozem shallow	AU	2,6	1,6	0,9	6,1	0,11	338	180	16	31	7	64	46	25	
			BCA	5,1	4,1	1,8	5,8	0,60	478	349	62	128	59	111	78	19	
6	Steppes with Stipa and Siberian wheatgrass	Chestnut	AU	5,1	8,6	2,2	5,5	0,31	485	275	79	107	25	137	97	23	

Notes: Place № 1 – Laninskaya tourist trail in subgoletz zone; 2 – Laninskaya trail on mountain taiga; 3 – tourist trail in submountains, near the Laninskiy brook; 4 – tourist centers on the shore of Lake Baikal; 5 – summer sport camp on the shore of Lake Baikal; 6 – tourist trail in Sarmonskoye hollow.

#### References

1. Abalakov A.D., Drovkov V.V., Pankeeva N.S. Organization of the Scientific-Training Ground "Sarma" in Lake Baikal Region // News of Irkutsk state university. A series: Sciences about the Earth. – 2012. – Vol. 5. – № 2. – P. 3–18.

2. Belozertseva I.A., Sorokovoy A.A., Dorygotov D., Batkhishig O., Ubugunov L.L., Badmaev N.B., Ubugunova V.I., Gyninova A.B., Balsanova L.D., Ubugunov V.L., Gonchikov B.N., Tsybikdorzhiev Ts.Ts. Soil cover // The Ecological Atlas of pool of lake Baikal. – Irkutsk: V.B. Sochava Institute of Geography SB RAS. 1:5000000 Mb. 2014.