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SURGICAL TREATMENT FOR LOCALLY ADVANCED LOWER THIRD RECTAL CANCER AFTER NEOADJUVANT CHEMORADIATION WITH CAPECITABINE: PROSPECTIVE PHASE II TRIAL

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Introduction: Treatment of rectal cancer requires a multidisciplinary approach with standardized surgical, pathological and radiotherapeutic procedures. Sphincter preserving surgery for cancer of the lower rectum needs a long-course of neoadjuvant treatments to reduce tumor volume, to induce down-staging that increases circumferential resection margin, and to facilitate surgery.

Aim: To evaluate the rate of anal sphincter preservation in low lying, resectable, locally advanced rectal cancer and the resectability rate in unresectable cases after neoadjuvant chemoradiation by oral Capecitabine.

Patients and methods: This trial included 43 patients with low lying (4–7 cm from anal verge) locally advanced rectal cancer, of which 33 were resectable. All patients received preoperative concurrent chemoradiation (45 Gy/25 fractions over 5 weeks with oral capecitabine 825 mg/m² twice daily on radiotherapy days), followed after 4–6 weeks by total mesorectal excision technique.

Results: Preoperative chemoradiation resulted in a complete pathologic response in 4 patients (9.3%; 95% CI 3–23.1) and an overall downstaging in 32 patients (74.4%; 95% CI 58.5–85). Sphincter sparing surgical procedures were done in 20 out of 43 patients (46.5%; 95% CI 31.5–62.2). The majority (75%) were of clinical T₃ disease. Toxicity was moderate and required no treatment interruption. Grade II anemia occurred in 4 patients (9.3%, 95% CI 3–23.1), leucopenia in 2 patients (4.7%, 95% CI 0.8–17) and radiation dermatitis in 4 patients (9.3%, 95% CI 3–23.1) respectively.

Conclusion: In patients with low lying, locally advanced rectal cancer, preoperative chemoradiation using oral capecitabine 825 mg/m², twice a day on radiotherapy days, was tolerable and effective in downstaging and resulted in 46.5% anal sphincter preservation rate.

Background

Management of rectal cancer requires multidisciplinary treatment with standardized surgical, pathological and radiotherapeutic procedures [1,2]. Preoperative chemoradiation is considered the preferred treatment option for locally advanced rectal cancer (LARC) to reduce the incidence of local recurrence. This option is based on the knowledge that irradiation before surgery is more dose and cost-effective than postoperative irradiation and less toxic. [3–5]. Sphincter preserving surgery for cancer of the lower rectum needs a long-course of neoadjuvant treatments to reduce tumor volume, to induce downstaging that increases circumferential resection margin, and to facilitate surgery [6].

Capecitabine is a fluoropyrimidine carbamate designed to generate 5-fluorouracil (5-FU) preferentially in tumor cells as concentration of the key enzyme thymidine

phosphorylase is higher in tumor cells compared with normal tissue. In preclinical studies, irradiation with thymidine phosphorylase was found to be upregulated in tumor tissue resulting in a supra-additive effect of capecitabine on radiotherapy [7–9]. Capecitabine is administered daily to mimic a continuous infusion of 5-FU [10].

Beyond the increase in convenience of using oral agents, data from phase II studies showed that the combination of preoperative capecitabine and radiotherapy in patients with LARC has significant anti-tumor activity, efficacy, and a low toxicity profile. These trials provide a clear rationale for replacing infusional 5-FU with oral capecitabine as part of chemoradiation [11, 12].

Patients and methods

This phase II trial included 43 patients and was conducted from March 2006 to September 2008 at Surgical Oncology Depart-

ment and Radiotherapy Department, South Egypt Cancer Institute, Assiut University, Egypt. This includes all new patients admitted to these departments during this period.

All patients underwent a complete clinical examination, including digital rectal examination (DRE), a chest X-ray, an abdomino-pelvic computed tomography (CT), a transrectal ultrasound (TRUS) and a colonoscopy. Laboratory studies include: complete blood count (CBC), kidney function tests, complete liver functions, random blood sugar, and coagulation profile. All patients underwent treatment with curative intent for a histologically confirmed adenocarcinoma of the rectum. Informed consent was taken from the patients and the study was approved by the institutional ethics committee.

Inclusion criteria

- Patients with lower third rectal carcinoma (within 47 cm of the anal verge using colonoscopy) with no clinical evidence of distant metastases

- Patients with T3-T4, N0 N1 disease

- Patients with a performance status < 2 according to the Eastern Cooperative Oncology Group (ECOG) system.

Exclusion criteria

- Previous pelvic irradiation therapy
- Previous history of malignant disease
- Any other serious illness and/or major organ dysfunction
- Pregnancy or lactation.

Primary endpoints were grade of tumor downstaging and rate of sphincter preservation. Downstaging was assessed by comparing clinical stage and postchemoradiation pathologic stage. Secondary end points were toxicity and postoperative complications. Toxicity was scored according to Radiation Therapy Oncology Group (RTOG) criteria.

Treatment details

Preoperative combined chemoradiation Radiotherapy

- **Target volume:** included the rectum and the draining lymph node chains (pararectal, hypogastric, presacral lymph nodes) and was defined using the simulator. Target volume was localized with the patient in the

prone position with a full bladder (to displace the small bowel anteriorly and superiorly). In the simulator, barium was introduced into the rectum and a wire marker was placed on the anal margin. Postero-anterior and lateral simulator films were taken. The contour of the pelvis was marked on the CT transverse section. The superior border of the target volume was placed at L5/S1 interspace, the inferior border at or distal to the obturator foramen and the lateral borders 1.5 cm outside the true bony pelvis. The anterior border was placed behind the symphysis pubis and the posterior border was placed 2 cm behind the sacrum.

- **Field arrangement:** Three field techniques were used (one posterior and two opposing wedged lateral fields) to give a homogeneous distribution to the target volume.

- **Dose and energy:** All patients were treated by a photon beam of either 6 or 15 MeV generated from a linear accelerator (Siemens Mevatron). The dose was 45 Gray in 25 fractions over 5 weeks prescribed at the isocenter of the plan according to ICRU report No. 50.

Chemotherapy

Capecitabine was administered orally at a dose of 825 mg/ m² twice a day only on radiotherapy days. The first daily dose was given two hours before radiotherapy and the second dose twelve hours later. Dose modifications were applied if the patient experienced any grade 3 or 4 haematological toxicity or any grade 3 nonhaematological toxicity, such as hand-foot syndrome, except for alopecia.

Evaluation

Approximately 4-6 weeks after completion of chemoradiation, physical examination, laboratory investigation and radiological studies (including CT scan of pelvis and abdomen) were performed to evaluate patients for the possibility of surgery.

Surgical procedure

According to the protocol of the study, surgery was performed 4-6 weeks after the end of preoperative chemoradiation. All operations were performed by a total mesorec-

tal excision technique which involves en-bloc resection of the rectum, perirectal fat and lymphoid tissue [13].

The decision to perform a low anterior resection versus an abdominoperineal resection depended on the distance of the lesion (after preoperative chemoradiation) from the anal verge and whether there was sphincter infiltration or not.

After histopathologic examination of the surgical specimens, rectal cancer regression grade (RCRG) was assessed, according to Wheeler et al. (2004) [14]. The three grades of RCRG are

- RCRG 1: Sterilization or only microscopic foci of adenocarcinoma with marked fibrosis
- RCRG 2: Marked fibrosis but macroscopic disease present.
- RCRG 3: Little or no fibrosis with abundant macroscopic disease.

Statistical methods

Kaplan-Meier estimates of survival and local recurrence free survival were estimated.

Results

Forty three patients with a lower third rectal cancer were included at this study; median age was 65 years old. Twenty eight patients were males and 15 patients were females with male to female ratio of 1.9: 1. Patients with T₄N₁ rectal cancer were considered unresectable (by pelvic CT scan) at presentation due to infiltration of the distal sacrum (in 3 patients), bladder neck infiltration (in 4 patients) and vaginal infiltration (in 3 patients). All patients and tumor characteristics are summarized in table 1.

Evaluation of the response to preoperative chemoradiation was presented in table 2. A complete pathologic response was found in 4 patients (9.3%, 95% CI 3–23.1). Overall downstaging was achieved in 32 patients (74.4%, 95% CI 58.5–85). No tumor progression had been observed. Postoperative pathologic assessment showed that T₀ disease was observed in 4 patients (9.3%), T₁ in 11 patients (25.6%), T₂ in 8 patients (18.6%), T₃ in 11 patients (25.6%), and T₄ in 9 patients (20.9%).

Table 1. Patient and tumor characteristics

Age:	
Median	65
Range	36–73
Gender, No. (%):	
Male	28 (65.1)
Female	15 (34.9)
Clinical tumor stage, No. (%):	
T ₃ N ₀	5 (11.6)
T ₃ N ₁	15 (34.9)
T ₄ N ₀	13 (30.2)
T ₄ N ₁	10 (23.3)
Performance status, No. (%)	
0	33 (76.7)
I	10 (23.3)
Distance from anal verge:	
Median (cm)	5.5
0 – <5 cm, No. (%)	16 (37.2)
5 – ≤ 7 cm, No. (%)	27 (62.8)

The majority of patients (26 patients; 60.5%), were classified as RCRG2 (table 3), while only 4 patients (9.3%) showed RCRG1, and 13 patients (30.2%) showed RCRG3. Seven out of 11 patients (64%) with ypT₃ tumor were classified as RCRG2.

The overall sphincter preservation rate in the present study was 46.5% (20 out of 43 patients; 95% CI 31.5– 62.2). Sphincter sparing surgical procedures were done in the majority of patients with clinical T₃ rectal cancer (15 out of 20 patients; 75%), and in only 5 out of 23 (21.7%) patients with clinical T₄ disease, 19 patients underwent abdominoperineal resection. Four patients with c T₄N₁ rectal cancer, showed no response to chemoradiation (ypT₄N₁ disease) and were considered unresectable during exploration because of tumor infiltration of the distal sacrum (in one patient), and presence of peritoneal deposits (in 3 patients). In those patients, palliative colostomy was done and biopsies from primary tumor and perirectal lymph nodes were taken. Sphincter preservation was achieved in the majority of patients with an initial tumor located 5 – ≤ 10 cm from anal verge (15 out of 27 patients; 55.6%) and in only 5 out of 16 patients (31.3%) with tumor located <5 cm. After a median follow up of 25 months (range 12–30 months), the 2 year overall sur-

vival was 79% (Fig. 1). There was only one patient out of 39 patients who underwent surgical resection due to local recurrence (2.5%), 18 months after treatment. This pa-

tient was reoperated for surgical resection of the recurrent tumor. The 2 year recurrence free survival rate was 75% (Fig. 2).

Table 2. Distribution of clinical tumor stage compared with postchemoradiation pathologic stage

Clinical staging	Postchemoradiotherapy pathologic (yp) staging									Total (%)
	ypT ₀ N ₀	ypT ₁ N ₀	ypT ₁ N ₁	ypT ₂ N ₀	ypT ₂ N ₁	ypT ₃ N ₀	ypT ₃ N ₁	ypT ₄ N ₀	ypT ₄ N ₁	
c T ₃ N ₀	4	1	0	0	0	0	0	0	0	5 (11.6)
c T ₃ N ₁	0	4	6	0	3	0	2	0	0	15 (34.9)
c T ₄ N ₀	0	0	0	5	0	3	0	5	0	13 (30.2)
c T ₄ N ₁	0	0	0	0	0	0	6	0	4	10 (23.3)
Total (%)	4 (9.3)	5 (11.6)	6 (14)	5 (11.6)	3 (7)	3 (7)	8 (18.6)	5 (11.6)	4 (9.3)	43 (100)

Toxicity was moderate and summarized in table 4. No hematological grade 3 or 4 toxicities occurred. Hematological toxicity was mild with grade II anemia in 4 patients (9.3%, 95% CI 3–23), and grade II leucopenia in 2 patients (4.7%, 95% CI 0.8–17). Regarding non hematological toxicity; hand-foot syndrome occurred only in one patient at the end of the treatment and required no treatment interruption. Grade II radiation dermatitis and diarrhea occurred in 4 patients (9.3%, 95% CI 3–23.1) and one patient (2.3%, 95% CI 0.1–13.8), respectively.

After completion of chemoradiation, sphincter conserving surgery was successfully performed in 20 patients (LAR in 19 patients and CAA in one patient, using hand-sewn technique in 14 patients and staplers in

6 patients, (due to short distal segment in 5 patients with lesions <5 cm from anal verge and narrow pelvis in one patient with lesions located 5–<10 cm from anal verge). Because of diabetes mellitus and atherosclerotic changes of mesenteric arteries, protective proximal stoma (colostomy) was applied in 3 patients. Nineteen patients underwent abdominoperineal resection. The circumferential resection margin was free in all cases. The postoperative 30 day mortality was not observed. Postoperative morbidity (10%) was in the form of anastomotic leakage (in one out of 20 patients; 5%), which healed conservatively and severe chest infection in one out of 20 patients; 5% (who underwent sphincter sparing surgery) and improved with broad spectrum antibiotics.

Table 3. Pathologic T stage compared with RCRG following chemoradiation

RCRG	Postchemoradiotherapy pathologic (yp) staging						Total
	ypT ₀	ypT ₁	ypT ₂	ypT ₃	ypT ₄	No.	% (CI)
I	4	0	0	0	0	4	9.3 (3.0–23.1)
2	0	11	8	7	0	26	60.5 (44.5–74.7)
3	0	0	0	4	9	13	30.2 (17.6–46.3)
Total (%)	4 (9.3)	11 (25.6)	8 (18.6)	11 (25.6)	9 (20.9)	43	100

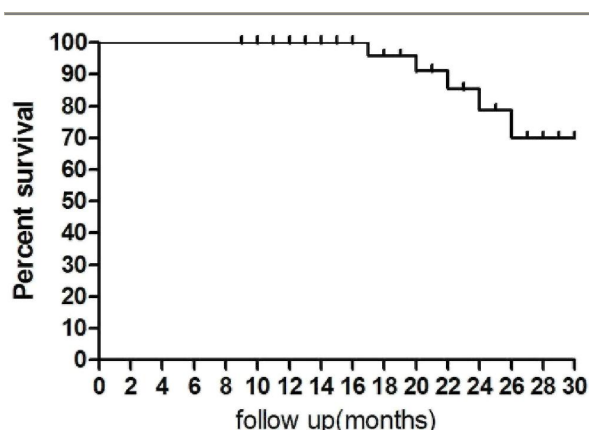


Figure 1. The two year overall survival. NB. After a median follow up of 25 months, the 2 year survival was 79%.

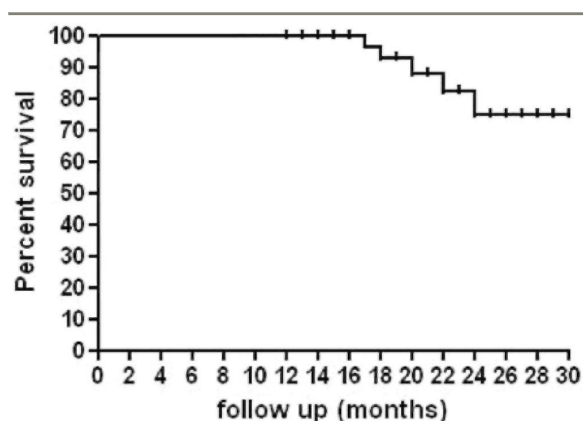


Figure 2. The two year recurrence free survival (NB. The 2 year recurrence free survival rate was 75%)

Discussion

The gold standard treatment for locally advanced rectal cancer is neoadjuvant chemoradiotherapy using 5-FU [15]. Because of the short half-life of 5-FU in plasma, it should be given during the course of fractionated radiotherapy in the form of prolonged intravenous infusions which is better tolerated than a bolus administration [16,17]. However, capecitabine (an oral fluoropyrimidine that mimics continuously infused 5-FU) can replace intravenous 5-FU and may further enhance efficacy and tolerability. Capecitabine generates 5-FU preferentially at the tumor site by increasing the higher activity of the enzyme thymidine phosphorylase in tumor tissue compared with the healthy tissue [7]. Therefore, exposure of normal tissues to 5-FU within the radiation field is likely to be lower with oral capecitabine compared with intravenous 5-FU. Capecitabine also has proven activity as both adjuvant and first line treatment for colorectal cancer. The results from two large, randomized phase III trials including over 1200 patients showed that oral capecitabine was more active than bolus 5-FU/LV in terms of tumor response (26% versus 17%), and produced at least equivalent time to disease progression and overall survival [11].

Table 4. Acute toxicity of preoperative chemoradiation

Toxicity	Grade I		Grade II	
	No	(CI)%	No	(CI)%
Anemia			4	9.3 (3.0–23.1)
Thrombocytopenia	10	23.3 (12.3–39.0)		
Leucopenia	10	23.3 (12.3–39.0)	2	4.7 (0.8–17.1)
Hand-Foot syndrome	1	2.3 (0.1–13.8)		
Radiation dermatitis	8	18.6 (8.9–33.9)	4	9.3 (3.0–23.1)
Nausea and vomiting	3	7.0 (1.8–20.2)		
Diarrhea	5	11.6 (4.3–25.9)	1	2.3 (0.1–13.8)

In a study on cost effectiveness for preoperative staging of rectal cancer, [18] evaluation with abdominal CT plus endorectal ultrasound (EUS) was found to be the most cost-effective approach compared with abdominal CT plus pelvic MRI and CT alone. Because EUS can delineate the layers of the rectal wall, it is superior to CT in staging accuracy. EUS and MRI can be used as complementary methods in the preoperative staging of rectal cancer. EUS is more accurate in determining bowel wall penetration of the tumor, while MRI is comparable to EUS in the evaluation of lymph node involvement [19,20]. In the present study, the preoperative

staging of rectal cancer was done by using abdominopelvic CT scan and EUS.

In light of the proven efficacy and safety benefits of the oral fluoropyrimidine capecitabine over bolus intravenous 5-FU/LV in the treatment of metastatic colorectal cancer and early stage colon cancer, a number of studies are evaluating capecitabine

as a replacement for 5-FU/LV in chemoradiation schedules for patients with rectal cancer, (table 5). Beyond the increase in convenience of using oral agents, there is also a clear rationale for improved efficacy, and a reduction in the toxicity associated with radiotherapy [11].

Table 5. Phase II studies of capecitabine chemoradiation regimens in patients with LARC

Reference	No. of evaluated patients	Treatment	Downstaging rate (%)	Response (%)	Sphincter preservation (%)	Main adverse events
De Bruine et al [10]	60	Pelvic RT(2 Gy/day, total 50 Gy) +C (825 mg/m ² b.i.d. on radiotherapy days) ×5 weeks	67	pCR (13)	50	Grade 3 diarrhea (2%), radiation dermatitis (3%).
De Paoli et al [21]	53	Pelvic RT (1.8 Gy/day, total 45 Gy) + presacral boost(3 × 1.8 Gy) + C (825 mg/m ² b.i.d.), 7-days/week	57	pCR (24)	59	Grade 3 leucopenia (4%), hand-foot syndrome (4%).
Dunst et al [22]	69 (efficacy) 63 (safety)	Pelvic RT (1.8 Gy/day) + presacral boost(3 × 1.8 Gy) + C (825 mg/m ² b.i.d.), ×6 weeks	73	pCR (4)	NR	Grade 3 leuko-/lymphocytopenia (10%), diarrhea (4%),
Dunst et al [23]	96	Pelvic RT (50.4–55.8 Gy, conventional fractionation) + C (825 mg/m ² b.i.d.)	61	pCR (7)	51	Grade 3 lymphopenia (12%), leucopenia (16%), hand-foot syndrome (12%), diarrhea(7%)
Dupuis et al [24]	51	Pelvic RT (1.8 Gy/day, total 45 Gy) + C (825 mg/m ² b.i.d.), 7-days/week	58	pCR (20)	58	Grade 3 diarrhea (12%), radiation dermatitis (8%).
Kim et al [25]	38	Pelvic RT (1.8 Gy/day) + presacral boost(3 × 1.8 Gy) + C (825 mg/m ² b.i.d.) + LV (20/m ² /day) days 1–14, 2 cycles of 14 days.	63	pCR (31)	72	Grade 3 hand-foot syndrome (7%), diarrhoea (4%), dermatitis (2%).
Lin et al [26]	53 (efficacy) 52 (safety)	Pelvic RT (1.8 Gy/day, total 45 Gy) + primary tumor/perirectal node RT(1.75 Gy/day, total 52.5 Gy) + C(825 mg/m ² b.i.d.) ×5 weeks	62	pCR (17)	NR	Grade 3 diarrhoea (13%), radiation dermatitis (6%)
Velenik et al [27]	57	Pelvic RT (1.8 Gy/day, total 45 Gy) + C (825 mg/m ² b.i.d.), 7-days/week	49	pCR (9)	65.5	Grade 3 dermatitis (34.5%), diarrhoea (3.6%),
Present study	43	Pelvic RT (1.8 Gy/day, total 45 Gy) +C (825 mg/m ² b.i.d. on radiotherapy days) ×5 weeks	74	pCR (9)	46.5	Grade 2 anemia(9%) leucopenia(5%), diarrhoea (4%) Grade I hand-foot syndrome (2%).

The comparison of initial diagnosis and pathological findings showed downstaging in 32 patients (74.4%), with pathologically determined complete response rate (ypT₀N₀ disease) of 9.3% (4 out of 43 patients). The downstaging rate in the present study is comparable to those in most of phase II studies of chemoradiation regimens where the downstaging rates ranged from 58% to 73% [10, 21-26]. On the other hand, our figure is much higher than that reported by Velinik et al., [27] (49%). The main reason for the lower downstaging rate in the reported study could be the prolonged radiotherapy course in 45.5% of patients with treatment interruptions of 3 days or more introduced in 18% of them. The pathological complete response rate, ranged from 4 to 31% in most of the reported studies [10, 21-27]. The pathological complete response rate in the current study (9%) is comparable with those found by Dunst et al, [22] (4%), Dunst et al, [23](7%), and Velenik et al, [27] (9%). On the other hand, it is lower than that reported by De Bruin et al. [10](13%), De Paoli et al, [21] (24%), and Kim et al, [25](31%). The higher figures in the reported studies than that in the present study may be due to more favorable distribution of T stage [10, 21] or the use of radiation boost to tumor as well as use of leucovorine in addition to capecitabine [25]. In the subgroup of our patients, with unresectable rectal cancer (10 patients with T₄N₁ disease), the resectability rate was 60% (6 out of 10 patients). The unresectable 4 cases were one patient with persistent sacral infiltration and 3 cases with peritoneal deposits diagnosed during exploration. The resectability rate in those patients is comparable with that found by Veditic et al. [28] (62%) and lower than that reported by Glimelius et al. [29](71%). The use of methotrexate, 5-FU and leucovorine as the chemotherapy regimen, in the reported study, may explain their higher figure of resectability rate [29].

In the present study, complete response to chemoradiotherapy resulted in favorable tumor and nodal stage. However, despite a

complete regression of the mural tumor, the mesorectum can harbor residual cancer deposits. Therefore, even those in whom a complete response is suspected should undergo standard excisional surgery [30].

The sphincter preservation rate, in the present study, was 46.5% (20 out of 43 patients). The reported sphincter preservation rates ranged from 50% to 72% [10,21,23,25,27]. These higher rates in the reported studies than that in the current study, may be due to higher radiotherapy dose (50 Gy) [10,25], capecitabine administration throughout the radiotherapy period including weekends [21,23,24], the more favorable distribution of T stage, [25,27] or the use of leucovorine in addition to capecitabine in the chemotherapy regimen. [25]

Sphincter preservation was achieved in the majority of patients with initial tumor located 5 – ≤ 10 cm from anal verge (55.6%) and in only 5 out of 16 patients (31.3%) with tumor located <5 cm from anal verge. This is in agreement with De Bruin et al. [10] who found a sphincter preservation rate of 25% in patients with initial rectal cancer <5 cm from anal verge compared to 65% in tumors 5 – 10 cm from anal verge. However, many authors stated that the decision to perform radical surgery (APR) should not be changed even when downstaging occurs. Between 1999 and 2002, 316 patients from 19 institutions were enrolled. [31] The sphincter preservation rate was 61% in the 5 Ч 5 Gy radiotherapy arm and 58% in the radiochemotherapy arm, $p = 0.57$. Despite significant downsizing, chemoradiation did not result in increased sphincter preservation rate in comparison with short-term preoperative radiotherapy. The surgeons' decisions were subjective and based on pre-treatment tumour volume at least in clinical complete responders [31].

No hematological grade 3 or 4 toxicities occurred. Grade II anemia occurred in 9.3% and grade II leucopenia in 4.7% of patients. Hand-foot syndrome occurred only in one patient at the end of the treatment and required no treatment interruption. Grade II

radiation dermatitis and diarrhea occurred in 9.3% and in 2.3% of patients respectively. The incidence of acute toxicity in the present study is obviously lower than other phase II trials using capecitabine, where 4–16% grade 3 leucopenia [21–23], 2% grade 4 anemia and neutropenia [32], 4–12% grade 3 hand-foot syndrome [21,23,25] and 2–13% grade 3 diarrhea [10,21–27] and 2–34.5% grade 3 radiation dermatitis [10,24–27] were reported. These differences can be explained on the ground of use of presacral boost [21,23,25,26] and capecitabine administration. In the present study, because of the two-day resting period every 5 days (i.e. capecitabine was given on radiation days only), toxicity might therefore be lower than that in the reported series, where capecitabine was administered twice daily, seven days a week. [10,21–27]

Conclusion

Despite statements by other authors that chemoradiation did not result in increase sphincter preservation rate, our study showed a 74.4% downstaging rate and 46.5% sphincter preservation rate. Therefore, preoperative chemoradiation using capecitabine (825 mg/m² twice a day) may be applied to patients with locally advanced low lying rectal cancer for downstaging and facilitate sphincter preservative surgery. Further studies with longer follow up period are recommended to assess the effect of this protocol on survival.

Consent

Written informed consent was obtained from all patients. Institutional approval was taken before the start of this study.

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THE PROMISE OF LONG-TERM EFFECTIVENESS OF SCHOOL-BASED SMOKING PREVENTION PROGRAMS: A CRITICAL REVIEW OF REVIEWS

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I provide a review and critique of meta-analyses and systematic reviews of school-based smoking prevention programs that focus on long-term effects. Several of these reviews conclude that the effects of school-based smoking prevention programs are small and find no evidence that they have significant long-term effects. I find that these reviews all have methodological problems limiting their conclusions. These include severe limiting of the studies included because of performance bias, student attrition, non-reporting of ICCs, inappropriate classification of intervention approach, and inclusion of programs that had no short-term effects. The more-inclusive meta-analyses suggest that school-based smoking prevention programs can have significant and practical effects in both the short and the long-term. Findings suggest that school-based smoking prevention programs can have significant long-term effects if they: 1) are interactive social influences or social skills programs; that 2) involve 15 or more sessions, including some up to at least ninth grade; that 3) produce substantial short-term effects. The effects do decay over time if the interventions are stopped or withdrawn, but this is true of any kind of intervention.

Background

Researchers and others have developed many school-based tobacco prevention programs over the past 30 years. Early approaches to smoking prevention went through several phases: informational, affective/motivational and psychosocial. Thompson [1], in a review of all English language papers on smoking prevention between 1960 and 1976, concluded that most methods evaluated up to that time, i.e., informational and affective approaches, were not effective and this was echoed by Beattie [2]. Many programs can change knowledge, but such change is not, by itself, enough to alter behavior [3] and, in any case, quickly decays [4]. Sometimes, information can actually make behavior worse [3,5] as can some affective programs [6]. U.S. Government agencies concluded during the late 1980's and early 1990's that traditional approaches (informational and affective) were largely ineffective and that the approaches based on social-psychological models [7,8] were modestly effective across a variety of settings, times and populations [9-12].

Over a dozen reviews of approaches to tobacco control or substance abuse prevention published since the early 1990's have included school-based smoking prevention within their realm [9,11,13-27]. Some of these reviews were broad-based and non-

systematic, and some were very systematic. Earlier reviews of this type always included school-based smoking prevention as a critical component of effective broad-based tobacco control. Many of the later reviews, especially after Lantz et al [18] tended not to include school-based prevention as an important component in broad-based tobacco control.

Lantz et al [18] concluded that "The long term impact of school based educational interventions is of concern" (page 49). However, they then emphasize the need to combine school-based prevention with media programming, other tobacco control efforts, and other problem behavior prevention efforts. Dobbins et al [28] recently concluded that "there is reason for optimism regarding the effectiveness of prevention programs on smoking behavior and initiation, albeit in the short-term." (page. 296).

During this same period there were many reviews [10,28,37] and meta-analyses [4,34,38-43] of school-based smoking prevention. These reviews and meta-analyses repeatedly reinforced the fact that informational and affective programs do not work to change behavior. Furthermore, meta-analyses further (established the fact that some psychosocial programs and strategies, particularly those that are interactive programs based on the social influences approach (educating youth about social norms and in-

fluences and providing skills for resisting such influences), can be effective.

However, findings in the field are sometimes confusing to practitioners and policy makers because some early or short psychosocial programs reported promising short-term effects that did not last [44-48]. In addition, some tested programs simply were not effective [49]. DARE is a prime example of a program that seems to be similar to many successful programs in many ways, yet it has been proven in multiple studies and two meta-analyses [50,52]. These mixed results have led some to question the overall value of school-based smoking prevention [53].

I now provide a critical review of findings from prior meta-analyses and reviews. In an accompanying paper [54] I will provide a review of selected school-based smoking prevention programs with the promise of long-term effectiveness.

Review of meta-analyses and the cochrane review

My objective is to provide a critical review of past reviews to determine whether or not school-based smoking prevention can be effective. Meta-analyses of school-based prevention programs have used various criteria and so have varied in scope, from focusing only on the quality of eleven evaluations (and not their outcomes) [34], to including 74 smoking prevention studies among 207 substance prevention studies [41], including evaluations of 65 separate programs [4], to reviewing 94 randomized trials of school-based smoking prevention but reviewing only 23 of them in detail because of methodological limitations with the rest [33]. Reviews of the long-term effects have also varied in scope from including 25 studies with at least 2-year follow-ups [21], to including only 8 studies with grade 12 (or age 18) outcome data [43]. The result has been a confusing array of findings, ranging from precise effect sizes for some types of programs [4,41] to a conclusion that most school-based prevention programs do not work [43,53]

Nan Tobler [55] summarized her series of meta-analyses and suggested that *pro-*

grams that used interactive learning strategies and involved same or similar-age peers as leaders or facilitators were most effective. Tobler and colleagues found that smoking prevention programs produced an average effect size of 0.16, with "interactive" programs producing a significantly larger effect size than non-interactive programs (0.17 versus 0.05) [41]. Tobler and colleagues [41] also found that programs that address multiple substances were less effective at reducing tobacco use than programs that targeted only tobacco (ES = .10 vs. .17) – but they had the added benefit of reducing alcohol and other substance use as well. They also found program effects to be larger in schools with predominantly special or high-risk (minority, high absenteeism or dropout, poor academic records) populations. This is an important finding suggesting that these programs can reduce the gap between low and high-risk groups of adolescents.

Hwang and colleagues [4] estimated an average short-term effect size of .19 for smoking behavior outcomes from the 65 programs they reviewed. They reported effect sizes of .22 for attitudes and skill, and .53 for knowledge. They found that all effects were smaller at delayed follow-ups. Behavior barely decayed over 1–3 years (to .18) but decayed by half (.09) at follow-ups of 3 or more years without further programming. Knowledge decayed dramatically by 1 year follow-up (to .19), and attitudes and skills decayed to about half their original effects by 1 year follow-up (.10 and .09, respectively).

Hwang and colleagues [4] also estimated the effects of different approaches to smoking prevention operationally defined as follows. Social Influence (SI) programs addressed immediate health, social, and cosmetic effects of smoking; peer and media influences; social norms, expectations, and acceptance; and other information; as well as social skills such as modeling, role-playing, and/or group practice. Cognitive-behavioral (CB) programs included the elements of the SI approach plus at least two cognitive skills such as problem-solving, decision-making,

assertiveness, self-control, and/or other coping skills. Life Skills (LS) programs included the components of the SI and CB programs plus at least one affective skill such as self-confidence (self-efficacy), values clarification, and/or generic social skills. A second way of distinguishing programs was by their setting levels: exclusively school-based only or school plus community settings. The latter setting level was defined as including at least one of the following: community members (mass media, community key workers, parent/family members) and any community involving activity such as homework assignments, awareness activities, organized campaigns, sports or cultural activities; efforts to develop and enforce a policy on tobacco use in schools or community; or volunteer work in the community.

Hwang et al. [4] found that social influences approaches had average effect sizes for short-term, 1–3 years and > 3 years smoking prevention, respectively, of .12, .15 and .07; cognitive behavioral approaches had effect sizes of .21, .21 and NA; Life skills of .29, .16 and NA. I do not consider these differences in effect sizes between types of programs to be very meaningful because a) it is very difficult to categorize programs accurately and, in any case, many of the differences between types of programs have, in practice, been minimized over time as researchers interacted and mixed components, and b) some of the differences between categories may be due to single research groups conducting multiple studies of one program that obtained unusually large effect sizes, as Hwang et al pointed out. For example, Steve Schinke and Lew Gilchrist (University of Washington) published results from 7 different small-scale studies of programs that Hwang categorized as using the CB approach, in which students rather than schools were randomly assigned to conditions, with higher effect sizes than most other programs and few long-term follow-ups. Similarly Gilbert Botvin conducted 9 of the 12 studies classified in this meta-analysis as life skills,

with an average effect size of .44, considerably larger than the others in that category.

Regarding setting, Hwang et al [4] found that school-only programs reported effect sizes of .22, .16 and .06 at short-term, 1–3 years and > 3 years, respectively; and school plus community programs reported effect sizes of .16, .21, and NA. Again, I do not place much confidence in these estimates because a) the school plus community category includes such a wide range of different types of activities and b) the underlying school program varied greatly among them. In a previous systematic review of school and school plus community programs [56], I concluded that *school plus community programs produce about double the effect when the type of school program is held constant*.

Rooney and Murray's [40] meta-analysis of 131 smoking prevention programs adjusted for studies with a unit of analysis error, although this had little effect on the overall effect sizes. The average effect size was around 0.10 at long-term follow-up. This would approximate to a 4% relative reduction in smoking. Using a modeling approach, the authors estimated that the impact could be increased if programs began around sixth grade as part of a multi-component health program, gave same-age peer leaders a role in program delivery, and used booster sessions. They estimated that this might achieve a relative reduction in smoking of between 19% and 29%.

Thomas and Perera [33] completed the most thorough systematic (Cochrane) review of school-based smoking prevention studies to date with a minimum of 6 months follow-up after the completion of the intervention. They reviewed only randomized trials and found 94 of them (115 others identified as RTCs were eliminated because the reviewers determined that they were not really RCTs or because the follow-up was less than 6 months after the end of the intervention). They rated the methodological biases of each study and separated studies into those with minimal risk of bias (category 1), medium risk of bias (category 2) and high risk of bias (category

3). Six areas of possible bias were considered for their bias rating: 1) selection bias (baseline differences due to imperfect randomization or no report of exactly how randomization was conducted or whether it was concealed), 2) performance bias (due to problems with program implementation or contamination of the control group), 3) attrition bias (due to attrition rates of 20% or more or differential attrition by condition), 4) detection bias (due to differences in outcome assessment), 5) statistical power bias (due to inadequate power or no power analysis reported), and 6) statistical bias (due to inappropriate analysis such as not taking account of clustering or ICCs were not reported). Based on these ratings, they found and analyzed in detail only 23 studies of the highest quality (that suffered from the least bias). Of the remainder of the studies, 31 were rated to be in category 2 and 40 in category 3.

These are rather rigid criteria, and even many high-quality studies of school-based programs cannot meet them all, partly because many of the criteria are outside the control of researchers and partly because of editorial decisions by journals. For example, performance bias is likely in any school-based effectiveness trial, where regular school teachers or other providers deliver the program, compared with an efficacy trial, in which research staff deliver the intervention. However, this kind of bias is likely to lead to an underestimation rather than an overestimation of program efficacy, although potentially a true estimate of effectiveness under real-world conditions. The second kind of performance bias, contamination of the control group has become more likely historically, at least in most developed countries, as more and more schools already have some form of smoking prevention program, often derived from the same theoretical principles as the program being evaluated. Again, however, such bias is likely to lead to an underestimation of program effectiveness (because the control group is doing smoking education in their "business-as-usual" mode rather than no smoking education).

Attrition is an issue that was more of a problem when the field considered the student as the unit of analysis. Now that we (correctly) take the school to be the unit of analysis (as well as of random assignment and program delivery), the amount of attrition at the individual student level is less of an issue (as long as it is similar across conditions in both magnitude and type). In addition, attrition is likely to be high in schools with high turnover, the very schools many studies have deliberately selected for their studies because students in these schools are at highest risk for smoking. Non-differential attrition may reduce external validity (generalizability) of study results but not the internal validity (bias). Although attrition should be assessed and any differential attrition reported (and adjusted for in analyses if appropriate), *studies should not automatically be penalized based on levels of student attrition*. On the other hand, if one or more schools drops out of a study, that would be a great cause for concern.

Another consideration is that journals often will not publish all of the details of studies. For example, they often do not care to know whether randomization was concealed or not. They usually do not require that ICCs be reported, and only a few researchers have reported them. Analytical approaches have changed over time as statisticians have developed the methods to handle clustered data. Thomas and Perera determined statistical significance from their own analysis of odds ratios – the odds of baseline never smokers starting to smoke by posttest in the intervention group compared to the control group. When ICCs were not reported, they assumed an ICC of .097, the average found in a limited set of older studies [57]. This approach probably has lower statistical power than necessary and, in many cases, led to a decision that a difference that was reported as significant by the original authors was judged to be non-significant by these reviewers. Thus, this approach leads to a bias against finding significant effects.

Another criterion that might be overly strict is requiring at least one assessment at least 6 months beyond the end of the intervention. As interventions have become more comprehensive and longer-lasting, it is becoming more difficult to meet this standard. For example, many programs include some type of follow-up sessions during high school. It is not clear that a study should be excluded from consideration in a review because the last posttest was less than 6 months after the last session, albeit at the end of high school, when the bulk of the intervention may have occurred several years earlier.

It is not clear that eliminating many studies because of the types of issues discussed above is beneficial to the field

It leads to the omission from consideration of many important studies, at least just as many of which may be biased to an underestimate of effect size as are biased to an overestimate of effect size. The overwhelming focus on methods is also at the expense of an informed focus on the interventions. A better approach would be thorough meta-analyses that provide analyses of the effects of methodological issues as well as programmatic ones [58].

Regarding program types, Thomas and Perera assigned studies to the groups of information-only, social competence (the Good Behavior Game and the Seattle Social Development Program), social influences (56 trials, 13 of which met the criteria for category 1), combined social competence/influences (e.g., Life Skills Training, Towards No Tobacco, Child Development Project), and multimodal (i.e., including family or community components). Some of the assignments are questionable. One glaring question, for example, concerns why most of Gilbert Botvin's studies of Life Skills Training were assigned to the combined social influences/competence category, yet one was assigned to the social influences group. A study by Ausems and colleagues [59] and another by Crone and colleagues [60] were of interventions that clearly included social influences components but they were catego-

rized in the information-only category. There are many other examples of questionable assignment; as Thomas and Perera acknowledge (page 10), it is extraordinarily difficult for people not intimately involved in the field to determine how to group the different interventions. Most prior reviews and meta-analyses by people outside of prevention have had major problems with this. Nan Tobler probably did the best job of overcoming this, particularly in her later papers as she learned more and more about the programs she was dealing with. In addition, over time, the programs have become more and more alike as they incorporate ideas from each other. There is no longer much that separates some of the programs assigned to the social competence and social influence groups.

The only outcome reported by Thomas and Perera was the prevalence of smoking among pretest never smokers. They did not include other possible outcomes, such as changes in the proportion of ever, weekly or monthly smokers. This also unnecessarily limited the studies that were considered.

Within all of the above constraints, Thomas and Perera concluded that:

1. There is little evidence that information alone is effective (only one study in this category met their inclusion criteria).

2. Nine (which they usually characterize as half in their text) of 13 studies of social influences that met their criteria demonstrated effects and 4 did not.

3. The most rigorous and long-lasting test (65 lessons over 8 years) of a social influences program (Hutchinson) was not effective (see further discussion of this study below).

4. There was limited evidence for the effectiveness of social competence programs (only two studies met criteria for inclusion).

5. Of only 3 high-quality studies of the combination of social competence and social influences, only one showed a significant effect and one showed a significant effect only for the health-educator led condition (but not the "self-instruction" condition).

6. Three of the 4 studies of multimodal approaches that met standards for inclusion produced positive effects (characterized in the text as providing limited evidence of effectiveness).

7. There is little evidence of the long-term effectiveness of smoking prevention programs.

The conclusions reached in this review are overly restrictive for several reasons. First, as pointed out above, too many studies were eliminated from consideration for suspicions of bias that are unreasonably strict. Second, evaluations of DARE, a program that is known to be ineffective from several RCTs and two prior meta-analyses were included with the social influences group. Although DARE is partly based on the social influence approach, it is clearly a very poor example of it (see further discussion below). Third, the focus on the Hutchinson study is unwarranted – it is an example of a preoccupation with methods leading to misleading conclusions – as detailed information about the intervention or data on the short-term effects of the program have never been reported (see further discussion below). There is no way to judge whether or not it was a good example of the social influences approach or another watered-down approach like the DARE program.

Reviews of Long-term effects

As noted above, Thomas and Perera concluded that there is little evidence of the long-term effectiveness of smoking prevention programs. Other recent reviews also raised questions about the long-term (high school or beyond) effects of school-based smoking prevention programs.

Wiehe et al. [43] conducted a meta-analysis of the only 8 studies they could find with results reported at grade 12 or age 18. These included evaluations of programs of known ineffectiveness from prior studies (e.g., Hutchinson and DARE). Other studies included in the meta-analysis were early studies of the social influences approach [47,61] that, in retrospect, we should never have expected to have long-term, or even

medium-term, effects. These programs were initial small-scale experimental tests of the social influences approach that included only 5–10 sessions in one or two grades without any boosters or programming in high school. Another was Project ALERT, which consisted of only 8 sessions in 7th grade and three booster sessions in 8th grade [44]. Clearly, programs need to include more sessions, preferably with some in high school, to be effective in the long term. This is a conclusion that could have been proposed by Wiehe et al but wasn't.

Of the studies reviewed by Wiehe et al., only the Life Skills Training (LST) program, which is an interactive program of 15 sessions in 7th grade, 10 in 9th grade, and 5 in 10th grade that incorporates the social influences approach as well as other general personal and social skills, was effective at long-term follow-up. Wiehe et al. concluded that "there is little evidence to suggest that existing programs produce medium-term decreases in smoking prevalence (page 168)." In an editorial comment, Glantz and Mandel [53] misleadingly stated that the Wiehe et al. review of long-term trials "convincingly shows that they are not effective (page 157)." [62]. They then discount the LST program evaluation because of the use of one-tailed t-tests and the failure to take account of multiple comparisons. However, it is perfectly appropriate to use one-tailed t-tests when a clear hypothesis is stated, and adjusting for multiple comparisons would not have eliminated the significant effects. In addition, the short-term effects of LST have been replicated in multiple studies (see below).

Glantz and Mandel suggest that all aspects of smoking education should be integrated into regular core curriculum classes. This approach has not been shown to be effective. Furthermore, it is not likely to happen in the near future because of the current demands on schools, nor is it likely to be effective because one would expect much less adherence to the program components if the program was delivered by multiple teachers.

Skara and Sussman [21] reviewed studies of 25 tobacco and other drug prevention programs that included long-term follow-ups (at least 24 months). They found that 18 of the 25 studies reported significant short-term effects and 15 of 25 reported significant long-term effects. Of 17 studies with pretest and posttest data, 11 (65%) reported significant long-term effects, with an average reduction in the percentage of baseline non-users who initiated smoking in the program condition relative to control conditions of 11.4% (range 9 to 14.2%). Of the studies with significant short-term effects, 72% (13 of 18) were found to have significant long-term effects. Results also indicated that program effects were less likely to decay for programs with extended programming or booster sessions.

Summary of review of reviews

Although meta-analyses and systematic reviews provide some very useful information (as well as some misleading information sometimes) for scholars, they do not provide enough information of value to policy makers and practitioners

Indeed, meta-analyses can obscure some kinds of information, particularly when there are wide variations between the types of interventions being reviewed. Meta-analyses make more sense in medicine, where the effects of the same drug or procedure can be estimated from multiple trials. In a field like school-based smoking prevention, one is often comparing different kinds of programs with differing formats, theoretical orientations, targeted behaviors, and targeted populations and age groups. Furthermore, different programs were developed by different researchers or practitioners with different theoretical or philosophical orientations (sometimes even when they claim to be the same), and implemented by different providers who, themselves, have different training and readiness for the work. There are also large differences among studies in research design and the measurement of smoking behavior. It really takes someone who is intimately familiar with a body of research and

program development to conduct the most useful kind of in-depth review of a field like smoking prevention, where different programmers and programs have different training, theoretical bases and degree of understanding of children, youth and their families and other social settings, such as peer groups, schools and communities.

Despite the above short-comings, the meta-analyses by Tobler and Hwang provide clear directions on what types of programs are most effective. On the basis of a systematic review of reviews and individual studies of mediators, boosters, peer-versus adult-led, community components, Pim Cuijpers [63] developed a nice summary of the effective ingredients of effective drug prevention programs. These include:

1. Interactive delivery methods
2. The use of the social influence model (defined more broadly than by Hwang – see below)
3. Including components on norms, commitment not to use, and intentions not to use
4. Adding community components
5. Including the use of peer leaders rather than relying totally on adult providers
6. Including training and practice in the use of refusal and other life skills

In addition, meta-analyses have established that programs that have more sessions, and that continue for multiple years are more effective.

Additional comments on reviews and metaanalyses

Some programs are not effective

Many smoking prevention programs and activities that have received lots of attention are not effective, especially in the long term, when evaluated fully. Examples include one-time visiting speakers, other one-day special events, poster competitions, lotteries, etc. A high-profile example in the literature is the "No Smoking Class" competition, first established in Finland, where it has been carried out annually since 1989 [64], and expended to seven countries in 1997/98 [65]. Each participating class has to decide if

they want to be a "Smoke-free Class" for the six-month period from fall to spring. Classes monitor their (non-)smoking behavior and report it to the teacher regularly. Classes in which pupils report refraining from smoking for this period of time participate in a prize draw, where they can win a number of attractive prizes, including trips to other European countries. In addition, three lessons are provided by teachers. Nonrandomized studies with high rates of attrition of schools suggest that the program has immediate effects [64,66,67]. However, all three long-term (15-month, 18-month and 12-month) follow-up studies, two randomized trials and one not [60,64,68], demonstrated that the small immediate effects were not maintained. From theory and other research, we would expect this.

The Hutchinson project (conducted at the Fred Hutchinson Cancer Center, University of Washington) is another ineffective program, the evaluation of which has received lots of attention because it was of high quality and long term. The project was designed to be a multiyear (grades 3–10) social influences tobacco prevention program. A large randomized trial (20 school groups per condition) produced no significant effects at the end of grade 12 or 2 years later [49]. These findings are impossible to interpret, because the investigators have never reported what effects there were or were not at any other time, including prior to entering high school (when most other programs report short-term results) or at the end of the program (grade 10). *The effects of an intervention should be measured immediately or shortly after the program, and then the long-term measurement should serve to assess how permanent the effect is, or how quickly it decays.*

Certainly, one cannot use the Peterson et al. results to conclude that the social influences approach to smoking prevention is ineffective in the long-term deterrence of smoking among youth, as these authors did. These results must be interpreted in the con-

text of the many other studies of the social influences approach in the literature [69,70].

The DARE (Drug Awareness and Resistance Education) Program was developed by the Los Angeles Police Department (LAPD) and the Los Angeles Unified School District (LAUSD) in the early 1980s. They essentially took the two variants of Project SMART (Self Management and Resistance Training) that were being tested with grade 7 students in LAUSD schools at the time [71], combined them, and added a great deal of information about drugs (including, in some variants of the program as delivered, what they looked like, where to get them, and how to take them), for LAPD police officers to deliver to grade 5 and 6 students. The results of a randomized trial of the two SMART variants found that the resistance skills program was effective and the self-management program actually led to increased drug use relative to control group students [71,72]. These results, combined with our knowledge that information usually does not influence behavior very much or actually makes things worse [3,5] and the use of police officers who are not usually highly skilled teachers, make it no great surprise that DARE is not effective.

Although early nonrandomized studies suggested that DARE sometimes had small effects for elementary school students, multiple randomized trials [50,73–77] and meta-analyses [51,52] have shown that DARE has little or no impact on drug use in the short-term and none in the long term. In response, DARE has developed new programs for junior and senior high school students; the junior high program also has been shown to be ineffective [78,79] and evaluations of the high school program are not yet completed.

Many health education programs are promoted as being effective even without good evaluation data. One smoking prevention program in this category is the "Tar Wars" program for elementary students operated by the American Academy of Family Physicians <http://www.tarwars.org>. Physicians or medical student volunteers go into

4th and 5th grade classrooms and provide one interactive 45-minute session that focuses on the short-term, image-based consequences of tobacco use. This is preceded by a lesson provided by the regular classroom teacher to teach students that, contrary to their perception, tobacco users are in the minority. The guest session is followed by a poster contest. A quasi-experimental evaluation suggests that this program produces short-term changes in knowledge [80]. Despite the lack of rigorous evaluation data, the

AAFP claims that this program has reached 8 million children in 50 states and 13 countries [80], including developing countries such as Nepal (see <http://www.tarwars.org/online/tarwars/home.html> accessed January 18, 2008).

Another program that has been promoted as being an effective prevention program, but that had no long-term effects on smoking, is the Michigan Health Education Model. It consists of 30 lessons taught during grades 5–8, some of which include resistance skills training. Although it produced an 82% relative improvement (RI) in ever smoking at the end of the program [48,81], no significant effects on smoking behavior remained by the end of grade 12 – indeed, there was a negative effect for boys [48]. It seems that the prevention content of this program was not intensive or long enough to produce permanent effects, that additional programming might have been needed when the students were adolescents, and/or that some content may even have had a negative effect as some older informational programs did.

Even programs of "proven effectiveness" do not always work

"Evidence-based practice" and other related terms have become common terms and standards in the U.S. and other countries in recent years. Multiple agencies have reviewed evaluation studies of substance abuse prevention programs and produced lists of "scientifically proven" or "evidence-based" programs (For one list of lists see <http://www.cdc.gov/HealthyYouth/AdolescentHealth/registries.htm> accessed January

18 2007). The University of Colorado provides a comparative matrix <http://www.colorado.edu/cspv/blueprints/matrix.html> accessed January 19, 2007). For one list of lists see <http://www.cdc.gov/HealthyYouth/AdolescentHealth/registries.htm> accessed January 18 2007). The University of Colorado provides a comparative matrix (<http://www.colorado.edu/cspv/blueprints/matrix.html> accessed January 19, 2007). The stated purpose of these lists and guides is to help decision makers, at both the federal and local levels, choose programs that are supported by the best available evidence [82]. These many lists have been confusing for practitioners because each uses different criteria and produces very different lists of "proven" programs [83, 84], yet they can have a profound influence on decision making. For example, after the U.S. Department of Education compiled one such list (of 9 "exemplary" and 33 "promising" programs) with the help of a panel of eminent prevention researchers, most school districts using Federal funds believed that they had to select a program from that list [85].

Another difficulty with these lists is that some of the programs that appear on them have very limited evidence of effectiveness [84]. Gandhi and colleagues analyzed the reported effects of five prominent programs that appeared on one or more of seven prominent lists of substance abuse prevention programs. They found limited evidence showing substantial impact on drug use behavior, even at immediate posttests for most programs, with the evidence for the effectiveness of most programs coming from only one or two studies, usually conducted by the program developers. In particular, they found very few studies showing substantial impact at longer follow-ups. Thus, even many of the programs that qualify for even the most rigorous of these lists do not yet have the kinds of data to meet rigorous standards of evidence required for being of proven efficacy, effectiveness or readiness for dissemination [83].

Policy makers and educators must be cautious about how they go about adopting and implementing smoking prevention programs, even those of "proven effectiveness"

Just because a program has been proven effective in a randomized trial does not mean that it will always be effective when delivered to different types of students (who may differ by age, culture or personality), by different providers (trained health educators, research staff, other types of visiting instructors, regular teachers), in different settings (e.g., community agencies, after-school programs). A clear example of this is the European Smoking prevention Framework Approach (ESFA) [86]. The ESFA was initiated in 1997 as a community intervention trial conducted in six countries (Denmark, Finland, the Netherlands, Portugal, Spain and the UK). It used an integrated preventive approach to smoking prevention guided by best-practice principles available at the time [12]. It targeted adolescents in and out of school as well as their parents and the schools themselves [86,87]. Short-term effects 1 year after the pre-test [87] were non-significant overall but significant effects were observed in Finland (smoking onset was 4.7% lower) and Spain (smoking onset was 3.1% lower); however, counter-productive trends were observed in Denmark and the UK. Long-term overall effects [88] were small but significant (RI = 6.4%), with larger effects in Finland (RI = 14.8% for weekly smoking, but no effect for ever smoking – see Vartiainen et al. [89] for more detail), Portugal (RI = 36% for weekly smoking, 14.9% for ever smoking) and Spain (RI = 11.8% for weekly smoking and 6.3% for ever smoking), and reverse effects in the Netherlands (except for non-natives). Effects were stronger in countries where more lessons were offered, teachers were trained longer, parents and community were more engaged, and the social influence content was taught well.

The details of the ESFA programs varied considerably across countries. Such variations may have accounted for the differ-

ences in outcomes, and prior research may be informative. For example, some studies have found programs to be ineffective (or even harmful) when delivered by regular classroom teachers [90,91]. The use of peer leaders has been found to improve effectiveness [63, 92], but they were not used in the ESFA. Some studies have reported effectiveness only when programs were delivered with high fidelity [91, 93-96].

Programs with replicated findings are more likely than programs for which there is no prior evaluation to be effective in different settings, but only if those replications showed effectiveness in many different types of students, providers and settings in evaluations by different investigators. The program with the most replications is Life Skills Training (to be reviewed below), but most of these have been conducted by the program's developer in the U.S, with replications in Spain and Europe.

Gandhi et al [84] found that only two of the programs on the lists they reviewed had studies of long-term follow-up, [93, 97]. These will be reviewed below.

Cultural sensitivity

Cultural sensitivity is believed to be important in public health [98] and for effective prevention [99-113]. Many studies have evaluated the effectiveness of untargeted or targeted prevention curricula in white, minority, or diverse samples, but few studies have directly compared culturally relevant smoking prevention curricula with curricula that do not address cultural issues [114]. Botvin et al [115] have found that culturally targeted and non-targeted versions of their Life Skills Program were both more effective than a control condition in preventing smoking among African American and Hispanic adolescents. Another group [102,116-119] compared prevention curricula targeted to the values of several cultural groups: a Mexican American curriculum, a Black/White curriculum, and a multicultural curriculum. All three curricula were more effective than a control condition, with the Mexican American and multicultural curricula affecting more out-

come variables (regardless of the students' ethnic characteristics) than the Black/White curriculum.

In a study in ethnically diverse schools (Hispanic, Asian-American, Caucasian) in Southern California, Johnson and colleagues [114,120] compared two 8-session, social influence based curricula. One was an individualist-framed program, a version of the SMART program [72] with highly individualized content that emphasized "looking after yourself" (Project CHIPS – Choosing Healthy Influences for a Positive Self). The other was a collectivist-framed program that included cultural values from Hispanic and Asian cultures that emphasized collectivist objectives, interdependence of family members, respect for ancestors, and harmonious interpersonal relations (Project FLAVOR, Fun Learning about Vitality, Origins and Respect). They found that only the culturally sensitive curriculum (Project FLAVOR) significantly effected smoking initiation. The effects were larger for schools with large proportions of Hispanic students, and especially among the Hispanic students within those schools. Indeed, the multicultural program was effective only for Hispanic students in mostly-Hispanic schools. In contrast, the individualist-framed curriculum was effective only for Asian students in Asian/multicultural schools.

The kinds of results reported above suggest great caution is needed when implementing programs with different ethnic groups or in different cultures. On the one hand, some programs seem to be equally effective with many different groups but, on the other hand, some studies suggest that making programs culturally relevant might be very important. Clearly, we need more research on this issue. In the mean time, *any community or country adopting a program will need to evaluate it rigorously to determine its effectiveness in the new setting or culture.*

Conclusion from review of reviews

In summary, findings from various reviews and meta-analyses suggest that school-

based smoking prevention programs can have significant long-term effects if they:

- (1) *are interactive social influences or social skills programs that*
- (2) *involve 15 or more sessions, including some up to at least ninth grade, that*
- (3) *produce substantial short-term effects.*

However, it is not easy to adopt and adapt a program for use in contexts different from those in which it was tested, especially in other cultures and countries, and great care must be taken to implement with integrity and monitor implementation and outcomes. These findings also suggest that many more programs that have reported short-term effects might also have medium and long-term effects if they were evaluated. Unfortunately, long-term studies are relatively rare, mostly due to lack of funding. In the accompanying paper I provide a review of selected school-based smoking prevention programs that have the promise of long-term effectiveness.

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DYNAMICS OF PHYSICAL PARAMETERS OF RED BLOOD IN PATIENTS WITH CHRONIC KIDNEY DISEASE ARTERIAL HYPERTENSIA

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Are investigated quantitative and quality indicators of red blood: hemoglobin, number of erythrocytes in litre, volume both their volumetric distribution and the contents at patients essential arterial hypertension (AH), chronic illness of kidneys (CDK) and at combination CDK with AH. Presence of the unstated factor negatively influencing constants of erythrocytes changes at CDK and AH is marked, and also at their combination. Thus influence of this factor most considerably at essential AH

Key words: chronic diseases of kidneys, arterial hypertension, erythrocytes indexes, hematocrit, hemoglobin

Urgency

Now authentic growth kidneys diseases in the world is marked, and the non-authorized problem is prevention terminal kidney failure. Considerably отстрочить the death of kidneys is possible at small percent of patients which are at initial stage chronic kidney failure. Inevitable progressing of chronic disease of kidneys (CDK) connect with such factor as joined arterial hypertension (AH).

The mechanisms started as damage kidney tissue so as AH, are not quite investigated. It is obvious, that the system of blood is not in this case only transfer part in these mechanisms. Therefore special interest is caused with physical parameters of erythrocytes in conditions of hemopressive influences as propellative, so as in interrelation with renal stimulus at CDK

Materials and methods

As object of research venous blood of patients with CDK, AH and a combination of these pathologies was used. Research was carried out on hematological analyzer VS-3200 of firm Mindray.

Parameters of red blood were defined: the maintenance of hemoglobin (Hb), amount erythrocytes (RBC), hematocrit (HCT), average erythrocyte volume (MCV), the average maintenance of hemoglobin in erythrocyte (MCH), the average maintenance of hemoglobin in 100 ml erythrocytes (MCHC) and factor of distribution erythrocytes on volume (RDW-CV).

The statistical analysis of the received data was carried out with use of a package of applied programs STATISTICA version 6.0 in view of the computing methods recommended for biology and medicine.

The analysis of the received data included calculation of average arithmetic variational lines (M) and its error (m). For revealing interrelations between investigated parameters and establishments of force of these connections, have been designed factors of Pirson's pair correlation (r).

Results of own researches

Results of research of parameters of red blood of sick surveyed groups are submitted in table 1.

The analysis of the results submitted in table 1 has shown, that the highest maintenance of hemoglobin was observed in blood of patients with essential AH, making 255,67 g/l, that on 60 % exceeds the top border of normal values.

The maintenance of hemoglobin in blood of patients with combination of AH and CDK, also exceeded normal values for this parameter, but is less expressed and has made 178,56 gramm per liter. The maintenance of hemoglobin in blood of patients with CDK has made 148,84 g/l.

The contents of hemoglobin in blood of patients with combination AH and CDK, also exceeded normal values for this parameter, but is less expressed and has made 178,56 g/l. The contents of hemoglobin in blood of patients with CDK has made 148,84 g/l.

Table 1. Parameters of red blood of patients with CDK, AH and with combination CDK and AH

	Hb g/l	RBC $\times 10^{12}$ /Liter	HCT %	MCV fl	MCH pr	MCHC g/L	RDW-CV %
Referencive values	110- 160	3,5-5,5	37-50	82-95	27-31	320-360	11,5-14,5
CDK (n=23)	148,84 $\pm 0,57$	4,88 \pm 0,016	44,92 \pm 0,13	86,89 \pm 0,16	31,59 \pm 0, 048	352,61 \pm 0,19	13,07 \pm 0,03
AH (n=10)	255,67 $\pm 0,30$	7,98 \pm 0,01	72,50 \pm 0,09	90,90 \pm 0,02	31,97 \pm 0, 01	352,67 \pm 0,06	12,47 \pm 0,01
AH+ CDK (n=10)	178,56 $\pm 0,72$	5,31 \pm 0,02	49,78 \pm 0,19	93,86 \pm 0,07	33,56 \pm 0, 03	357,78 \pm 0,10	12,24 \pm 0,01

The increased contents of hemoglobin in blood of patients with AH can speak a condensation of blood that proves to be true high parameters of amount of erythrocytes and hematocrit. The condensation of blood at patients of this group can be estimated as compensatory reaction to increase blood pressure (BP) with purpose to reduce volume of a circulating liquid and to lower pressure. Calculation of erythrocytes indexes has shown, that the greatest average volume of erythrocyte was observed in group of patients with combination AH and CDK. Thus in the given group the least value of parameter RDW-CV reflecting erythrocytes anisocytosis was marked.

In group of patients with CDK the return picture was observed - value of parameter RDW-CV was maximal on all sample, and average volume of erythrocyte - the least.

The contents of hemoglobin in erythrocyte in all groups exceeded value of norm, but the most essential difference was observed in group of patients with combination CDK and AH. The contents of hemoglobin in 100 ml erythrocytes, also was maximal in group of patients with combination CDK and AH.

Thus, the analysis of parameters of red blood has shown various deviations in characteristics of erythrocytes in patients with CDK, AH and a combination of these pathologies.

Now change erythrocytes` indexes of blood basically connect with development of

anemias (hypo-, normal-or hyper) or malignant diseases of blood

At the same time, it is necessary to forget, that erythrocyte-one of the major data carriers about processes of fabric structures of an organism proceeding at a level (Kozinets G.I., 1998).

For revealing dependence of researched parameters among themselves, the pair correlation analysis with definition of size and the importance of correlation has been carried out.

Results of the correlation analysis of parameters of red blood of patients with XBP are submitted in table 2.

The analysis of correlations of parameters of red blood of patients with CDK has shown, that between parameters MCH and MCHC the expressed dependence ($r=0,9$ is observed at $p < 0,05$).

In pairs MCV-MCH and MCV-MCHC factors of correlation have made 0,53 and 0,56 accordingly.

Between parameter RDW-CV and parameters MCH and MCHC, correlation with $r = -0,63$ and $r = -0,58$, accordingly has been determined.

Also dependence between amount erythrocytes and hematocrit ($r=0,87$ has been revealed at $p < 0,05$) and the contents of hemoglobin and hematocrit ($r=0,47$ at $p < 0,05$).

Thus, we can tell, that the parameters reflecting a saturation of erythrocyte by hemoglobin and them morphometric characteristics at patients with CDK are in linear de-

pendence from each other, that allows to assume absence of the additional factors influencing a condition эритроцитов in blood of patients of this group.

Results of the correlation analysis of parameters of red blood of patients with essential AH are submitted in table 3.

Table 2. Results of the pair correlation analysis (son) parameters hemogramma patients with CDK

	HGB	RBC	HCT	MCV	MCH	MCHC	RDW-CV
HGB	1,00	0,33	0,47*	-0,06	0,40	0,27	-0,18
RBC	0,33	1,00	0,87*	-0,20	0,06	-0,11	-0,02
HCT	0,47*	0,87*	1,00	-0,10	0,35	0,18	-0,22
MCV	-0,06	-0,20	-0,10	1,00	0,53*	0,56*	-0,37
MCH	0,40	0,06	0,35	0,53*	1,00	0,90*	-0,63*
MCHC	0,27	-0,11	0,18	0,56*	0,90*	1,00	-0,58*
RDW-CV	-0,18	-0,02	-0,22	-0,37	-0,63*	-0,58*	1,00

Notes

– Significance value

* $p < 0,05$

Table 3. Results of the pair correlation analysis (r- factors Pirson) parameters of hemogramm in patients with essential AH

	HGB	RBC	HCT	MCV	MCH	MCHC	RDW-CV
HGB	1,00	1,00*	1,00*	-0,43	-0,49	0,17	-0,06
RBC	1,00*	1,00	0,99*	-0,51	-0,56	0,20	-0,12
HCT	1,00*	0,99*	1,00	-0,41	-0,48	0,13	-0,03
MCV	-0,43	-0,51	-0,41	1,00	0,97*	-0,58	0,80
MCH	-0,49	-0,56	-0,48	0,97*	1,00	-0,38	0,65
MCHC	0,17	0,20	0,13	-0,58	-0,38	1,00	-0,86
RDW-CV	-0,06	-0,12	-0,03	0,80	0,65	-0,86	1,00

Notes

– Significance value

* $p < 0,05$

The analysis of correlations of parameters of red blood of patients with essential AH has shown strict linear dependence between amount of erythrocytes, contents of hemoglobin and a parameter of hematocrit. Pirson Factors in these pairs have made from 0,99 up to 1. In pair MCV-MCH the significant degree of the correlation which have made 0,97 at $p < 0,05$ also has been determined. Thus parameters MCHC and RDW-CV did not give significant correlations with one of investigated parameters. At the same time, between these two parameters reveal correlation with $r = -0,86$, but with an insufficient significance value.

Results of the correlation analysis allow to assume, that in change erythrocytes indexes in blood of patients with AH brings the contribution the additional factor which value is not taken into account at calculation of an index. Change of the form erythrocytes, or their change electrical conduction can serve one of such factors, that will create additional errors at application of an inductive way of measurement of cells. Absence of a sufficient significance value of correlation between parameters MCHC and RDW-CV can be caused by presence of "emissions" of values or presence of several groups in the submitted sample. Revealing of this depend-

ence demands increase in sample of the data and the further analysis.

Results of the correlation analysis of parameters of red blood of patients with

combination CDK and AH are submitted in table 4.

Table 4. Results of the pair correlation analysis (r- factors by Pirson) parameters of hemogramm of patients with combination CDK and AH

	HGB	RBC	HCT	MCV	MCH	MCHC	RDW-CV
HGB	1,00	0,90*	1,00*	0,31	0,35	0,38	0,72
RBC	0,90*	1,00	0,94*	-0,12	-0,08	-0,04	0,94*
HCT	1,00*	0,94*	1,00	0,23	0,27	0,29	0,77
MCV	0,31	-0,12	0,23	1,00	1,00*	0,92*	-0,43
MCH	0,35	-0,08	0,27	1,00*	1,00	0,95*	-0,39
MCHC	0,38	-0,04	0,29	0,92*	0,95*	1,00	-0,34
RDW-CV	0,72	0,94*	0,77	-0,43	-0,39	-0,34	1,00

Notes

– Significance value

* $p < 0,05$

The analysis of correlations of parameters of red blood of patients with combination AH and CDK has shown presence of dependences characteristic both for CDK, and for AH. So, in group of patients with combination AH and CDK linear dependences between parameters MCH, MCV and MCHC with factors by Pirson from 0,92 up to 1,0 were marked. At the same time in this group high correlation between amount erythrocytes, the contents of hemoglobin and hematocrit, characteristic for group of patients with essential AH also was marked. Parameter RDW-CV was in dependence from the contents of erythrocytes ($r=0,94$ at $p < 0,05$)

On the basis of the data of the correlation analysis we can assume, that parameters of an erythrocytes condition of patients with combination AH and CDK also are in de-

pendence from some factor which is not taken into account at calculations erythrocytes indexes. Thus influence of this factor on erythrocytes patients of this group is less expressed, than at patients in group with essential AH.

Thus, the data of the carried out research have shown, that development AH is accompanied by action of some factor on erythrocytes blood that leads to change of the parameters reflecting their functionality. Thus action of such factor can be both the reason, and consequence of development AH. As one of applicants for a role of such factor change electrical conduction cells owing to change of structure of their membranes can be considered, but it demands independent studying.

INCIDENCE OF SYNCHRONOUS APPENDICEAL NEOPLASM IN PATIENTS WITH COLORECTAL CANCER AND ITS CLINICAL SIGNIFICANCE

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Background: The aims of this study were to evaluate the incidence of synchronous appendiceal neoplasm in patients with colorectal cancer, and to determine its clinical significance.

Methods: Pathological reports and medical records were reviewed of patients with colorectal adenocarcinoma who underwent oncological resection of the tumor together with appendectomy at the Faculty of Medicine Siriraj Hospital, Mahidol University, Thailand between September 2000 and April 2008.

Results: This study included 293 patients with an average age of 62 years (range 19–95) and 51 percent were male. Of the patients studied, 228 (78 percent) had right hemicolectomy, whereas the others (22 percent) had surgery for left-sided colon cancer or rectal cancer. One patient (0.3 percent) had epithelial appendiceal neoplasm (mucinous cystadenoma) and 3 patients (1.0 percent) had metastatic colorectal cancer in the mesoappendix. However, the presence of synchronous appendiceal tumors and/or metastasis did not alter postoperative management, as these patients had received adjuvant therapy and were scheduled for surveillance program because of nodal involvement.

Conclusion: The incidence of synchronous primary appendiceal neoplasm and secondary (metastatic) appendiceal neoplasm in colorectal cancer patients was 0.3 and 1.0 percent, respectively. However, these findings did not change the postoperative clinical management.

Background

Synchronous colorectal cancer (CRC) has been reported in 0.6–1.4 percent of patients and metachronous CRC in 1–8 percent of patients [1]. Any neoplastic change of the colon and rectum could possibly affect the appendix because the appendix is derived embryologically from the large intestine and has a similar mucosal pattern to the colon and rectum. The histological features of appendiceal adenocarcinoma are also identical to those of colorectal adenocarcinoma [2]. Moreover, it has been reported that almost a quarter of patients with appendiceal cancer are found to have synchronous or metachronous neoplasms elsewhere in the large intestine [2, 3].

Although there have been increasing advances in both endoscopy and radiology, the appendiceal mucosa remains inaccessible and the accuracy of preoperative diagnosis of appendiceal neoplasm is still poor. During an operation, a correct diagnosis is made in less than half of the cases [4]. Several case reports of synchronous appendiceal tumors in CRC patients have been published in the literature [5–9], but only one study has explored its incidence which is about 4 percent of CRC patients having synchronous appen-

diceal neoplasm [7]. Given the difficulty in diagnosis of appendiceal tumors and the certain risk of synchronous and metachronous neoplasm of the appendix, the question of whether an incidental appendectomy should be performed in CRC patients has been raised [5, 7].

In attempt to address this question, it is first essential to know the incidence and the biological significance of synchronous appendiceal tumors in CRC patients. The aims of this study were to evaluate the incidence of synchronous appendiceal neoplasm in patients with resectable CRC in a university hospital, and to determine the clinical significance of these findings.

Methods

Pathological reports and medical records were retrospectively reviewed of patients with colorectal adenocarcinoma who underwent oncological resection of the tumor together with appendectomy at the Department of Surgery, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok, Thailand between September 2000 and April 2008. Patients were excluded if they had familial adenomatous polyposis syndrome or had had a previous appendectomy, or if there

had been direct invasion of CRC to the appendix. Patients receiving neoadjuvant therapy were also excluded. Notably, there were about 100–120 operations for CRC per annum in our unit, and one-third of them were for right-sided colon cancer.

The appendix is normally a part of the specimen removed in patients with right hemicolectomy. All the appendices removed along with the right colon specimen were systematically analyzed. Incidental appendectomy had also been performed in patients who had undergone left hemicolectomy or rectal resection at the discretion of the surgeon. We tended to perform incidental appendectomy if the patient was younger than 45 years, or there was a fecalith in the appendix. Histopathological study of the appendix included gross and microscopic examination. Specimens were sectioned at the tip, body, and base of the appendix as well as other suspicious lesions. All specimens were examined by a consultant or senior pathologist.

The site of the primary tumor, type of operation, and pathological staging of CRC were noted. Macroscopic and microscopic features of the appendix were also recorded. The presence of synchronous appendiceal tumors and/or metastasis was correlated with follow-up data to demonstrate the clinical significance of these findings. The study was approved by the Institutional Ethics Committee.

Results

Two hundred and ninety-three patients were included in this study. The patients studied had an average age of 62 years (range 19–95) and 51 percent were male. Of the patients studied, 228 (78 percent) had a right hemicolectomy, 45 (15 percent) had a left hemicolectomy, and 20 (7 percent) had surgery for rectal cancer. One patient (0.3 percent) had epithelial appendiceal neoplasm (mucinous cystadenoma), and 3 patients (1.0 percent) had metastatic colorectal cancer in the mesoappendix (Table 1). All metastatic lesions were mucinous adenocarcinoma. Clusters of metastatic cancerous cells were 1–5 mm in diameter; primarily located in the subserosal area. All appendices with neoplasms did not appear abnormal in the preop-

erative imaging and during the intraoperative examination. However, the case of metastases in the mesoappendix from a descending colon cancer was associated to other peritoneal implants.

There was no specific morbidity that could be attributed to incidental appendectomy in the present study. The presence of synchronous appendiceal tumors and/or metastasis did not alter postoperative management, as these patients had received adjuvant therapy and were scheduled for surveillance program because of nodal involvement.

Discussion

The question of whether an incidental appendectomy should be performed in CRC patients has been raised due to the difficulty in diagnosis of appendiceal tumors and the certain risk of synchronous and metachronous neoplasm of the appendix [5,7]. Little is known about the incidence of appendiceal neoplasm in CRC patients. To the best of our knowledge, there was only one study determining such an incidence [7]. Khan and Moran retrospectively reviewed 169 CRC patients who underwent CRC surgery and removal of the appendix in Basingstoke, United Kingdom. They reported 4.1 percent synchronous primary appendiceal neoplasm in these patients, and mucinous cystadenoma was the most common neoplasm found [7]. Furthermore, these authors suggested performing incidental appendectomy in all CRC patients. Meanwhile, Albright et al determined the cost-effectiveness of interval appendectomy in patients who undergo curative resection for CRC and found that the benefit in cost was only realized for patients younger than 45 years of age [5]. Synchronous CRC and appendiceal tumors have been observed in high-risk patients such as those with longstanding ulcerative colitis [10]. Moreover, patients with rectal cancer had a slightly higher rate of synchronous appendiceal tumors than those with right-sided colon cancer [7]. However, absent from the literature are such studies in Asian population, in which the incidence of synchronous appendiceal neoplasms in CRC patients could be different.

Table 1. Patients' characteristics, details of primary colorectal cancer, and pathological results of synchronous appendiceal neoplasm

Age (years)/Gender	Primary tumor	Type of surgery	Staging of primary tumor	Appendix abnormality
59 M	cecum	RH	T3N2	Metastatic adenocarcinoma in the mesoappendix
62 F	ascending colon	RH	T3N2	Metastatic adenocarcinoma in the mesoappendix
48 M	descending colon	LH	T3N1	Metastatic adenocarcinoma in the mesoappendix
64 F	rectum	APR	T3N2	Mucinous cystadenoma

Abbreviation: RH (right hemicolectomy), LH (left hemicolectomy), APR (abdominoperineal resection)

The present study in Thailand demonstrates that the incidence of synchronous primary appendiceal neoplasm and secondary (metastatic) appendiceal neoplasm in patients with resectable CRC is 0.3 and 1.0 percent, respectively. One possible explanation for the low incidence of synchronous primary neoplasm of the appendix in CRC patients in the present study could be that tumorigenesis of the appendix and other parts of the large intestine are not the same. Appendiceal mucosa is not directly exposed to potential carcinogens in fecal material as the colorectal mucosa is. Epidemiological study revealed that appendiceal tumors account for 0.4–1 percent of alimentary tract cancers and are found in 0.7–1.7 percent of appendectomy specimens [11], whilst CRC is the most common gastrointestinal malignancy [12]. Also, the peak incidence of appendiceal neoplasm is in patients in their early forties, 20-year younger than that of CRC [13]. It is possible that the incidence of appendiceal tumors in Asian population is different from that of Western population [14], and thus the incidence of synchronous appendiceal neoplasms in CRC patients could vary among various ethnic and geographic backgrounds. Lastly, in view of the examination of the specimens, different protocols of tissue sec-

tion and methods of histopathological examination may lead to differences in the incidence percentages.

The unexpected finding in the present study was that one percent of CRC patients had metastatic lesions in the mesoappendix. This finding was fairly consistent with a previous study by Albright and his colleagues [5]. They reported 2 cases of metastatic implants to the appendix from routine interval appendectomy in 210 patients with intraabdominal malignancy; accounting for 0.95%. One case was secondary to a sigmoid cancer with limited peritoneal carcinomatosis while the other was secondary to an ovarian adenocarcinoma. As the mesoappendix encloses the appendiceal artery and vein, together with lymphatic vessels and lymph node, metastasis to the mesoappendix could occur via the lymphatic, hematogenous or transcoelomic route. With regard to the transcoelomic route, CRC may spread throughout the peritoneum either via the subperitoneal lymphatic drainage or by viable cells being shed from the serosal surface of a tumor [15]. This is supported by the observations that 14.6 percent of CRC had positive cytology for cancer cells on the peritoneal or perirectal surface of the bowel, particularly in those with extensive lymphatic involvement, poorly differentiated

tumors, or liver metastases [16]. Metastasis to the appendix has been reported in both gastrointestinal and nongastrointestinal malignancies such as gastric [17], pancreatic [18], ovarian [5,19], cervical [20], nasopharyngeal [21], breast [22], and lung [23].

A limitation of this single-center study is a relatively small sample size, particularly those with left-sided colon cancer and rectal cancer. Considering this reason, a larger number of incidental appendectomy in patients with leftsided colon cancer and rectal cancer are warranted to verify our findings. Besides, this review has some limitations which are mainly inherent to a retrospective study and to different clinical judgments of surgeons. There could be a selection bias to perform incidental appendectomy as we did not have specific criteria for performing appendectomy in CRC patient at our institute. It is possible that the appendix was more likely to be removed because of its abnormal appearance. In order to determine the true incidence of synchronous appendiceal neoplasms, a cohort or prospective study of patients where the appendix is always removed (either by necessity in a right hemicolectomy specimen; or as a protocol where the appendix is always removed in CRC patients) is required.

Conclusion

Based on this study, the incidence of synchronous primary appendiceal neoplasm and secondary (metastatic) appendiceal neoplasm in CRC patients was 0.3 and 1.0 percent, respectively. These findings did not change the postoperative clinical management.

Abbreviations

APR: abdominoperineal resection;
CRC: colorectal cancer; LH: left hemicolectomy; RH: right hemicolectomy.

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TEMOZOLOMIDE AND CISPLATIN IN RELAPSED/REFRACTORY ACUTE LEUKEMIA

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Cisplatin depletes MGMT and increases the sensitivity of leukemia cells to temozolomide. We performed a phase I study of cisplatin and temozolomide in patients with relapsed and refractory acute leukemia. Fifteen patients had AML, 3 had ALL, and 2 had biphenotypic leukemia. The median number of prior chemotherapy regimens was 3 (1–5). Treatment was well tolerated up to the maximal doses of temozolomide 200 mg/m²/d times 7 days and cisplatin 100 mg/m² on day 1. There was one complete remission in this heavily pretreated patient population. Five of 20 (25%) patients demonstrated a significant reduction in bone marrow blasts.

Background

With currently available chemotherapy regimens, most patients with acute leukemia will not be cured [1, 2]. There is an ongoing effort to develop new agents to treat this disease. Temozolomide is a cytotoxic alkylating agent that is approved by the United States Food and Drug Administration for the treatment of patients with newly diagnosed glioblastoma multiforme as well adult patients with refractory anaplastic astrocytoma. Preclinical studies demonstrated that temozolomide is active against a broad range of tumor cell lines, including L1210 and P388 leukemia [3, 4].

Based on in vitro sensitivity of leukemia cell lines to temozolomide as well as the favorable toxicity profile of the drug, we conducted a phase I study of temozolomide in patients with relapsed and refractory acute leukemia [5]. Dose escalation occurred by increasing the number of days that patients received a temozolomide dose of 200 mg/m². The dose-limiting toxicity was myelosuppression, manifested as prolonged aplasia in patients receiving 9 days of temozolomide. Extra-medullary toxicity was mild, consisting of nausea, vomiting, headache, dizziness and constipation. The recommended phase II dose of temozolomide was 200 mg/m²/d for 7 days. Significant antileukemic activity was seen in this heavily-pretreated patient population. Two patients obtained formal complete remissions (CR), and 2 other patients had complete remission without platelet recovery (CRp). In addition, 5 other patients had sig-

nificant decreases in bone marrow blasts despite not obtaining a formal response (total of 9 of 20 patients had a significant decrease in bone marrow blasts).

One obstacle to temozolomide cytotoxicity is the DNA repair enzyme, O⁶-methylguanine-DNA methyltransferase (MGMT) [6, 7]. Temozolomide acts predominantly through methylation of O⁶-guanine in DNA [8, 9]. This results in mispairing of guanine with thymine, and, in the presence of active mismatch repair, DNA strand breaks and apoptosis [10,11]. MGMT removes these methyl groups which would have otherwise led to apoptotic cell death. Since MGMT becomes irreversibly inactivated in this process, the degree to which a cell can repair itself is inversely proportional to the level of MGMT present [12].

Laboratory studies have shown that only 25% of leukemia cells demonstrate low levels of MGMT [13]. Therefore, strategies to deplete MGMT in these cells could potentially render them more sensitive to temozolomide. One strategy is to combine temozolomide with other agents that deplete MGMT, such as cisplatin. Piccioni demonstrated that cisplatin and temozolomide were synergistic in leukemia cell lines, and that *in vivo* treatment of leukemic patients with cisplatin was followed by a reduction of MGMT activity in peripheral blood mononuclear cells [14]. D'Atri et al reported that, in Jurkat cells, cisplatin decreased MGMT activity in a time and dose-dependent manner with maximal suppression observed 24 hours after

treatment with cisplatin [15]. Thus, cisplatin is potentially one agent that could increase the efficacy of temozolomide. Based on these data we performed a phase I study of cisplatin and temozolomide in patients with relapsed and refractory acute leukemia.

Methods

Patients with acute myelogenous leukemia (AML), acute lymphoblastic leukemia (ALL) or chronic myelogenous leukemia in blastic phase (CML-BP) that had either relapsed following, or was refractory to standard chemotherapy were eligible. Additional entry criteria included age greater than 17 years, an ECOG Performance Status of 0–3, serum bilirubin less than 1.5 mg/dl, serum creatinine < 2.0 mg/dl and a creatinine clearance greater than 60 cc/ min. Patients must have recovered from any toxicity from previous chemotherapy regimens. Patients must not have received chemotherapy (other than hydroxyurea) in the 4 weeks prior to entry into this study.

All patients gave written informed consent under the guidance of the New York Medical College Institutional Review Board.

Pretreatment evaluation included a complete history and physical examination, bone marrow aspiration and biopsy for histology, cytogenetics, and flow cytometry, and routine laboratory studies including CBC with differential, chemistry profile and coagulation studies.

Treatment

Cisplatin was administered on day 1 of therapy. The dose of cisplatin was escalated from 50 mg/m² to 100 mg/m² as in Table 1. Patients received standard hydration and antiemetics during cisplatin administration. Temozolomide was administered at a dose of 200 mg/m²/d, orally as a single dose on an empty stomach. The first dose of temozolomide was given 4 hours after the completion of cisplatin. The initial group of patients received temozolomide for 5 days every cycle. Patients treated at higher dose levels received 7 days of temozolomide (Table 1). Patients were eligible to receive subsequent cycles of therapy unless they had evidence of

progressive disease (bone marrow blasts or peripheral blood blasts greater than pretreatment). Treatment was given every 21–28 days, provided there was no persistent non-hematologic toxicity. Patients remained on treatment until there was evidence of progression of disease. Patients who had intolerable toxicity during a course of treatment could receive subsequent cycles at one dose level lower than that at which toxicity occurred.

Table 1. Dose Levels

Level	n	Cisplatin	Temozolomide
1	3	50 mg/m ²	200 mg/m ² /d times 5 days
2	4	75 mg/m ²	200 mg/m ² /d times 5 days
3	5	75 mg/m ²	200 mg/m ² /d times 7 days
4	8	100 mg/m ²	200 mg/m ² /d times 7 days

Patients were entered in cohorts of 3 at the different dose levels stated. Temozolomide was increased to the dose determined in our original phase I study, and cisplatin was increased to 100 mg/m².

Patients were assessed for clinical signs and symptoms of toxicity at least twice a week during the first month of treatment. Stable patients without significant toxicity in course 1 were monitored at least once a week in subsequent cycles. Patients had a bone marrow aspiration and biopsy approximately 3 weeks after treatment. Patients with obvious disease progression were not required to have this procedure. Subsequently, responding patients were to have a bone marrow aspiration and biopsy monthly for 3 months and then every 3 months until disease progression. A complete response required [1] the presence of a cellular marrow with less than 5% blasts and trilineage maturation, and [2] return of peripheral blood counts: absolute neutrophil count >1000/mm³, hemoglobin (untransfused) >10 gm/dl, and platelet count (untransfused) >100,000/mm³. Patients must have demonstrated these criteria for at least 4 weeks.

Results

Patient Characteristics

Twenty patients were treated on 4 dose levels of cisplatin plus temozolomide (Table 1). Sixteen patients received one cycle of therapy, three patients received two cycles, and one received three cycles. The baseline characteristics are summarized in Table 2. Fifteen patients had AML, of whom 5 patients had MDS that evolved to AML and one had aplastic anemia that evolved to AML. Five of the patients with AML had primary refractory disease. Three patients had relapsed ALL. Two patients had acute biphenotypic leukemia. One of these had primary refractory disease. Patients had received a median of 3 prior intensive chemotherapy regimens for their acute leukemia (range 1–5 treatments). The median duration of first remission for those patients who were not initially refractory was 9 months (range 3–31 months) for patients with AML, and 6 months (range 3–17 months) for patients with ALL. Three patients had relapsed after stem cell transplants (1 autologous, 2 allogeneic). Of the patients with AML, two had t(8;21), twelve had intermediate risk cytogenetics and two had poor risk cytogenetics. Of the patients with ALL, two had normal cytogenetics and one was hypodiploid. Of the patients with biphenotypic leukemia, one had complex cytogenetics and the other had t(9;22).

Toxicity

Overall treatment was well tolerated. There were no true dose limiting toxicities. Due to the need for hydration, most patients received their chemotherapy in the hospital. The median number of hospital days was 9 (range 0–39). Hematologic toxicity is difficult to assess in this patient population. All patients had significantly abnormal blood counts at the start of therapy. There was no evidence of prolonged myelosuppression. For the limited number of patients who received more than one cycle, the median time between cycles was 21 days (range 21–28). The median number of red blood cell transfusions per cycle was 4 range (0–8) and the median

number of platelet transfusions was 4 (range 0–12). Only 8 patients required intravenous antibiotics. The remaining 12 patients did not develop neutropenic fever, presumably due to the use of prophylactic oral antibiotics. For all patients, the median number of days of intravenous antibiotics was 3 (range 0–33 days); for those who did require intravenous antibiotics the median number of days was 13 (range 3–33 days).

Table 2. Baseline Characteristics

	N = 20
Age	52 (24–73)
Sex	10M/10F
Performance Status	2 (1–3)
Diagnosis:	
AML	15
ALL	3
Biphenotypic	2
Number of prior regimens	3 (1–5)
Prior stem cell transplant	3 (1 auto/2 allo)
Prior AHD	6 (5 MDS/1 aplastic anemia)
Cytogenetics:	
Good Risk	2 (10%)
Intermediate Risk	13 (65%)
High Risk	5 (25%)

Other grade 1/2 toxicities included nausea and vomiting in seven patients and constipation in three patients. One additional patient (treated at level 4) developed grade 3 constipation. Two patients developed grade 2 orthostatic hypotension (one patient day 8, level 2, and the other day 6, level 3). Two other patients developed asymptomatic bradycardia that occurred during chemotherapy administration (days 2–7) and resolved spontaneously. Both of these patients were treated at level 4. Due to the use of cisplatin, it was anticipated that patients would develop increases in creatinine as well as hypokalemia and hypomagnesemia. Therefore patients received hydration with supplementation of potassium and magnesium supplementation preemptively, provided they did not have hyperkalemia due to tumor lysis. Despite this, four patients developed grade 1/2 elevated creatinine (one patient level 2, three patients level 3). None of the patients treated at level 4 developed an increased creatinine, indicating that patient factors other than cisplatin

dose were important in predicting this toxicity. There was no grade 3/4 renal toxicity. In all of the patients the abnormalities were rapidly reversible. Two patients treated at level 4 developed significant hypomagnesemia (grade 2) and hypokalemia (one grade 3, one grade 4). These abnormalities responded rapidly to aggressive supplementation.

Antileukemic Effect

One patient (treated at level 4) had a formal complete remission. This patient had de novo AML with normal cytogenetics. Her first remission duration (after 3 + 7 therapy) was only 3 months. She then failed to respond to idarubicin and high dose cytarabine. This patient only received one cycle of cisplatin and temozolomide; she declined further chemotherapy and expired in relapse 3

months after treatment. Two other patients (both treated at level 4) had dramatic reductions in bone marrow blasts in their bone marrow (pretreatment 69% and 87% blasts, to post-treatment 3% and 5% blasts, respectively). These patients did not meet criteria for complete remission due to a lack of peripheral count recovery. The mean percentage of blasts prior to and following treatment for the different dose levels is summarized in Figure 1. There was a trend towards increased antileukemic effect in patients treated at the highest dose level compared to the other dose levels ($p = 0.07$). At level 4, the mean percentage blasts in the marrow was 67% prior to treatment and 18% following treatment.

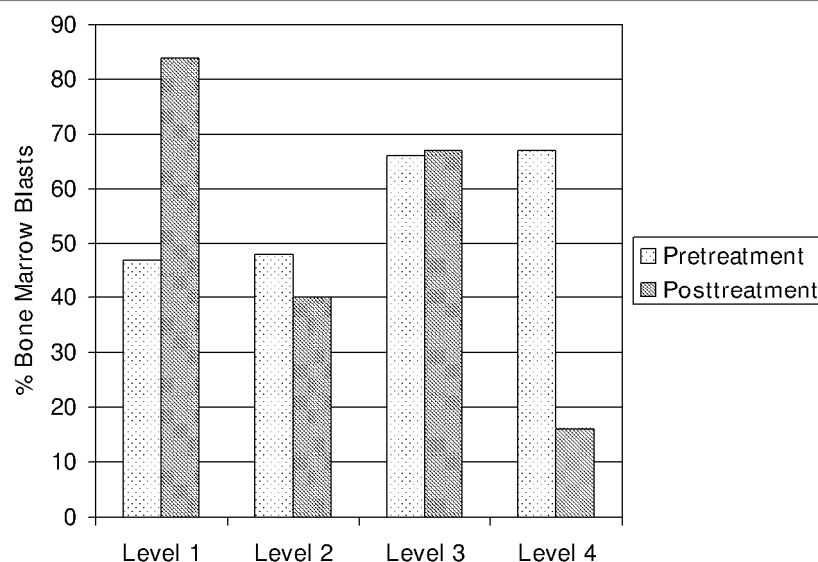


Figure 1. Percentage bone marrow blasts prior to and following treatment. The results are given for the 4 dose levels of treatment. Patients treated at level 4 had the greatest antileukemic effect

Discussion

This study demonstrates that the combination of temozolomide and cisplatin is well tolerated in a heavily pretreated group of patients with acute leukemia. No dose limiting toxicity was seen with the addition of cisplatin to the full dose of temozolomide that was administered as a single agent in our previous study. Toxicities were as expected and included myelosuppression, nausea,

vomiting and (mild) renal and electrolyte abnormalities. We chose not to increase temozolomide beyond the dose in our other study and did not escalate cisplatin beyond that which is recommended in other malignancies.

Antileukemic activity was demonstrated, particularly at the highest dose level. Of 8 patients treated at this level, there was one complete remission and 2 other patients

had 5% or fewer blasts in the bone marrow without peripheral count recovery. Although the complete remission rate at this level is only 14%, this group of patients is notoriously difficult to treat. Estey et al reported that for patients with AML in first relapse, only 11% of those whose first remission was less than 12 months achieved a complete remission with high dose cytarabine-based salvage therapy [16]. Five patients in the current study were treated as first salvage. All had a first remission duration of less than one year. Patients beyond first salvage are even more difficult to treat. Giles et al reported the outcome of 594 patients with AML undergoing second salvage therapy [17]. Overall, 13% of patients achieved a complete remission. Six adverse prognostic factors were identified: first complete remission duration less than 6 months, second complete remission duration less than 6 months, salvage therapy not including allogeneic stem cell transplant, non-inversion 16 AML, platelet count less than $50 \times 10^9/l$, and leukocytosis greater than $50 \times 10^9/l$. Patients were divided into prognostic groups based on the number of risk factors they had. In the current study only 3 patients were treated as second salvage. According to the Giles criteria one of them would have an anticipated CR rate of 8% and two would have an anticipated CR rate of 0%. The other AML patients treated in this study were beyond second salvage. Thus the low complete remission rate seen in our study is not unexpected.

One question is whether the addition of cisplatin to temozolomide is synergistic or at least additive. In our previous study of 20 patients who received temozolomide as a single agent there were 2 formal complete remissions (10%), and 2 complete remissions without platelet recovery (10%) [5]. In that study, nine patients (30%) had a significant decrease in bone marrow blasts. In the current study there was one complete remission (5%), and 5 patients (25%) had a significant reduction in bone marrow blasts. Only 13 patients received 7 days of temozolomide (the minimum dose in the single agent study) on

the current study. In this subset, the percentage of patients with reduction in bone marrow blasts (5/13, i.e. 38%) was comparable to that seen in the single agent study. Therefore it would appear that the efficacy of the two drug regimen was comparable to the single agent regimen.

However due to the small number of patients and heterogeneity of the patient groups it is impossible to draw any conclusions. A larger study would be needed to answer this question.

Another question is why cisplatin has not been used to any degree in the treatment of acute leukemia. Clearly there is in vitro data showing that some leukemia cell lines are sensitive to cisplatin [18]. Complete remissions have also been reported in relapsed and refractory AML patients treated with carboplatin [19]. Undoubtedly there could be a reluctance to use an agent that causes renal and electrolyte abnormalities in a group of patients who are at high risk of these complications from their disease (tumor lysis) and supportive care (antibiotics). However with currently available supportive measures these issues are easily managed. In the current study several patients with high white blood cell counts (as high as $78,000/\text{mm}^3$) had rapid reductions in their peripheral counts. It was our impression that the reduction in peripheral counts was more rapid with the addition of cisplatin than with temozolomide alone, suggesting that the former is an active agent in this disease.

MGMT expression is an important mechanism of resistance to temozolomide. This has been demonstrated in gliomas [12] as well as in leukemia. Brandwein et al conducted a phase II study of temozolomide in poor prognosis AML patients 60 years of age or older [20]. Of 46 patients treated there were 3 complete remissions and 2 complete remissions without platelet recovery for an overall response rate of 11%. In previously untreated patients the overall response rate was 22%. Twenty-eight samples were obtained for MGMT analysis. The frequency of MGMT negativity was higher in previously

untreated patients than in previously treated patients. Absent MGMT expression was significantly correlated with higher likelihood of response to temozolomide. The overall response rate was 60% for patients who were MGMT negative compared to 6% for patients with expression of MGMT. In the previously treated patients there was only one patient with no MGMT expression and that patient was the only one to attain complete remission. Caporaso et al have also added the MGMT inhibitor lomeguatrib to patients with refractory leukemia receiving temozolomide. Patients also received IL-2 subsequent to their chemotherapy. In this study six of eight heavily pretreated patients showed partial or complete disappearance of blast cells in the peripheral blood or bone marrow [21].

Conclusion

In this phase I study in patients with relapsed/refractory acute leukemia, treatment was well tolerated up to the maximal doses of temozolomide 200 mg/m²/d times 7 days and cisplatin 100 mg/m² on day 1. Significant anti-leukemic activity was observed. Further studies with direct measurement of MGMT levels could determine which patients are likely to benefit from this therapy.

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Materials of Conferences

POSSIBLE WAYS OF BLOOD PRESSURE CORRECTION AT PATIENTS WITH DIABETES MELLITUS ASSOCIATED WITH COPD

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The aim of our research was to evaluate the effectiveness of the imidazoline receptor agonist – moxonidine («Physiotens») in the treatment for high blood pressure at patients with diabetes mellitus type 2 associated with the chronic obstructive pulmonary disease (COPD).

Materials and methods: our study group included 28 patients with diabetes mellitus type 2 (average age - $53,7 \pm 3,1$ years old, duration of diabetes mellitus - $9,8 \pm 1,1$ years) associated with COPD of I-II stages (GOLD, 2003). Mild COPD was diagnosed at 21 patients, moderate - at 7 patients. All patients received Physiotens as a monotherapy in dose 0,2 mg/day with titration till 0,6 mg/day. The therapy duration was 24 weeks. All patients received the earlier prescribed broncholytic therapy. The examination of the test persons included the following aspects: daily monitoring of blood pressure; evaluation of microcirculation by bulbar biomicroscopy method including estimation of perivascular space, vessels and intravascular blood flow and determination of conjunctival indices; examination of endothelium-dependent vasodilation; measuring insulin resistance according to HOMA IR. The function of external respiration was studied using lung-tester «Spiro S-100».

Results: after the treatment, the average daily systolic blood pressure reduced by 13,3% ($p < 0,01$), and diastolic by 10,1% ($p < 0,05$). Daily blood pressure profiles showed a positive dynamics; variability, value and velocity of the morning rise in blood pressure reduced ($p < 0,01$). All studied parameters of the microcircular blood flow improved: we observed a diminution of perivascular edema, higher velocity of microcircular blood flow and disappearing of «sludge syndrome». Perivascular conjunctival index reduced from $2,12 \pm 0,08$ till $1,85 \pm 0,09$ ($p < 0,05$); vascular - from $14,13 \pm 1,11$ till $10,12 \pm 0,91$ ($p < 0,01$); intravascular - from $6,94 \pm 0,44$ till $5,39 \pm 0,31$ ($p < 0,05$). Evaluating the endothelium-dependent vasodilation, we could see a reliable growth of brachial artery diameter ($p < 0,05$). The HOMA IR index reduced reliably ($p < 0,05$) after taking Physiotens. We have not observed any statistically significant changes in external respiration during the conducted study.

Conclusion: Physiotens (moxonidine) can be recommended as a basic therapeutic medication to correct blood pressure at patients with diabetes mellitus type 2 associated with COPD.

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EPIDEMIOLOGIC PECULIARITIES OF THE CEREBROVASCULAR DISTURBANCES IN THE VERTEBROBASILAR SYSTEM AMONG THE POPULATION OF THE KARELSKY REGION, PETROZAVODSK.

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Bioclimatic severity of the Karelsky region is determined by its high latitude, as well as by the main environmental factors of the North – temperature and light conditions, humidity, pressure, speed and direction of wind – and their negative influence on people's health (N.A. Agadzhanyan, P.G. Petrova, 1996; N.V. Dorshakova, 1997). According to the data of the Republican center of medical analytics, prevalence of cerebrovascular diseases is high in the region, on average 11,4 cases per 1000 persons. High prevalence of acute ischemic cerebrovascular disturbances (ACD) was measured at the level of 8,4 cases per 1000 persons. In this respect, epidemiologic peculiarities of the cerebral blood flow disturbances among region's population become a worthy issue for research. The aim of this study was to research on the epidemiologic peculiarities of the cerebral blood flow disturbances of the vertebrobasilar system (VBS) among the citizens of Kareliya's capital Petrozavodsk. The study group included 140 patients with cerebral blood flow disturbances (CBFD) of VBS, who underwent a treatment at the angioneurology department of the Petrozavodsk City Emergency Hospital. The group consisted of 61 men (43,6%) and 79 women (56,4%). The patients were aged between 38 and 77, average age is $55,4 \pm 7,7$. Age structure of the study group was the following: till 45 years old – 10,7%, 46-59 – 61,4%, 60-74 – 27,1%, over 74 years old – 0,7%. Working-age patients prevailed in the group – 72,1%. Medical history of the patients with ACD often included ischemic stroke of VBS – 42,1%, ischemic stroke in the carotid system (CS) – 17,1% and mini-stroke of VBS – 17,1%, less frequently were found ischemic stroke of both carotid and vertebrobasilar systems, – 7,9%, transient ischemic attacks (TIA) in CS – 7,9%, TIA in VBS – 6,6%, mini-stroke in CS – 1,3%. Men had ACD more often – 59,2%. It was revealed, that 84,2% of the patients suffered one ischemic ACD incident, 14,5% – two ACD incidents and 1,3% of the patients had three ACD incidents. To sum up, prevalence of

the acute ischemic cerebrovascular disturbances in the vertebrobasilar system is high among the population of Petrozavodsk; working-age people prevail among the patients, and more and more younger people suffer from the disease.

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THE IMMUNITY STATE & PURINE NUCLEOTIDES ENZYMES ACTIVITY AT THE RATS, HAVING EXPOSED TO THE DUST AND RADIATION FACTOR & THEIR CORRECTION

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Actuality

The structural and functional disorders of the tissue homeostasis, having accompanied by this or that pathology beginning and development, are always connected with the tissue integrity disorder, the various cell populations' death and reproduction just in the lesion focus. In its turn, this means, that some universal characteristics of the destructively and reparative processes, having proceeded in the organism's organs and tissues, have to be existed, besides the specific metabolic shifts, having caused by the ethiopathogenetic diseases factors. The enzyme systems of the free predecessors exchange of the nucleic acids and their derivatives are belonged to a number of such pathological processes characteristics. So, the immunodeficient states are connected with the enzymes activity disorder, having controlled the adenosine level in the lymphocytes: the adenosine deaminase (ADA) insufficiency results in the serious immunodeficiency, at which the number is being lowered and the T – and B – lymphocytes function is being disturbed; the 5 – nucleotidase insufficiency results in the easier immunodeficiency form, at which the B – lymphocytes functions are being left normal, but the T – lymphocytes functions are being violated [4, 5]. The catabolic processes of the purine nucleotides exchange in the organism have the large significance for the immunological organism reactivity regulation.

And the adenylate cyclase system is also involved in the adenosine immunosuppressive system and cytotoxic action. But the cyclical adenosine monophosphate (cAMPH) can be served not only the negative, but and the positive lymphocytes function's regulator. The cAMPH effects different orientation

can be conditioned by the its content change in the various immune system cells compartments, by these compartments functions, having provided the lymphocytes biological qualities or the other cells [2].

The Aim

The aim in the experiment on the animals at the combined influence of the asbestos dust and the ionizing radiation the has been defined by us, to study the immune status change, and the enzymes activity of the purine nucleotides metabolism: the adenosine deaminase (ADA), the adenosine monophosphate deaminase (AMPH – DA) and 5' – nucleotidase (5' – HT) in the more sensitive tissues of the liver, the thymus gland organs, and in the blood lymphocytes. Our aim is, moreover, to find it out the immunity changes interconnection presence with these enzymes activity, and also to study the Be phytopreparation action (e.g. triterpenoid from the *Betula Pendula* Roth).

The Research Methods

Three tests series on 40 albino rats have already been carried out for the assigned task realization. The I – st group – the intact ones (n=10), the II – nd group – the irradiated ones in 6 gr. dose, having primed by the asbestos dust, at the same time (n=15), and the III – rd group – the irradiated and primed ones by the dust and having received the Be phytopreparation (n=15). The II – nd and the III – rd groups' animals have been one time irradiated during 30 days and nights before the examination on the «Teragam ⁶⁰Co» radio therapeutic installation (Czech Republic) in the 6 gr. dose. We have carried out the animals' topometric and dosimetric preparation on the «Terasix» X – ray photography simulator, which is provided the correct bringing to the planned dose, before to conduct the irradiations. The asbestos dust was brought into the rats' lungs (e.g. intratracheally) for the pneumoconiosis reproduction by the method, which had been developed by us [1]. The animals have been killed by means of the incomplete decapitation, having, preliminarily, put to sleep by the chloroform. This kind of work with the experimental animals has been conducted, in accordance with the principles of the Helsinki Declaration of the World Medical Association on the humane treatment with the animals. The immune status has been estimated on the basis of the content study in the lymphocytes' peripheral blood and their subpopulation with the phenotypes: CD3⁺, CD4⁺, CD8⁺, CD19⁺ by the method of the immunofluorescent staining of the cells with the antibodies use, having conjugated with the ФИТИ phenylizothiocyanate (PHETC) (the «CALTAG Laboratories» Company, the USA), having adapted, exactly, for the rats' analyses. The neutrophils' phagocytal activity (PHA) definition, the serum immunoglobulins level of the A, M, G classes, the CIC (the circulating immune complexes), ITML (the inhibition test of the migration of leukocytes) number have been conducted.

The 5'-HT activity in the lymphocytes has been defined by the AMPH hydrolysis speed up to the adenosine and the phosphoric acid, and they have been expressed in the H_3PO_4 mmole number per 1 mg of the protein. The AMPH – DA and ADA activity have been defined by the methods, which have been developed by Mr. Tambergenov C.O., by the deamination rate, and they are expressed in the ammonia mmole per the protein mg (1984). Especially, for this investigation, the lymphocytes have been isolated from the peripheral blood, and the homogenates have been prepared from the liver and the thymus gland. The triterpenoid from the (Be) *Betula Pendula* Roth has been used, as the phytopreparation, and it has been prescribed by the 2,5 mg./100 gr. of the mass per os during 14 days. The immunological and biochemical indicators have been defined in the all above – mentioned groups with the statistical processing and with the Student's criteria calculation carrying out.

The Results and the Discussion: The investigation results have shown that the leucopenia is registered at the combined gamma – irradiation and the asbestos dust exposure. The lymphocytes quantity has been increased, for certain, in the experimental groups: in the II – nd group for 41,44%, in the III – rd group – 28,63%. The $CD3^+$ lymphocytes absolute and the relative quantity lowering has been registered, reliably, in the II – nd group: in 2,33 times (e.g. $p<0,001$) and 1,34 time (e.g. $p<0,05$), correspondingly. After the treatment, the $CD3^+$ lymphocytes absolute quantity rise takes its place for 65,82 % and OK – for 27,45% (e.g. $p<0,05$), in comparison with the group, which has been exposed to the dust and the radiation factor.

The $CD4^+$ lymphocytes absolute and the percentage quantity at the animals, which have been exposed to the dust and the radiation factor, statistically, are being lowered, for certain: the absolute quantity – in 1,78 time (e.g. $p<0,001$), the relative quantity – in 1,43 time (e.g. $p<0,05$), but at the animals, having received the phytopreparation, the $CD4^+$ lymphocytes absolute quantity is being increased in 1,88 time (e.g. $p<0,01$), the relative quantity – in 1,55 time (e.g. $p<0,01$). It has been determined, that the dust and the radiation factor is resulted in the main indices lowering of the cellular immunity system. All these given changes have resulted in the ($CD4^+/CD8^+$) immunoregulatory index increasing, that is made up, in average, $1,83\pm0,07$ (e.g. $p<0,01$), in comparison with the II – nd group $1,31\pm0,08$, that is for 21,83%. The ITML (the inhibition test of the migration of leukocytes) results have shown, that it has been mentioned the migration index lowering down to $0,60\pm0,04$ (e.g. $p<0,05$) in the III – rd group, in comparison with the II – nd group. It is connected, possibly, with the Be preparation influence – the $CD3^+$ cells lymphokine producing capacity has been increased. The B – lymphocytes absolute and relative quantity were rushing to the normalization under the influence of the phyto-

preparation, in comparison with the II – nd group. At the same time, the statistically significant immune complexes are increased up to $(1,56\pm0,10)$ standard units (e.g. $p<0,01$) in the group, having received the phytopreparation, has been registered. The phagocytal activity (PHA) of the blood cells at the animals of the II – nd group has been made up $31,24\pm2,76\%$, the increase, for certain, up to $39,61\pm2,55\%$ (e.g. $p<0,05$) has been registered in the III – rd group. The IgA common level in the blood serum, at the animals of the II – nd group has been reliably lowered ($2,01\pm0,17$ gr./l. (e.g. $p<0,05$)). It has, moreover, been revealed the IgA level increase in the III – rd group. It has been registered the reliable increase in the II – nd group ($6,49\pm0,57$ gr./l. (e.g. $p<0,05$)) at the IgM common level research. The statistically IgM level lowering, for certain, takes its place in the III – rd group (e.g. $p<0,05$) just after the herbal therapy. The IgG level has been increased in the II – nd and the III – rd groups, in comparison with the intact group.

Having generalized the received results, it is quite possible to state, that have been revealed the significant changes, which have been characterized by the leucopenia, the $CD3^+$, $CD4^+$, $CD8^+$ quantity lowering, the CIC (the circulating immune complex), PHA (the phagocytal activity), and IgA levels, and also by the $CD19^+$ quantity, and the IgM and IgG levels increase at the experimental animals, having exposed to the dust and the radiation factor. The almost all indications normalization takes its place, having increased the organism's protective reaction just in the adaptation mechanisms, having possessed the immunomodulating property at the Be phytopreparation introduction.

The enzymes activity state of the purine nucleotides cycle, as at the dust and radiation exposure, well as at the phytopreparation introduction has also been studied. In the first place, the ADA activity is being defined by the T – cells content, whereas the 5' – HT activity is being depended from the B – lymphocytes. The ADA activity sharp lowering, the purine nucleoside phosphorylase (PNPH), and the 5' – HT in the lymphocytes of the chronic leucoses patients, is testified to on the processes slowing down of the purine nucleotides decomposition, and it also promoted to the toxic for the lymphoid cells of the metabolites accumulation – e.g. the adenosine and the deoxyadenosine. Their concentration increase in the lymphocytes short – term culture of the chronic leucoses patients under the ADA inhibition conditions is caused these cells lysis. As the research results have shown, it has been observed the ADA enzyme activity increase at the animals in 1,79 time (e.g. $p<0,001$), and the 5' – HT and AMPH – DA enzymes activity, for certain, has not been distinguished just from the benchmark, from the side of the purine exchange in the thymus gland at the dust and radiation exposure. It has been registered the reliable all investigated enzymes activity increase in the thymus gland cells just

after the medical treatment. Thus, the enzymes stimulation and activation of the purine exchange take its place against the background of the medical treatment for the balanced action of the immune system components.

As the researches have shown, the AMPH – DA activity factor is not being undergone the special changes in the blood lymphocytes at the dust and radiation exposure. The 5-HT activity is being increased in 6,33 times, and the ADA is, on the contrary, being lowered almost in 1,7 time. These changes are being promoted to the adenosine and deoxyadenosine quantity accumulation, which in the increased concentrations are able to exert the cytostatic and cytological effect upon the lymphoid cells [5]. It has been registered the positive changes of the enzymes activity against the background of the medical treatment, that is in the increase direction: the ADA activity has been increased for 59,09% and AMPH – DA – for 56,25%. The research results have shown, that the ADA, 5 – HT, and AMPH – DA enzymes activity in the liver at the animals just after the dust and radiation exposure has been increased up to $0,452 \pm 0,035$ (e.g. $p < 0,001$), up to $0,044 \pm 0,004$ (e.g. $p < 0,05$), and up to $0,229 \pm 0,022$ (e.g. $p < 0,001$), correspondingly. It has been registered the subsequent enzymes activity increase, which is being resulted in the metabolism activation of the purine nucleotides at the medical treatment.

It is quite known, that the cytoplasmic enzymes of the adenosine deaminase ADA and $\text{PIH}\Phi$ are being catalized the consequent stages of the adenosine and deoxyadenosine degradative transformations, which are the intermediate metabolic exchange products of the purine nucleotides. The superficially – membrane 5' – nucleotidase is dephosphorylized the extractocellular AMPH with the adenosine formation, which is easily able to be transported inside the cell.

Thus, all these enzymes are being taken their part in the maintenance of the metabolites intracellular balance of the purine exchange – that is, the adenosine and deoxyadenosine, which in the increased concentrations are able to exert the cytostatic and cytological effect upon the lymphoid cells [5]. The pathogenetic mechanism has been defined at the molecular level with the indication of the specific deficient enzyme at the IDS (immunodeficiency states) series: the ADA one at one from the IDS and $\text{PIH}\Phi$ or the transcobalamin II forms at the IDS one, having accompanied by the megaloblastic or hypoplastic anaemia. The defects at the ADA and $\text{PIH}\Phi$ enzymes level are being broken the adenosine metabolism. These enzymes defects are being blocked the hypoxanthine production, so the adenosine, ADPH, and ATPH excessive accumulation is being taken its place just in the tissues, that is being blocked the T – cells maturation, by the unknown reasons. It is quite possible to use the metabolism enzymes of the purine nucleotides in the functional condition analysis of the immune status and also in the

immune reaction adequacy [3]. Thus, it has been registered in our experiment that the dust and radiation factor is being brought to the functions disorder of the immune system cells, having changed their activity that is being accompanied by the activity lowering of the exchange enzymes of the purine nucleotides. The dysfunction state of the immune protection system is being appeared, that it is quite able to intensify the adaptative mechanisms disorders. The immunomodulatory quality of the Be phytopreparation has also been revealed.

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PHARMACOLOGICAL AND SURGICAL SYMPATHECTOMY OF VERTEBRAL ARTERIES

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With degenerative damages of cervical spine (CS), by force of closely linked with the second segment of vertebral arteries (VA), the symptoms of vertebral-basilar insufficiency (VBI) are often developed. Hypoperfusion in the bath of VA with spondylogenic damage is sometimes caused by their irritative or reflector spasm, even for lack of considerable

extravasal compression. The syndrome of cervical artery (CAS) is developing for correction of which many specialists follow the conservative medicine tactics.

We observed 52 patients with the CAS with the signs of VBI. Discirculation in the vertebral basilar system (VBS) mostly (77%) showed itself as transient ischemic attacks, other patients had chronic disease. All patients had radiography confirmation of cervical spine damage, with triplex scanning of VA one-sided and two-sided spasm came into light, with contrast angiography the extravasal compression of VA is not revealed.

All patients were made Procaine and spirit-Procaine blockades of the periarteric plexus of VA in the third segment with clinic – ultrasonic positive effect at 43 (82,7%). The duration of therapeutic effect of blockades was varied from 72 hours to 14 days. If Procaine is intolerated, we used 2% Lidocaine solution.

Taking into account pathogenetically founded high effectiveness of sympathectomy of VA, in order to liquidate their pathologic spasm 10 patients were made surgical denervation of the vertebral artery in the third segment under the endotracheal anesthesia. The conditions for making this operation were absents of the hemodynamic significant changes in the first segment of VA and positive effect with making spirit-Procaine blockades.

Under general anesthesia by poster lateral approach on the neck with the usage of magnifying optics nervous fibers of the periarterial plexus of the vertebral are excised and cut, without interference on the vessel itself.

Thanks to liquidation of efferent sympathetic influence on the vertebral artery, irritative or reflector vasoconstriction are fully disappeared, thereby blood flow in the third segment of the vertebral artery and other parts of VBS is improved. Destruction of sensitive fibers of vertebral nerve reduces the appearance of vegetalgetic symptom complex.

In long term observation from 2 to 8 months all operated patients had stable improvement with considerable reduction of manifestations of VBI and algetic component of the vertebral artery syndrome. The clinic improvement is correlated with data of ultrasonic research – on the side of operation the spasm of vertebral artery is fully disappeared, volumetric speed of blood flow is increased. More often we observed the reduction of vestibulocochlear dysfunction, pains in occiput and orbit. 5 patients had diminishing of arterial hypertonic with diminishing of system arterial tension on 20 mm/hg in average.

The usage of pharmacological and surgical sympathectomy of vertebral arteries with their spondylogenic spasm is the affective and little invasion method in the complex treatment of patients with vertebral basilar failure.

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ON THE HEMOMICROCIRCULATORY CHANNEL STRUCTURAL ORGANIZATION

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It has been done quite a number of attempts to single out the structural unit of the hemomicro circulatory channel (HMCC) in the last century. The central canal (e.g. Zweifach B., 1939, 1961) and the module, including in a form of the arterioles and the venules with the capillaries network among them (e.g. Fung V.C. a. Zweifach B..W., 1971) have been mentioned in the most frequently way.

The HMCC 10 dogs’ mesenteries have been studied by me. Its total preparations, just after their fixation in the 10% formalin solution, have been stained by the aluminous hematoxylin, or they have been impregnated by the silver nitrate. The serial paraffin sections of the mesentery, having 7 mcm thickness, have been stained by the Van Gieson and Verhoeff method picrofuchsin, and 10 mcm thickness – by the hematoxylin. The microvessels sizes have been defined by means of the eyepiece – micrometer.

The mesenteries bands of the various sizes and forms (e.g. the HMCC interfascicular segments) are found among the great microvessels’ fascicles (e.g. the I-st order arteriole, the IV-th – V-th order venule). The big branches (e.g. the arterial flows) of the great microvessels are being passed by the fascicles, and they are being divided the mesenteric segments into the microareas. The terminal arterioles and the collective venules are more often being moved away from their contour. The metabolic blocks (e.g. the precapillary – the capillaries – the post – capillary venule) are being formed their ramifications, together with which the HMCC typical modules are made up, and also the central canals and the anastomoses – venular, arteriolar, and arteriolovenular. The combined anastomoses are met, when one arteriole’s branches take its part in the various anastomoses and modules formation. The central canal has its structure of the arteriolovenular semi – shunt, from which its branches are being moved away, where its main links: the metarteriole – is the terminal arteriole, having passed into the precapillary; the main artery – is the main capillary (not always), the postcapillary and the collective venules. The annular module is distinguished from the typical module by its configuration: the terminal arterioles are moving together, in one fascicle with the collective

venules, they are being formed the complete contour (e.g. the biconjugated circular anastomoses). The small terminal arterioles, the primary collective, and the post – capillary venules are being moved away inside the annular module. The annular module «is fixed» to the main arteriole and the (e.g. muscular) venule fascicle, by means of the preterminal arteriole and the premain venule fascicle.

The Conclusion

The HMCC is consisted from the polymorphous microareas – the vascular and tissular complexes, which are limited by the large arterioles and venules fascicles. The various microvessels complexes are formed in their composition in the different combinations. The classical microvessels sequence with the branching and linear angioarchitecture is defined in the most frequently way (e.g. the HMCC typical module). The annular module is met seldom.

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IMMUNOGENETIC MARKERS OF PREDISPOSITION AND RESISTANCE TO THE OBSTRUCTIVE PYELONEPHRITIS AT CHILDREN

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During the last two decades, the number of the urinary system pathologies at children [1,2, 10], and obstructive anomalies [2,3] in particular, has increased considerably, calling for more research on their etiopathogenesis, diagnostics and treatment. Despite a great number of studies concerning etiological aspects of inborn obstructive uropathy (IOU) [4,5,6,7], some diagnostic questions of differentiation between IOU and some similarly appearing diseases and conditions, are still poorly studied. Intensity of IOU's clinical symptoms obviously depends on how strong the primary pathology is complicated with a secondary infection [6,8]. That is why we tried to find out, if there are any immunogenetic markers of obstructive pyelonephritis (OP), and whether it is possible to prognosticate a secondary infection?

We examined 117 Russian children aged between 8 till 15, with a secondary chronic obstructive pyelonephritis and intact kidney function. We studied the distribution of the HLA-complex antigens, their phenotypic and haplotypic combinations. Loci HLA-A, HLA-B, HLA-C were identified with the help of the two-step micro lymphocytotoxicity test (Terasaki P. et al, 1970), loci HLA-DR and HLA-DQ – via long protocol of polymerase chain reaction

using a standard serum set of the Russian Research Institute of Hematology and Transfusiology, St. Petersburg. CD22-lymphocytes for DR-typing and DQ-typing were obtained by filtration of lymphocyte suspension through nylon fiber. In locus HLA-A were determined 15 specificities, in locus HLA-B – 28, in locus HLA-C – 4, in locus HLA-DR – 14 and in locus HLA-DQ – 12 specificities. Antigen frequency rate was determined as a number of persons bearing the antigen compared to the total number of patients in the group [9]. Frequency of phenotypic antigen combinations was determined separately in loci HLA-A and HLA-B, frequency of haplotypic antigen combinations was determined by formula of Mattiuz P. et al (1970). In order to measure essentiality of discrepancy in antigen distribution in the compared groups, we used a fitting criterion (X^2) adjusted for variation continuity; using special mathematical tables, fitting criterion X^2 was changed into coefficient of difference reliability (P). To determine degree of association for different forms of inborn obstructive uropathies with immunogenetic parameters, we used a criterion of relative risk (RR), according to Sweigaard A., Rider L.P. (1994) [11]. Relative risk criterion shows, how often this disease or condition develops in people with a specific HLA-antigen, in comparison with those who do not have it. It is accepted, that when the RR equals or is higher than 2,0, there is a positive association between the marker and the disease (predisposition to disease); and when the RR is smaller than 1,0 – it is a sign of an individual resistance to this pathology. In order to describe this «+» or «-» association quantitatively, we determined the values of etiological fraction (EF) and preventive fraction (PF) correspondingly [9]. Control group in this study included 253 virtually healthy children of the same population sample.

It was revealed, that patients with OP demonstrated a reliable positive association between the disease and inter-locus combination of antigens HLA-A11-B27 in tissues (0,85% compared to 0,01% in control, RR=2,7). We also found the major histocompatibility antigens that prove an individual resistance to this pathology: HLA-DRB1*07 (16% compared to 30,1% in control, $X^2=6,5$, $P<0,05$, RR= 0,45, PF=0,163); HLA-DRB1*09 (0% compared to 2% in control, $X^2=4,4$, $P<0,05$, RR=0,21, PF=0); HLA-DRB1*15(2) (22% compared to 36,9% in control, $X^2=6,15$, $P<0,05$, RR= 0,49, PF=0,186); intra-locus antigen combination HLA-A9-11 (0,85% compared to 7% in control, $X^2=4,6$, $P<0,05$, RR=0,25); and also haplotypic combinations HLA-A2-B12 (8,6% compared to 62% in control, RR=0,06); HLA-A3-B7 (7,7% compared to 84,1% in control, RR=0,02); HLA-A11-B35 (2,6% compared to 29,9% in control, RR=0,07).

To sum up, the patients with OP demonstrated a reliable positive associative connection of the disease with inter-locus antigen combination HLA-A11-B17. Carrier state of this immunogenetic marker increases the a risk for the development of the disease

by factor of 2,7 (RR=2,7). Resistance to this pathology have individuals with antigens HLA-DRB1*07, HLA-DRB1*09, HLA-DRB1*15(2), phenotype HLA-A9-11 и haplotypic combinations HLA-A2-B12, HLA-A3-B7, HLA-A11-B35.

Specific immunogenetic determinants let use immunogenetic methods, to determine the risk for complications such as secondary infections, after an obstructive pathology, or resistance to it, and thus, to optimize medical tactics for diagnostics and treatment of this pathology at children.

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THE LIPIDS PEROXIDATION ACTIVATION INFLUENCE ON THE DNA SYNTHESIS IN THE RATS' PARENCHYMATOUS LIVER CELLS

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The lipids peroxidation processes (LPP) are the universal ones by their nature, and they have the great significance in the many pathological states development in the clinic, including in the hepatitis dif-

ferent forms development. Therefore, the DNA quantity measuring in the rats' hepatocytes nuclei in 12, 24, 48, 120, 168 and 264 hours just after the paraquat injection – the LPP activator has been our investigation aim.

The paraffin sections have been stained by the Schiff's reagent by the Tomazzi's method for the DNA quantity content investigation in the nuclei's parenchymatous liver cells.

The quantitative cytophotometry has been conducted at the "Protva" automatic analyzer in the Institute of the Physiology of CO of the Russian Academy of the Medical Sciences (RAMS) of the city Novosibirsk. The Analyzer has calculated the cells nuclei's area, besides the DNA content.

The average area of the hepatocytes nuclei is for certain being lowered in 12 hours after the paraquat injection. The octaploidic nuclei quantity is being increased from 2% up to 8%.

The main modal class is being situated in the region of 4sec. – 86%, and the DNA average quantity is for certain being increased in 24 hours after the paraquat injection. The diploidic hepatocytes quantity is sharply being decreased from 31% down to 7%.

The cytophotometric investigation results of the hepatocytes nuclei have been shown in 48 hours that the main modal class shift is clearly marked out to the right from 2sec. up to 4sec. and 8sec. on the histogram. The diploidic hepatocytes quantity is sharply being decreased from 31,0% down to 9,3%, namely, the maximum hyperpliodic cells increase from 2,0% during the control up to 14,7% during the test has been registered in this group.

The diploidic nuclei quantity lowering (e.g. from 31,0% during the control down to 9,3% during the test) has been registered in 5 days (e.g. 120 hours) just after the paraquat injection. The main modal class is being situated in the region of 4sec. (e.g. 83%).

The cytophotometric indices will being come to the control values in 5 days (e.g. 120 hours) just after the paraquat influence, but to the 11 days (e.g. 264 hours) the cytophotometric indices are being corresponded to the 24 hours of the experiment.

Thus, the phase changes in the DNA quantitative content are being observed in the LPP activation process by the activator in the experimental rats' liver.

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TERRITORIAL DIFFERENTIATION OF RUSSIAN FAR EAST POPULATION PROVISION WITH HEALTH SERVICES

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As part of the Russian Far East Regions' population health territorial differentiation investigation the study of the District residents' provision with various social services, health services among them, seems to be of great importance. It is especially urgent in the light of the RF Federal Program implementation in the area of health protection. That is why our task was to study out the provision of the Far Eastern Federal District residents with the services in this very important service sector. Besides, the given esteem demonstrates the situation of the first years after the adoption and implementation of the given Federal Program.

To define the level of the regions' population provision with health services the following factors were taken: the supply with doctors and low-grade medical workers (per 10000 of the population), the number of hospital beds (per 10000 of the population), the efficiency of medical outpatient institutions (visits on one shift, per 10000 of the population).

To calculate a cumulative index the linear scaling method fairly often used while calculating the life quality index was employed. It is based on defining referential points (maximum and minimum values of indicators) and shows the position of every region between them. The calculations were performed on the given factors for the period of 2006 in ten Far Eastern District subjects [1, 3].

First, the calculation of special indexes on every factor was performed by the formula:

$$Y = (X - X_{\min}) / (X_{\max} - X_{\min}),$$

where Y – is a special index, X – the factor of this or that region, X_{min} and X_{max} – referential points. The Y value varies anywhere from 0 to 1. Zero corresponds to the worst complex estimation, and 1 – to the best one.

Zero is taken for the minimum value factor. The smallest and largest values of the given factors were chosen as the minimal and maximal referential points for the studied factors in the RF in 2006. So, for the doctor supply factor the maximal referential point is 83,5 per 10000 of the population; that corresponds to the given factor value for St.-Petersburg. Maximal referential points for the low-grade medical worker supply factors were 159,3 per 10000 of the population (the Evenk AD), for the number of hospital beds – 276,8 per 10000 of the population (the Evenk AD), for the efficiency of medical outpatient institutions – 588,9 visits on one shift per 10000 of the population (the Chukchee AD) [2]. The spread in values of the chosen factors varied from 1,8 to 2,7 times.

The final index of the population provision with health service = (Y1+ Y2+ Y3+ Y4)/4, where Y1 – is the supply with doctors (per 10000 of the population), Y2 – the supply with low-grade medical workers (per 10000 of the population), Y3 – the number of hospital beds (per 10000 of the population), Y4 – the efficiency of medical outpatient institutions (visits on one shift, per 10000 of the population).

We assumed that the Far East population health service index maximum value fell on the Chukchee Autonomous District; that makes 0,95. The minimum value of the given factor is registered in the Primorski Krai – 0,46. The difference between the minimal and maximal factors of the population health service provision index among the Far Eastern regions makes 2 times.

Proceeding from the obtained population health service provision indexes we marked out 5 groups of the Far Eastern regions by the population health service provision final index value and the combination of doctor and low-grade medical worker supply levels (per 10000 of the population), the number of hospital beds (per 10000 of the population), the efficiency of medical outpatient institutions (visits on one shift, per 10000 of the population).

The Chukchee AD, in the territory of which 0,75% of the FE population live, formed the first, **very high** population health service provision level, group. The population of this region has the greatest possibility to get health services at the extremely high (100%) efficiency of medical outpatient institutions (visits on one shift, per 10000 of the population) for the RF, high level of supply with doctors and low-grade medical workers and also the number of hospital beds.

The population health service provision level **above the average** is observed in the Koryak AD and Magadan Region and makes 2,9% of the residents from the total population of the District. A high supply with low-grade workers is indicative of this group of regions. The factors of the hospital bed number, medical outpatient institutions' efficiency and supply with doctors conform to the above-the-average value or one factor is lower and the other is higher.

The **average** population health service provision level is observed in the Amur, Kamchatka Regions and the Republic of Sakha (Yakutia), in the territory of which 33,3% of the FE population live. For the given Far Eastern subjects the average values of supply with doctors and low-grade medical workers, hospital beds and medical outpatient institutions' efficiency is typical, or one factor is lower and the other is higher.

The population health service provision level **under the average** is defined in the Khabarovsk Territory, Jewish and Sakhalin Regions, where 32,4% of the FE population live. The average values of supply with low-grade medical workers and under-the-average supply with hospital beds, medical outpatient institutions' efficiency and supply with doctors are typical for the given regions' health service provision level.

The low population health service provision level is defined in the Primorski Krai with the part of 30,8% of the total District population. The low efficiency of medical outpatient institutions (visits on one shift, per 10000 of the population) and number of hospital beds at the average supply with doctors and low-grade medical workers.

An **index-map** with the Far Eastern subjects' population health service provision level territorial difference has become the result of our research.

The analysis of the Far Eastern Federal District population health service provision level allowed coming to the following conclusions:

- The Far East as a whole has average, under-the-average and low population health service provision levels in Russia (in the whole Russia in 2006 – 0,52).
- Regional differences in the population health service provision final index within the Far East are essential and make from 0,46 to 0,95.
- On the final index value and the combination of special indexes of supply with doctors, low-grade medical workers and hospital beds, the efficiency of medical outpatient institutions there are 5 groups of regions marked out in the Far East with the differentiation on the population health service provision level. The majority of the FE subjects has an average and under-the-average population health level (33,3% and 32,4% of the FE population accordingly).

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EVOKED BRAIN POTENTIALS IN DIAGNOSTICS OF LIVER CIRRHOSIS WITH SIGNS OF ENCEPHALOPATHY AND EVALUATION OF CRIO-APHERESIS' EFFECTIVENESS

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Currently existing methods of hepatic encephalopathy (HE) diagnostics at patients with liver cirrhosis, including psychometric tests, measuring ammonia level, electro-encephalography, magnetic resonance spectroscopy and other methods, are either not sensitive and specific enough, or are too expensive.

The objective

Our goal was to evaluate the method of cognitive evoked brain potentials in diagnostics and evaluation of hepatic encephalopathy dynamics at patients with liver cirrhosis who receive a complex therapy.

Materials and methods

We examined and treated 25 patients with liver cirrhosis of classes A and B according to Child-Pugh, with HE of 0-2 stage. The test group consisted of 15 men and 10 women aged between 38 and 63 years old (average age $49,9 \pm 1,5$). Beside the common therapy that included detoxification measures, hepatoprotectors, aldosterone blockers and preparation «Dufalak» (Solvay Pharma) in dose 45-60 ml/day during 30 days, all patients received a course of crio-apheresis (from 5 till 7 treatment procedures). Method of cognitive evoked brain potentials or P300 was applied in order to analyze cognitive processes in the brain. Using method P300, we studied slowing dynamics of inter-peak latency before and after the therapy. The study was conducted using multifunctional computer equipment «Neuro-MVP».

Results

We analyzed the results of the research on the cognitive evoked brain potentials, and saw an obviously bigger latency of peak P300 at all test persons. Average P300 wave was $531,1 \pm 10,8$ ms. Normal latency in this age group should not exceed 361 ms. These data proved a clear disruption of cognitive functions, which was probably not related to defective identification of important stimulus, but was rather connected with defects in memorizing and operative memory of events. Positive dynamics was observed after the treatment: the latency of component P300 decreased ($p < 0,001$), its average value reached $424,2 \pm 7,2$ ms.

Conclusion

To sum up, quantitative parameters of inter-peak latency (P300) could be used as criteria in the evaluation of treatment effectiveness for hepatic encephalopathy, and improve its control.

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THE COST OF FLYING STOCK AND NEEDFUL CAPITAL INVESTMENTS

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The factors influencing on the flying stock of aircrafts and aircraft engines cost are examined in the article. The methods of the cost definition of flying stock are produced which show the cost typical for the definite types of aircrafts and engines and the technical level of home and world practice.

The effectiveness of transport system and the quality of its work are organically connected with the improvement of technical devices of aerial transportation on the basis of modern science and technology. The most important index of technical progress in the field of civil aviation technique is aircrafts economic effectiveness. Naturally that technical economic performances and standards used for determination of aircrafts economic effectiveness differ by various degree of reliability for operated, designed and planned ones. For the first ones they are actual data, for the second ones they are statistical and planned. According to this the evaluation of aircrafts economic effectiveness can be absolute and comparative. The absolute evaluation is meant for determination of being operated aircrafts economic effectiveness or newly built crafts and it is made according to actual technical-economic performances and standards. The last ones are being changed for the time and are defined as planned performances for the given year. The aim of the absolute evaluation is to define the economic performances of aerial technique for planning of operated work for the given period.

Flying stock cost influences on the level of operated expenses (including depreciation and current repairs), on the amount of main productive funds and that's why on profitableness and needful capital investments in flying stock.

Capital investments in flying stock consist of expenses for aircrafts development and engines (scientific research works and experimental design ones), for series production (capital investments for acquisition of engine stock on selling prices) and expenses in connection with putting into operation of

new types of aircrafts (air-crew teaching, expenses on making and acquisition of training equipment etc).

An aircrafts initial cost (on selling prices) depends on many factors. The main ones are:

- the mass of construction;
- cruising speed;
- total series of production that is the whole quantity of built (or planned to be built) aircrafts of the given type by one plant.

The main factors determining the aircraft engine are:

- take off traction or engine mass;
- number M of an aircraft for which the engine is meant;
- total series of production by one plant.

The given methods of determination expenses take into account only the principal enumerated above factors, but not all the factors influencing on the aircrafts price and engines and expenses on their making. The influence of constructive and technological peculiarities, the plant technical level where the article is produced are not taken into account and other are hardly taken into account ones, especially for perspective aircrafts factors. It follows from what is said above that methods are typical and shows that the cost which is conventional for definite types of aircrafts and engines and the technical level of home and world practice.

The aircrafts and engines cost and expenses on their making, which we have in the course of its use, are relative. Actually expenses can differ, but at the same time the correlation in different aircrafts and engines types cost is being kept. That's why the given methods are meant for comparative evalua-

tion of economic different aircrafts and engines types, for economy in the course of parameter research of flight performances and solution of optimistic tasks on economic cri-

terion connected with flying stock development in Russia.

The aircraft cost with its equipment without engine cost in roubles is counted to the formula

$$C_c = VCG_{ch} \cdot G_{ch}, \quad (1)$$

where VCG_{ch} is a specific cost that is aircrafts price with its equipment without engines cost related with the equipped aircrafts mass, r/kg;

G_{ch} is the mass of empty equipped aircraft engines, t.

Cost in roubles, is counted to the formula

$$C_o = VCP_{oi} \cdot P_{oi}, \quad (2)$$

where VCP_{oi} is a specific cost that is engines price related with one Neuton of take off traction;

P_{oi} is take off traction of one engine, N.

Taking into account the correlation and total series of production cost of (TJBE) in roubles is counted to the formula

$$C_o = \left(\frac{42,9 P_{oi}^{0,55} \cdot M^{0,62} \cdot \sum n_o^{0,1} + 0,311 P_{oi}^{0,6} \cdot \sum n_o^{0,846}}{\sum n_o} \right) \cdot 112, \quad (3)$$

where M is Mahs number to aircraft, where the engine is mounted;

$\sum n_o$ is the total series production of the given type engine;

P_{oi} is the engine take off traction, N.

Expenditures on aircraft development include scientific research works (SRW) and design developments (DD). The latter ones consist of designing expenses, construction and testing experimental articles and other

works except expenditures, related with providing series of production.

Expenditures on development of an aircraft or an engine are meant as expenses related with making a new object in a designed form without expenses on next modifications of the given type of aircraft or engine.

Expenses on aircraft development (without the engines cost) in roubles are counted to the formula

$$C_{pa3.c} = VC_{pa3.c} \cdot G_{ch}, \quad (4)$$

where $VC_{pa3.c}$ is a specific cost of the development (expenses on one ton of equipped aircraft mass).

Expenses on one engine depend on many factors. The main ones are:

- engine traction;

- the degree of bicontouring m;

- the degree of succession of the construction related with earlier made engines.

Expenses on engines development in roubles, are counted to the formula

$$C_{pa3.o} = VC_{pa3.o} \cdot P_{oi}, \quad (5)$$

where $VC_{pa3.o}$ is a specific cost of the development on one ton of power traction.

Capital investments in flying stock in millions of roubles are counted to the formula

$$K = K_c + K_\partial + K_\gamma, \quad (6)$$

where K_γ are expenses directly connected with putting into operation of new aircrafts types (crew staff teaching, making of training equipment and expenses on their acquisition) except needfull capital investments on the

ground-based airdromes devices (airdromes, ATB, mechanization devices and etc).

Needful capital investments on the whole flying stock of the given type in millions of roubles are counted to the formula

$$K_c = C_{\text{pas.c}} + 1,05C_c \cdot n_c, \quad (7)$$

where $C_{\text{pas.c}}$ are expenses on the working out of an vehicle, r;

$1,05C_c \cdot n_c$ are expenses for a vehicle on selling prices, r;

$1,05$ is a coefficient including vehicles price, cost of turnover spare parts fund for an vehicle with its equipment;

n_c is a total number of vehicles of the given type (total series of production).

When a new aircraft is being made, capital investments in flying stock, needfull for vehicles of the given type are counted in roubles to the formula

$$K_\partial = 0,5C_{\text{pas.}\partial} + 1,03C_\partial \cdot n_\partial \cdot n_c \cdot \lambda = 0,5C_{\text{pas.}\partial} + 1,545C_\partial \cdot n_\partial \cdot n_c, \quad (8)$$

in which $0,5$ is a coefficient showing the part of expenses on the engine working out (or its modification) on one type of the aircraft;

$1,03$ is a coefficient including the initial cost of engine and cost of turnover spare parts fund in operation;

λ is a coefficient showing the ration of a summery number of engines mounted on an aircraft or needfull in operation quantity of engines on one engine socket.

According to advance of scientific and technical progress the rule in aircraft is the increasing of selling prices and expenses on their making. It is supposed that aircrafts use,

its technical effectiveness and its effectiveness in operation must increase faster than expenses on their making and operation.

This statement must be taken into account during working out of technical demands on making new aircrafts.

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*Materials of Conferences***MODERN KAZAKHSTAN: THE DEVELOPMENT OF POLITICAL COMMUNICATION IN MASS-MEDIA**

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In the last decades in Kazakhstan, Russia and the other countries of the CIS actively have been surveyed researches of the political communication in information-oriented society and have been forming scientific schools in this direction. The study Eurasian countries' political communication's theoretical-methodological and practical bases, including consideration Kazakhstan's political system's political particularities, is materially vital and timely step for designing and prediction of the region's further development. Changes in the society which occur in the last decade demand rearrangement of incidences which are inseparably linked with social consciousness.

Today there are outlined two tendencies in mass political information. One of them appears in transformation of different messages, without any monitoring system, in huge quantity. Humanity lost his social orientation which turns, in conclusion, to indifference toward politics of the society's main part. Huge number of messages is being published in the newspapers, coverage of facts happens in common stream system. The splitting up method pursues quite definite political aims. It helps to form man's consciousness, the man's consciousness that seems to be well-informed, but in reality the person who doesn't have clear ideas in politics.

The other political information tendency consists informational stream's cruel submission to ideological propagandistic purposes. This approach is typical for those printings which are the properties of political parties and movements. For party prints in Kazakhstan are typical periodicals like 'Ak zhol', 'Kazakhstan', 'Zhas alash', 'Megapolis', 'Kala men Dala', 'Strana I Mir', 'Express K', 'Subbota', 'Azamat Times' etc. The activity of such periodicals is especially

become apart during the pre-electional agitational period. In 2004 in pre-electional period for Parliament Mazhilis of RK the newspaper 'Zhas Alash' published series of materials about leaders and strategically platform of 'Ak zhol' party.

The occurrence of yellow press is natural process in the information market in Kazakhstan and others the exsoviet countries. The mass editions 'of yellow press' and occurrence 'of the electronic yellow newspapers' define (determine) differentiation of MASS-MEDIA in political life. "Navigator" - among the web-editions differs by the boldness and criticism of a different sort of "unreasonable" and "biased" materials in relation to authority. The republican

newspaper "Caravan" (in Russian) and regional newspaper "Zamana" (in the Kazakh language) and many other appendices of this periodic edition is limited to secular news, materials and stories of entertaining character, do not cause serious fear of государственно-governmental bodies. On the contrary increases of quantities(amounts) and increase of circulation 'of yellow press' in the market of MASS-MEDIA just testifies of viability of a method 'splittings of the information'. The periodic editions opposition of character 'Epoch', newspaper of a party(set) 'Akh zhol-Kazakhstan' and close to them 'Vremia', 'Zhas alash', 'Azamat Times', 'Soz', 'Subbota', 'Kazakhstan' in modern information space have the certain audience, is especial in the large cities of republic. Among the periodic editions of the country 'Exclusive', 'Mir Eurasia', 'Kazakhstan' etc. is the well illustrated republican and corporate editions. They concerns to a category 'of the qualitative editions'.

Having summarized a role of the Kazakhstan MASS-MEDIAS on development of the political communications, the political technologies and formation of public consciousness can allocate the following tendencies: increase of the editions of an analytical periodic seal and organizations of analytical interactive transfers; occurrence party and opposition of the editions; increase of professionalism of the international journalism illuminating political news, use of dirty PR-technologies in pre-election information campaigns, increase of the political electronic editions etc.

As the negative tendencies of development of the Kazakhstan MASS-MEDIAS it is possible to define(determine): monopolizing MASS-MEDIA; practice of the custom-made publications; weak understanding of modern PR-technologies by all participants of the market; backward economic model of activity of MASS-MEDIA; corruption; high enough politicians of business.

The modern condition of the market of MASS-MEDIA in Kazakhstan is characterized: by occurrence large of mass media by practice of clauses; by self-censorship; by the state orders for accommodation in MASS-MEDIA of paid materials.

In the future the development of the political communications in Kazakhstan is connected to competent realization of process of political choices, political activity of the citizens, use of new models of information technologies in political process, civilized observance of norms of behaviour and ethical morals, professional belief of the political players.

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ROLE OF FISHING INDUSTRY IN PROVIDING COUNTRY'S FOOD SECURITY

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Food security is one of the most important problems of Russia's economy. Scientific researches show that the majority of agribusiness sectors in Russia have already exceeded their threshold limits of food security. And fishery is not an exception. Products of the fishing industry are an essential part of balanced nutrition and a valuable source of animal proteins. Moreover, fishing industry in the world, and especially in coastal countries, is regarded as one of the most vital factors of food security of the country and plays an important role in providing population with fish products.

According to Russia's official statistics, the harvest in 2006 consisted of 3263992 tonnes (101,6% in comparison with the previous year); seafood production, including canned seafood amounted for 346502 tonnes (102,6%) [1]. Seafood export increased yearly, having reached a level of about 1,1 million tonnes. At the same time, seafood import also rose considerably, and was estimated to be 686109,7 tonnes.

As a result, the Russians consume 13,1 kg of seafood a year, which is almost two times less than recommended by the Russian Institute of Nutrition, which advises to eat about 23,7 kg of seafood a year for the average person). Moreover, seafood consumption differs considerably in the Russian regions. This is caused by their peculiarities, geographical location, current financial state and lack of stable relations between them. For example, consumption in the Far East Federal District reaches 22,5 kg, in the North-Western District – 18,2 kg, Central – 14,3 kg, Ural – 14,2 kg, Siberian – 11,7 kg, Southern – 10,4 kg and in the Volga Federal District – 9,9 kg.

In general, the Russian regions are being unequally supplied with fish products, except for Moscow and the Arkhangelsk, Kaliningrad, Moscow, Murmansk and Primorsky regions. Population prefers frozen fish, light-salted and smoked seafood, as well as many types of canned seafood. However, the quality of many products available on the consumer market, does not always meet all the standards. According to the Russian Agency for Health and Consumer Rights, in 2006, 35% of national and 21% of imported goods were of a poor quality.

It should be mentioned, that fishery is a subsidized branch of economy. World investments into the fishing industry are about 120 billion dollars, but the revenues do not exceed 70 billion dollars. Positive ef-

fect is achieved through profit distribution in fishing sales and processing sectors. Governments are focusing on improving fish resource management in the 200-mile zone, where the majority of fish is being caught, as well as support the fishing industry. Unfortunately, this scheme is not efficiently used in Russia.

Unlike Russia, seafood consumption in the leading countries varies from 19 kg till 100 kg per capita (Netherlands – 19 kg, Italy – 20 kg, France – 25 kg, Denmark – 31 kg, Norway – 55 kg, Japan – 72 kg, Island – 100 kg) [2]. Average consumption level in Europe is 20 kg per capita a year, i.e. twice as much as in Russia.

In many countries, seafood is not only a source of animal protein, but also contributes to the development of the domestic fishing industry, as it brings foreign currency to the country's budget. In the structure of the international food trade, seafood have a higher quote than many other products. According to the FAO, export from the developing countries to the developed ones exceeds 13 billion dollars, which is much higher than export of meat, rice, coffee, tea and bananas. Such countries as Canada, Norway and Island, export seafood for over 3 billion dollars a year, but not at the expense of the domestic market.

The state keeps its food independence, if import does not exceed 25% of the domestic consumption. In Russia, the level of seafood import has already exceeded the critical point of economic security (since 2001 import amounts to nearly 30% of the seafood consumption in the country), although Russia has great resources of food fish.

Russia's seafood export, mainly from its Far East, consists of raw products. More than 80% of the total export is frozen fish. Export of canned shellfish accounts for 6,63% and fish fillet - 5,53%. Russia exports seafood in more than 20 countries: Korea, China, U.S.A., Japan, Gibraltar, Singapore, Virgin Islands, Germany, Mauritania, Panama and other.

At the same time, about 70% of import is also inexpensive frozen fish (herring, poutassou and etc.), which is mainly consumed in the European part of Russia. Import of canned seafood (12,08%) and fish fillet (7,78%) also remains considerable.

Active development of seafood export from Russia does not results from a balance between import and export. On the contrary, export of seafood, which is also demanded in the home market, stimulates its import from abroad, but for a higher price.

However, seafood import cannot and should not be limited by governmental measures only. In our opinion, a complex state policy is needed to support national fish market and producers. Growing domestic demand for seafood can be satisfied by means of a modern wholesale seafood trading system, especially in Russia's coastal regions; crediting seafood trading in futures contracts; renewing state orders for seafood production, including canned seafood.

To sum up, a priority task for the fishing industry in Russia should be food security, which means availability of seafood and one's access to it in all Russian regions; its availability for all social groups; support of a balance between prices and incomes in the country.

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THE INTERNATIONAL COOPERATION OF THE FACULTY OF MATHEMATICS AND MECHANICS OF THE PERM STATE UNIVERSITY IN 2008 AND ITS FUTURE PROSPECTS

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Perm State University is one of the oldest institutes of higher education in Russia. It was created in 1916. There are 12 departments. The faculty of Mathematics and Mechanics numbers more than 800 students and post-graduate students, more than 200 teachers and employees. It has large scientific and educational potentials. For their realization it is necessary to develop international cooperation.

Now there are many international educational projects all over the world. One of them is Bridge. This is the collaboration project between Britain and Russian Universities started in 2008. The faculty of

Mathematics and Mechanics takes part in it. According to the Memorandum made between Perm State University and University of Reading, in 2008 – 2010, after training in Reading and in Perm, ten Perm students will obtain master diplomas of Computer Science of both Universities. Now students established a reputation as the best students of University of Reading. Therefore the further it is planned to develop the cooperation between Russian and British Universities.

The memorandum made between these Universities, provides cooperation not only in educational, but also scientific domain. The research issues that are of interest to both Universities are being defined.

There are negotiations considering the participation of Perm State University in other large-scale international projects. According to the application, Perm State University should enter a consortium of high schools of 15 countries of Europe and Asia.

In 2008 the strong contacts with Bulgarian Academy of Sciences were established. The Memorandum of scientific cooperation between the faculty of Mathematics and Mechanics of Perm State University and the Institute of Mathematics and Computer Science of Bulgarian Academy of Sciences is signed.

In order to establish and continue the international scientific relationship in last 2 years employees of the faculty of Mathematics and Mechanics have visited the Great Britain, Austria, the USA, Bulgaria, Norway, Germany, Slovenia, Hungary, Spain, the CIS countries. New projects concerning the international scientific and educational collaboration are being developed.

The overseas company "PROZNOZ " (Perm) is a sponsor of the faculty.

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STAGES OF DEVELOPMENT AND PARADIGMS OF NATURAL SCIENCE

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Notion "nature" are considered in article in system of the worldview, cognition of the person of the nature, structure and level of the nature with standpoint of the modern science, as well as questions about purpose and subject natural. In article are analysed stages of the development of nature, signs, characterizing modern natural.

Keywords: nature, culture, system of the worldview, stages of the development of natural science, system of nature, purpose, synergetics, attitude towards nature.

The notion of nature is one of the substantial categories of philosophy. The notion of nature is very close to the notion of substance covering everything even the endless universe. In a broad sense of the word nature is substance and simple reality together with its different links, relations and attributes. In a narrow sense of the word it is a totality of all natural conditions necessary for existence and development of man and society. It is important to compare it with the notion of culture in order to clarify the notion of nature in detail. Culture is a study of objects changed as a result of man's activity. Nature is a totality of things existing on the basis of objective rules. In other words culture is a part of nature changed and learned by man, and man's activity is a process of turning of natural into cultural, artificial. Man remains high education of nature. Nizami, the great poet of Azerbaijan, called people not only be responsible for nature, but also to love as a mother and be attentive and honest towards nature. So the notions man, society and culture are the notions opposite to the notion of nature. Man's contradicting attitude towards nature throughout history has been connected with different positions of man. These positions can be grouped in the following way:

1. Nature in its development falls behind culture and is an ill-formed unconscious activity.

2. Nature is a personification of perfectness. It stands higher than man, society and culture.

3. Nature is natural forces, reign of chaos, reality regulating man's sober mind.

4. Nature is a reality of true rules, reign of natural inevitability, reality which does not go beyond the limits of existing rules. The philosophers of the ancient times used to connect the notion of nature with notion of outer space.

The attitude towards nature changed in the Christian culture in the middle ages. According to Christianity nature surrounding man and society is created by the God. However, man used to stand higher than nature for the stages of development.

With the lapse of time nature was considered as a means for getting out of negative situations in philosophy and romantic esthetics. Russo thought man to be a reason of all misfortunes. Bacon thought that the main idea of the science and philosophy helped man to master the great forces of nature.

Summing up man's changing attitude towards nature with the lapse of time there are 2 main stages:

1. The period of extensive attitude towards nature to the middle of XX century.

2. The period of intensive attitude towards nature to which began in the middle of XX century.

The contemporary science defines several levels in the structure of nature which are in dialectical interconnection. The interrelation of man and nature is reflected in the notion of environment. It is important to define natural and artificial forms. According to qualitative characteristics nature is divided into living and lifeless. Life is a main index of life beings. One of the problems being encountered is a problem of the source of the

origin of life. This problem has been troubling mankind since the ancient times. People had tried to solve the problem using the religions, myths and natural philosophy. The natural science as compared the religion thought that the birth of life on the earth was a result of the evolution which existed before life. The first signs of life appeared approximately 2 milliards years ago.

Like any spheres of knowledge natural science also has its history and logic of development. According to modern understanding natural science is a system of natural sciences which are based on mathematical description of objects of the research. Natural knowledge is also one of the three important spheres of knowledge about nature, society and contemplation. Natural science elaborates a system of certain points of view for cognition of phenomena and processes of nature and this system is called conception. The system of views on the cognition of processes and phenomena undergo corresponding changes and changed to new conceptions and paradigms. Paradigm is a concrete type to position a problem which can be used within certain period of time. The aim of natural science is primarily a reality of natural phenomena, detection of rules and regulations of forming and development these phenomena, and achievement of their mental combination foreseeing new events. Another aim is to create real possibilities for using in the interests of man and society. The aims of natural science can be close as well as remote.

There are 3 stages in the development of natural science:

1. The classical stage of natural science.
2. The non-classical period of development.
3. The modern period of development.

The classical period of development has 2 stages: classical natural science and the ideas of evolution. The classical period of natural science can be divided into 2 periods: the period of mechanical natural science and period of appearing and formation of the natural science of evolutionary ideas. The

development of the mechanical natural science can be divided into 2 steps:

1. Step of the development of the mechanical natural science before Newton.
2. Step of the development of the mechanical natural science in Newton's times.

Some well-known scholars such as Copernic, Brage, Newton, Galiley, etc. made a big contribution to the cause. Galiley had 2 methods of experimental study of nature: analytical and synthetic and deductive method. Kepler discovered 3 laws of the movement of the planets round the earth. The works of Faradey, Maxwel, Lamark were famous in the evolutionary period of classical natural science. The works of Rezenford, Bor, Boryl, ets. were famous in the non-classical natural science. The decay of the classical natural science was primarily connected with Einstein's theory of relevance.

The first feature characterizing the modern natural science is its broad development in its different spheres of ideas and methods of synergetic. Synergetic is a theory of self-education and development of free natural complex systems. The second feature characterizing the modern natural science is strengthening of the theory of totality, cognition of the necessity of comprehensive outlook. The third feature is a strengthening of the idea of co-evolution and their gradual development in a broader scale. The modern natural science is characterized with the change of an object of the research and strengthening of the role of the complex approach in its study. Another feature is its broad application in all the spheres of philosophy and its methods. One of the features is the reign of methodological pluralism. The penetration of man's activity, connection of the objective world with man's world, bridging the gap between the object and the object are also distinctive features of the modern natural science. The modern natural science is characterized with its deep penetration in all the spheres of the ideas of development. The distinctive feature is mathematization of natural sciences. The possibility to be generated on the basis of the principles of global

evolution is also a feature. The distinctive feature is its apprehension as a natural organism. Finally, another feature is that this form of thinking cognates the world not only as a system of harmony, but also a system of stability and instability, order and chaos, etc.

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REGULARITIES OF THE UNDERLYING PLANT BASE STASIS FACTORS FOR QUALITY CONTROL OF SOIL ON ISO 11269-1

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International Standard ISO 11269-1 gives the example of the influence of the concentration of nickel in the soil at the root length of barley.

A basic scheme of the influence of pollutants on the growth of plant roots. This is considered the entire set of statistics without the use of the arithmetic means.

Keywords: standard, an example of experiments, the hidden factors, results of simulation

The international standard ISO 11269-1 results an example of nickel concentration C (mg/kg) influence in soil on barley L (mm) [1, p.186, table 17.2]. The standard recommends to process results by statistical methods of Student or Dannet. Our methods

[2, 3] have allowed to reveal biotechnical regularities of underlying factors.

Basic data

Basis of modelling in the standard is the arithmetic mean significances calculation (table 1). However same arithmetic mean significance can characterize a wide variety of statistical distributions.

Table 1. Results of the barley base test of in soil samples on the ISO 11269-1 [1, p.186, table 17.2]

Nickel concentration, mg/kg	Base length, mm										Mean base length, mm
0	98	99	105	100	100	101	102	103	97	101	101
	101	104	102	97	100	99	96	102	105		
50	96	104	99	101	102	97	102	100	97	99	99
	98	98	100	99	97	96	100	103	98		
100	85	91	93	92	88	84	90	84	89	88	88
	90	87	93	88	87	83	86	82	84		
500	17	9	8	11	16	13	11	12	9	12	12
	15	15	7	8	15	17	10	12	9		
1000	9	3	4	11	3	7	7	5	8	6	6
	7	4	5	5	6	9	7	6	8		

In table 1 each several 18 plants for same concentration of nickel are placed in a number on the principle unknown to us. Therefore it is impossible obviously to select the influencing factor. In this case we apply a technique of mediate base length ranking. In the beginning we shall show statistical models on the table 1.

Biotechnical regularities

On a table model from table 1 some formulas of nickel concentration influence on a change of barley base length, mm (fig. 1), are received:

- On the arithmetic mean base length

$$\bar{L} = 96,5882 \exp(-5,09941 \cdot 10^{-5} C^{1,74943}) + 5,66927 ; \quad (1)$$

- On the typical base length

$$\tilde{L} = 96,4414 \exp(-4,77729 \cdot 10^{-5} C^{1,77103}) + 5,55494 ; \quad (2)$$

- On the maximum base length (upper limit of a confidence interval)

$$L_{\max} = 95,9266 \exp(-4,3725 \cdot 10^{-5} C^{1,76972}) + 10,25557 ; \quad (3)$$

- On the minimum base length (lower limit of a confidence interval)

$$L_{\min} = 96,2020 \exp(-5,31762 \cdot 10^{-5} C^{1,76583}) + 2,75881. \quad (4)$$

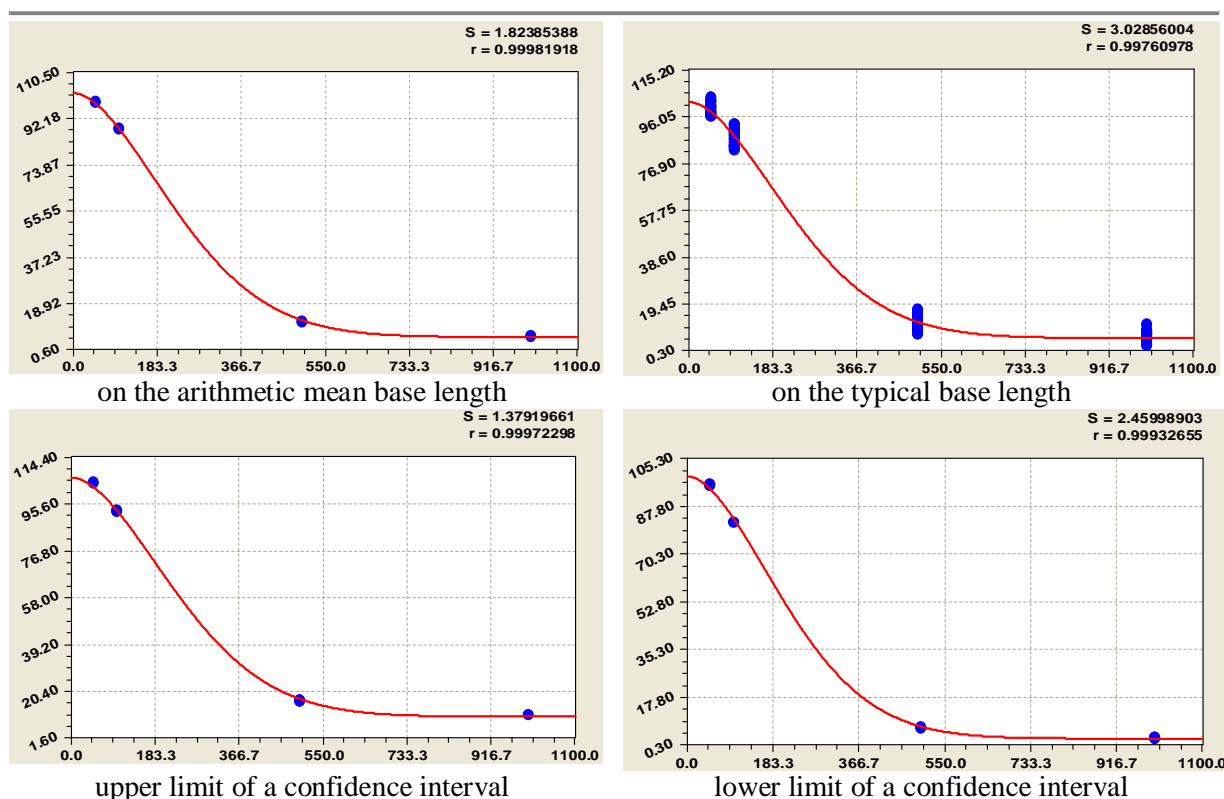


Fig. 1. Graphs of nickel concentration influence on the barley base growth

All four equations show limits of growth on condition that $C \rightarrow \infty$. But the parameters of models of means that is equations (1) and (2) within pollutant concentration change differ from each other. It proves that the statistical numbers including 18 significances of base length don't follow the Gaussian-Laplace law that is known as normal distribution law [2, 3]. Therefore arithmetic mean method gives an error on a comparison with the typical approach.

Modelling conception

In a fig. 2 the schematic diagram of pollutant influence on plant base growth is represented. With that all statistical ensemble consisting of $5 \times 18 = 90$ members (table 2) is considered. The greatest and least signifi-

cances of base length derive a variation of plant development and growth in changing soil conditions. The transition from a level $L_{\max \max}$ in $L_{\min \min}$ occurs under the death distribution. The line of transition divides area of behaviour of a plant set on two parts:

a) from above graph in a fig. 2 is plant base stasis effect;

б) from below graph is stasis effect by plants;

All equations are obtained on a line of stasis effect by plant in growth process.

Then biotechnical regularities of stasis by plants are received under the general formula:

$$L = L_{\max \max} (-a_1 C^{a_2}) + L_{\min \min}, \quad (5)$$

where a_1, a_2 - required model parameter.

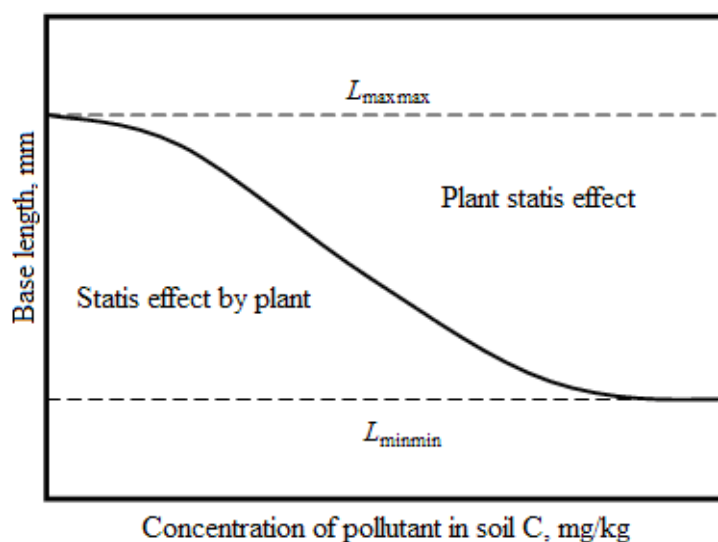


Fig. 2. The schematic diagram of pollutant influence

And the effect of plant stasis will be identified by biotechnical regularity of a kind:

$$L_s = L_{\max \max} - L. \quad (6)$$

Under the standard the longest base of a plant is measured.

Table model

The formulas (5) and (6) are applied to samplings and we shall receive table 2.

Table 2. Test result ranking

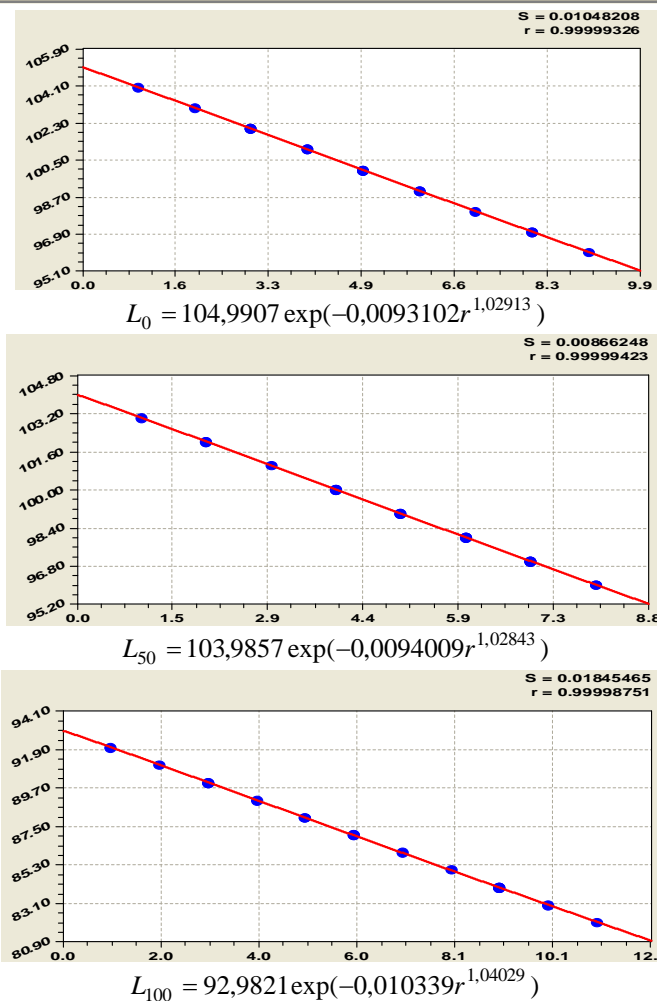
C , mg/ kg	L , mm	Ra nk r	L_{\max} , mm	$L_{\max} - L$ mm	C , mg/ kg	L , mm	Ra nk r	L_{\max} , mm	$L_{\max} - L$ mm	C , mg/kg	L , m m	Rank r	L_{\max} , mm	$L_{\max} - L$ mm
0	98	7	105	7	50	99	5	104	5	500	11	5	17	6
0	99	6	105	6	50	97	7	104	7	500	12	4	17	5
0	105	0	105	0	50	96	8	104	8	500	9	7	17	8
0	100	5	105	5	50	100	4	104	4	500	15	2	17	2
0	100	5	105	5	50	103	1	104	1	500	15	2	17	2
0	101	4	105	4	50	98	6	104	6	500	7	9	17	10
0	102	3	105	3	100	85	8	93	8	500	8	8	17	9
0	103	2	105	2	100	91	2	93	2	500	15	2	17	2
0	97	8	105	8	100	93	0	93	0	500	17	0	17	0
0	101	4	105	4	100	92	1	93	1	500	10	6	17	7
0	104	1	105	1	100	88	5	93	5	500	12	4	17	5
0	102	3	105	3	100	84	9	93	9	500	9	7	17	8
0	97	8	105	8	100	90	3	93	3	1000	9	1	11	2
0	100	5	105	5	100	84	9	93	9	1000	3	7	11	8
0	99	6	105	6	100	89	4	93	4	1000	4	6	11	7
0	96	9	105	9	100	90	3	93	3	1000	11	0	11	0
0	102	3	105	3	100	87	6	93	6	1000	3	7	11	8
0	105	0	105	0	100	93	0	93	0	1000	7	3	11	4
50	96	8	104	8	100	88	5	93	5	1000	7	3	11	4
50	104	0	104	0	100	87	6	93	6	1000	5	5	11	6
50	99	5	104	5	100	83	10	93	10	1000	8	2	11	3

C , mg/ kg	L , mm	Rank r	L_{\max} , mm	$L_{\max} - L$, mm	C , mg/ kg	L , mm	Rank r	L_{\max} , mm	$L_{\max} - L$, mm	C , mg/kg	L , mm	Rank r	L_{\max} , mm	$L_{\max} - L$, mm
50	101	3	104	3	100	86	7	93	7	1000	7	3	11	4
50	102	2	104	2	100	82	11	93	11	1000	4	6	11	7
50	97	7	104	7	100	84	9	93	9	1000	5	5	11	6
50	102	2	104	2	500	17	0	17	0	1000	5	5	11	6
50	100	4	104	4	500	9	7	17	8	1000	6	4	11	5
50	97	7	104	7	500	8	8	17	9	1000	9	1	11	2
50	98	6	104	6	500	11	5	17	6	1000	7	3	11	4
50	98	6	104	6	500	16	1	17	1	1000	6	4	11	5
50	100	4	104	4	500	13	3	17	4	1000	8	2	11	3

Here L_{\max} means a maximum of base length in each sampling for same significance of an explanatory variable.

Number ranking

On vectorial orientation «it is better → worse» we shall give ranks $r = 0, 1, 2, \dots$ to each significance of length in five samplings. After death distribution identification the biotechnical regularities (fig. 3) were obtained.



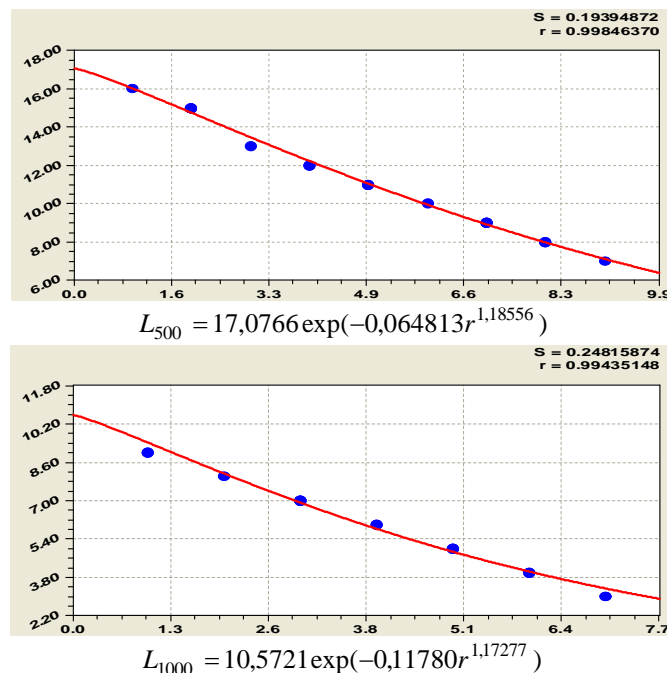


Fig. 3. Graphs of unknown factor influence

The high equation correlation coefficients (in a right upper graph angle) show availability of underlying factor or even groups of underlying factors in experiment results.

The residuals after the equations in a fig. 3 equal to less than 0,5 mm, that is there are below measuring precision of length of the longest plant base.

The two-factor image is shown in a fig. 4.

The unknown factor exerts noticeable influence for significant concentration of pollutant.

On rank length, that is on a maximum rank r_{\max} , it is possible to judge about attempts of a plant to resist to harmful pollutant influence.

Confidence interval

It is determined more precisely on data of table 3, when curculating members of general statistical sampling consisting from 90 members as the formulas (fig. 5) come into account:

- on the upper limit of confidence interval of base length

$$L_{\max} = 105,0076 \exp(-4,38223 \cdot 10^{-5} C^{1,84524}) + 0,20528 C^{0,84335} \exp(-0,0018467 C^{0,99989}); \quad (7)$$

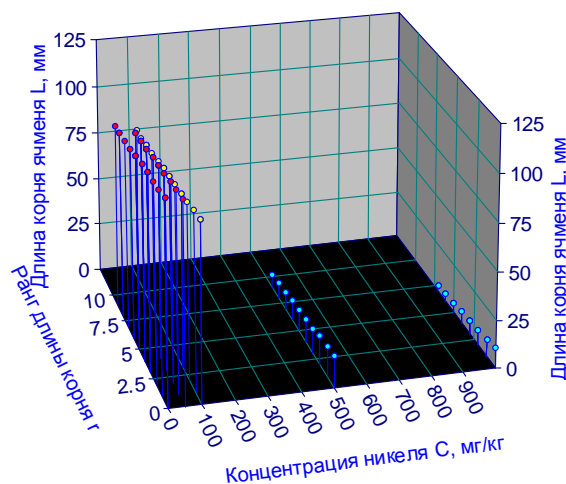


Fig. 4. Disposition of base length

- on the under limit of confidence interval of base length

$$L_{\min} = 96,0000 \exp(-0,21378C^{0,40327}) + 0,12512C^{1,94994} \exp(-0,028479C). \quad (8)$$

Table 3. Limits of confidence interval

upper		under	
0	105	0	96
0	105	50	96
50	104	50	96
100	93	100	82
100	93	500	7
500	17	1000	3
500	17	1000	3
1000	11		

These binomial equations contain two stable distribution laws. First component is the death distribution offered by us [2, 3], in which in difference from the Laplace law intensity of death (degree of an explanatory variable) is entered. Second component indicating high-stress excitation of test plants from pollutant effect is the biotechnical law of prof. P.M. Mazurkin. Besides first component is a special case of the biotechnical law. Therefore all regularities are received from one formula.

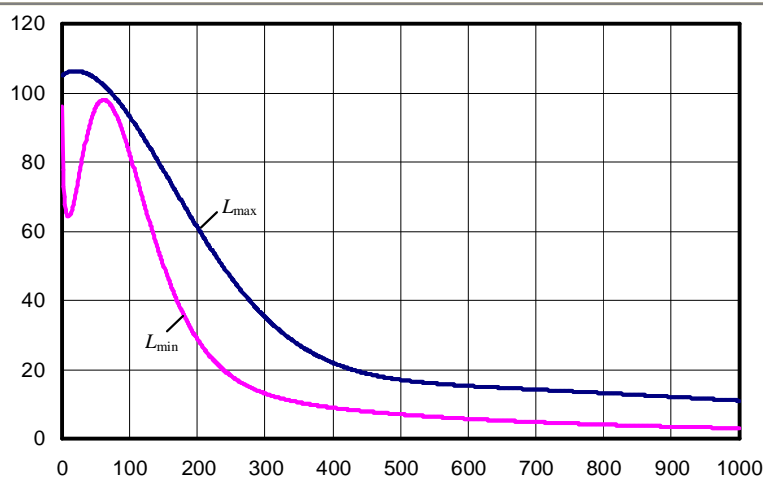


Fig. 5. Limits of confidence plant behaviour interval on the length of longest base in each plant (axis of ordinates) depending on pollutant concentration (abscissa)

Table 4. Scatter of length and stasis of plant base, mm

C , mg/kg	Maximum		Minimum		Scatter ΔL	Stasis	
	rank r_{\min}	L_{\max}	rank r_{\max}	L_{\min}		$L_{C \max}$	$L_{C \min}$
0	0	105	9	96	9	0	0
50	0	104	8	96	8	1	0
100	0	93	11	82	11	12	14
500	0	17	9	7	10	87	89
1000	0	11	7	3	8	94	93

Small nickel concentrations up to 30 ... 40 mg/kg exert positive influence to robust plant development and growth. And depauperate plants fast reduce their growth, but

according to increase of nickel concentration in an interval 10 ... 250 mg/kg depauperate plants receive death high-stress excitation. These conclusions are preliminary, as the

scale of explanatory variable, accepted in the standard, is small. The additional researches by the rules of developmental experiments are necessary.

Scatter of length of base and stasis

The composite indexes obtained on the basis of table 1 data disregarding recurrings of the members of statistical sampling, are represented in table 4.

The interval between lines of the upper and under limits of confidence interval shows

scatter of length of plant base ΔL . This parameter is equal to $\Delta L = L_{\max} - L_{\min}$. Stasis L_C will be defined on a difference of a variable length L from greatest base length L_0 for zero concentration of pollutant in soil that is from expression $L_C = L_0 - L$.

The change of a maximum rank will be defined under the biotechnical formula (fig. 6)

$$r_{\max} = 9 \exp(-0,068416C^{0,18838}) + 6,61267 \cdot 10^{-11} C^{5,90256} \exp(-0,025330C). \quad (9)$$

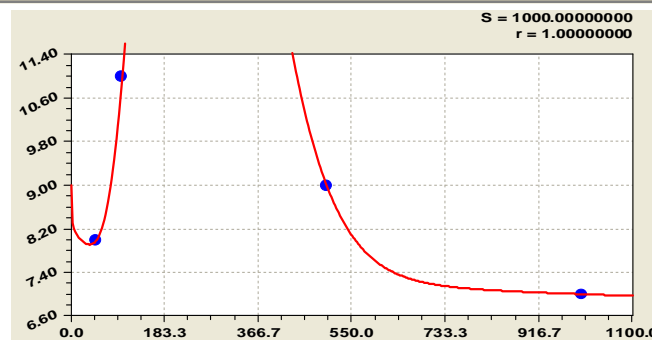


Fig. 6. Graph of maximum rank of base length (axis of ordinates) from pollutant concentration (abscissa)

The disposition of points concerning contour shows insufficiency of observations in an interval 100 ... 500 mg/kg.

Scatter of base length (fig. 7) shows even more intuitive intense sparsity of nickel concentration significances:

$$\Delta L = 8,52730 \exp(-6,71576 \cdot 10^{-5} C) + 1,93804 \cdot 10^{-31} C^{17,06904} \exp(-0,069594C). \quad (10)$$

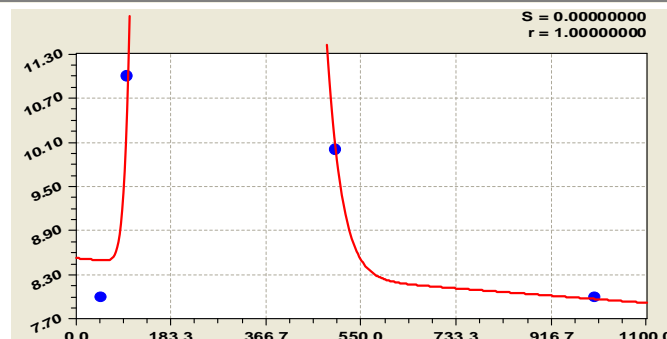


Fig. 7. Graph of scatter of base length (axis of ordinates) from pollutant concentration (abscissa)

The residuals after the formula (10) are capable to give wave component (fig. 8) because of that they is significant more error of measurements in $\pm 0,5$ mm.

$$\Delta L_3 = 1,25505 \exp(-0,018019C^{1,00055}) \times \cos(\pi C / (89,13295 - 0,0011380C^{1,02453}) + 1,18463) \quad (11)$$

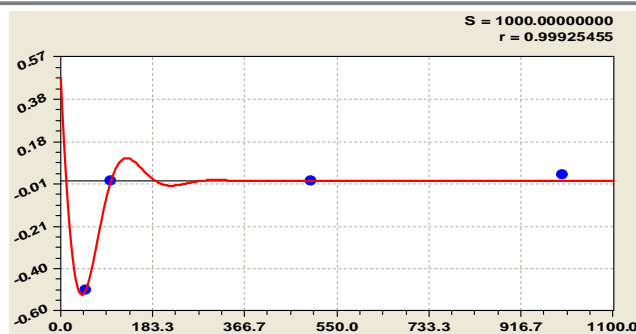


Fig. 8. Wave component graph of model of base length scatter (axis of ordinates) from pollutant concentration (abscissa)

Thus, for small concentrations pollutant offers vibrational perturbation in plant behavior. Therefore influencing on development and growth of barley base can be both positive, and negative depending on a soil nickel concentration change scale, accepted in experiments.

Then the general model of barley base length scatter change, depending on nickel concentration in soil, after repeated parametric identification in a software envelope CurveExpert-1.3 will be defined by the trinomial equation of kind:

$$\Delta L = 8,53098 \exp(-6,42631 \cdot 10^{-5} C) + 1,93473 \cdot 10^{-31} C^{17,06865} \exp(-0,069603C) + 1,25404 \exp(-0,017927C^{0,99926}) \cos(\pi C / (89,09648 - 0,0020767C^{1,24037}) + 1,18747) . \quad (12)$$

Stasis of robust species

They are present in each subgroup (fig. 9) and are determined by the tendency (trend) of difference kind and wave component on formula:

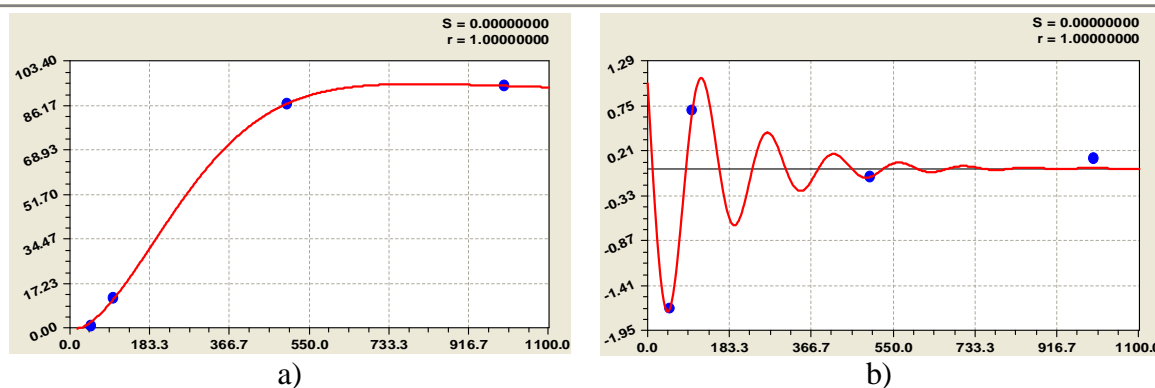


Fig. 9. Behavior of robust barley species for stasis: a – on a trend with first two not wave components; b – on third wave component

$$L_{C_{\max}} = 99,82401 \exp(-5,97800 \cdot 10^{-5} C) - 100,83128 \exp(-4,10906 \cdot 10^{-5} C^{1,76153}) + 2,28550 \exp(-0,0060152C) \cos(\pi C / (75,23778 - 0,0011263C) + 1,11439). \quad (13)$$

Dynamic factor is significant on a model (13) in an interval 0 ... 500 mg/ kg.

Stasis of depauperate species

With even greater dynamism perturbation influence of nickel concentration in soil (fig. 10) on growth depauperate barley species is exhibited:

$$L_{C_{\min}} = 94,39225 \exp(-2,80992 \cdot 10^{-5} C) - 96,18219 \exp(-4,00000 \cdot 10^{-5} C^{1,81633}) + 2,78417 \exp(-0,00070954C) \cos(\pi C / (73,77210 + 0,012625C) + 0,87252). \quad (14)$$

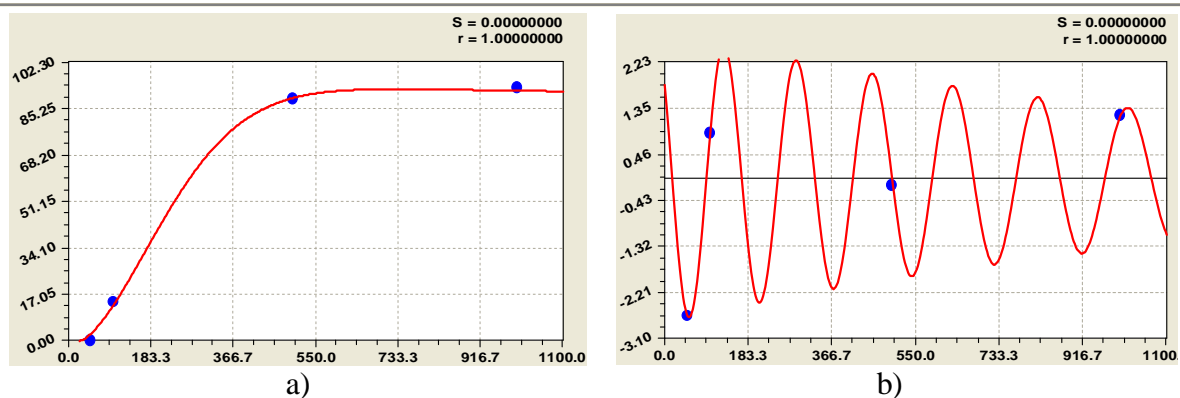


Fig. 10. Behavior of depauperate species for stasis on two and three components

Comparison of the graphs in a fig. 9b and the fig. 10b shows that depauperate species confront own death longer, than robust barley plant species. But behavior dynamism

of robust species is greater. It is visible for comparison of the graphs under both full formulas (13) and (14) in a fig. 11.

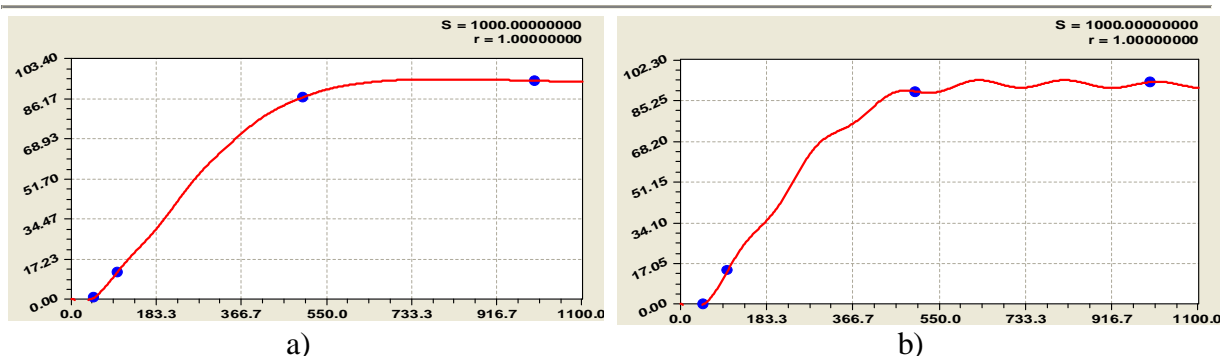


Fig. 11. Adaptation of robust (a) and depauperate (b) plants to polluted soil

Stasis in plant subgroups

The subgroups from 18 plants conduct itself variously. The makers of an example from ISO 11269-1 have arranged results of monitoring so, that on significances of soil nickel concentration regularities were ob-

tained by us for each plant subgroup under the formula (6), that is under the expression $L_s = L_{\max} - L$.

For first three significances of nickel concentration in soil 0, 50 and 100 mg/kg under the formulas of biotechnical regulari-

ties in a fig. 3 functional accuracy $L_s = L_{\max} - L = r$, where r - rank of distribution $r = 0,1,2,\dots$ was received.

The concentration levels in 500 (fig. 12a) and 1000 (fig. 12b) mg/kg have changed proportionality of small levels of the nickel contents in soil under the formulas:

$$L_{s500} = 742,1466r^{2,77434} \exp(-6,75035r^{0,19763}); L_{s1000} = 1,72778r^{0,77620}. \quad (16)$$

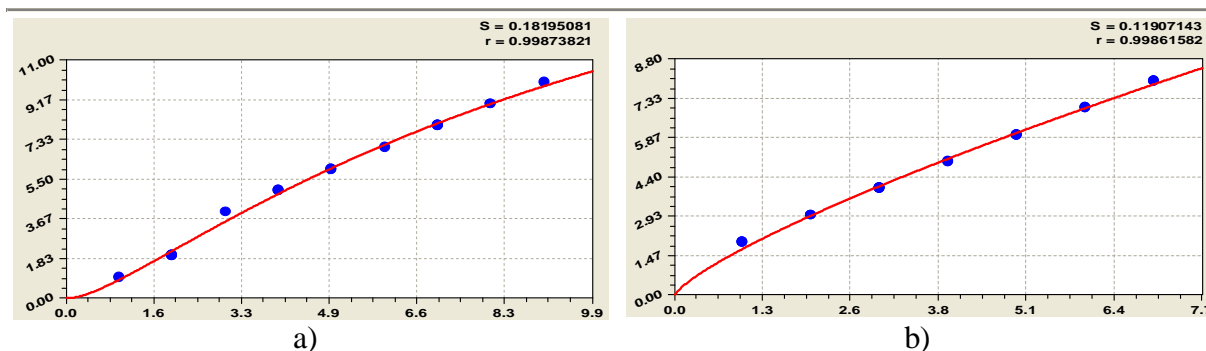


Fig. 12. Stasis for nickel concentration 500 (a) и 1000 (b) mg/kg in soil

The plants for $C = 500$ confront and change growth under the biotechnical law, and at a level $C = 1000$ mg/kg the aggravation of base growth occurs under the exponential law.

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REGULARITIES OF NEEDLE DISTRIBUTION ALONG FIR-TREE RAMULE

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Needle length along ramule of fir-trees growing in pollution conditions, allows to compare various ecological conditions of habitat of these ramules on the same fir-tree. And the distribution character of needles along ramules varies depending on a pollutant level of a section near tree.

The differences on cardinal directions in needle quantity on numbers on one ramule are hardly appreciable, and depending on a pollutant level determine a characteristic figure of distribution of needle sizes on ramule length from its the basis. The analysis method of needle length distributions along one fir-tree ramule allows to determine general tendencies of needle distribution and gives fundamental biotechnical regularity.

Key words: accountable fir-tree, ramules placed on verticils, needle disposition, length parameter, needle distribution along ramules

The fir-trees are capable to register in difference age annual changes of an environment [2].

The changes of fir-tree needle properties are considered as adaptive behaviour directed on survivability and supporting of persistent growth and development in conditions of environmental pollution [3]. These changes allow defining ecological relations on territory, on which investigated accountable trees grow [2]. Therefore fir-trees can be used for realizations of ecological monitoring by a discrete evaluation of effects on fir environment, in other words its habitat.

However in the known publications attention is insufficiently directed to geometric parameters of needles, which should be of different length on ramules, situated in a small zone of pollution.

The purpose of the article - to prove biotechnical regularities of distribution of needle length along ramule stem taken in a specific geodesic direction on accountable fir-tree verticil limb tip.

For consummation of the purpose in view the following problems were decided:

- 1) Parameter of distribution along ramule as fir-tree needle length was determined;
- 2) Model of needle distribution by identification of the stable laws was obtained;
- 3) The possibility of accountable fir-tree needle length application for realization of an ecological evaluation of fir-tree habitat was justified.

For study of a fir-tree needle length change on ramule length on Yoshkar-Ola centre territory one accountable fir-tree *Picea abies* [1] at the age of 25-30 years was selected. The tree is situated near building of theatre named after Shketan on square named after Lenin. Auto-road and parking lot are situated from east direction of a tree, and from western direction fir-tree is bedimmed by adjoining building of theatre. Other fir-trees are disposed between accountable tree and auto-road, and also between accountable tree and parking lot.

In a fig. 1 disposition scheme of accountable fir-tree, from which ramule sampling for experiment realization was conducted, is represented.

Before sampling cardinal directions were defined by a compass, paper packets with the indication of the cardinal direction and number of sample were prepared. Fir-tree ramules were snipped by knife. Linear needle parameters were measured by ruler and caliper. Needles were dried on a paper square with meshes for preservation them before measurements after drying-up. About each mesh number cardinal direction and distance up to the basis of each fir-tree needle beginning from ramule stem were denoted.

Ramules were snipped from limb stem extremity approximately at height 1,3 m from tree trunk root collar level.

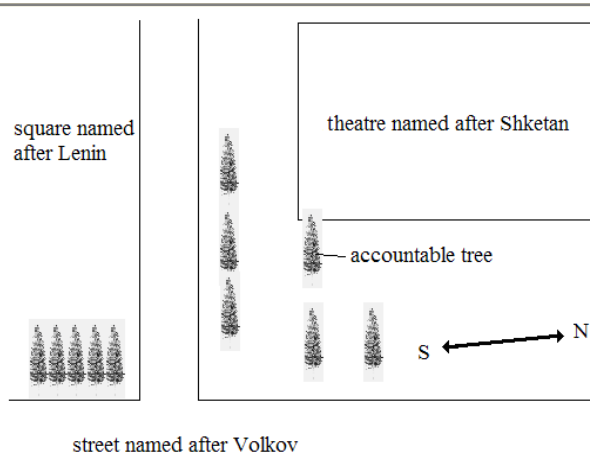


Fig. 1. The accountable fir-tree disposition scheme

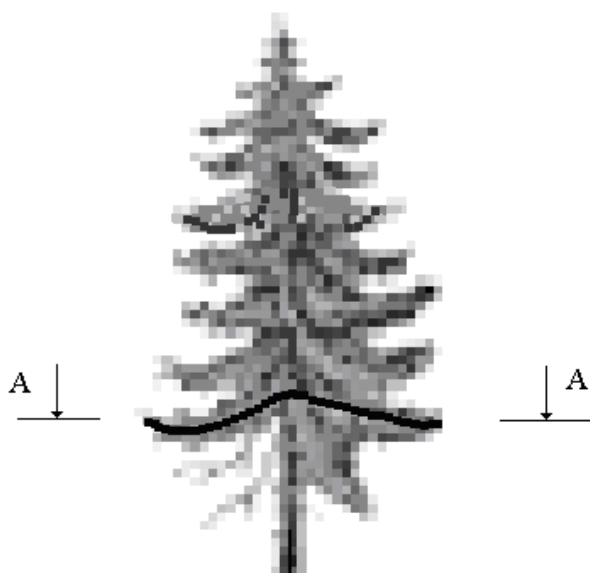


Fig. 2. An accountable fir-tree

Sampling for measurements of needle sizes on ramule length was conducted once in March, while vegetation period of fir-trees was not yet begun. On accountable fir-tree verticil was selected, then on it limb with a measurement of a geodesic direction of its stem was selected. After from an extremity of limb sample as ramule was snipped.

On accountable fir-tree (fig. 2) limbs inside one verticil were selected in four cardinal directions.

Before snipping of each ramule mark was made about what party of needles on it grows upward. Fir-tree ramule samples were

combined in paper packets, on which snipping time and geodesic direction from four cardinal directions (north, east, south and west) were noted, and then the samples were delivered in laboratory for consequent linear measurements.

In a fig. 3 verticil of a fir-tree V-01 (top view) from which samples were collected (cut A - A in a fig. 2) is represented.

Further in room conditions measurements of needle length l_i by caliper to within 0,01 mm, where i - needle number from ramule stem were conducted. The distances x_i from the basis cut ramule up to i -ой иголки were measured by scale to within $\pm 0,5$ mm.

In a fig. 4 the tentative schemes of a needle disposition on fir-tree ramule are shown. The needle serial numbers are represented on a frontal projection.

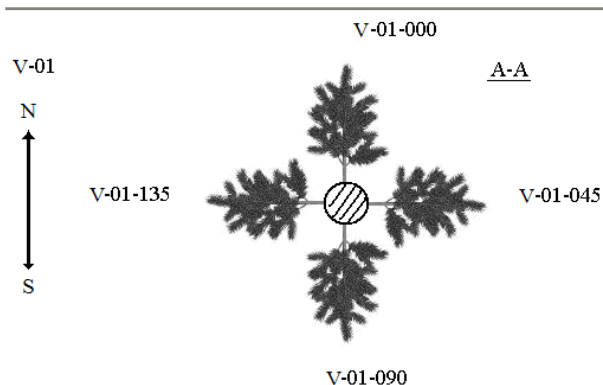


Fig. 3. Verticil V-01 of accountable fir-tree

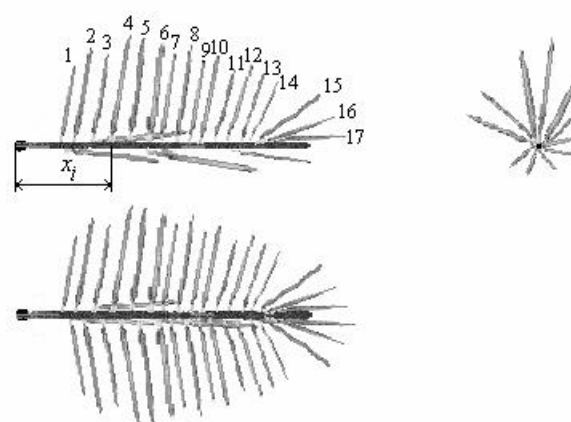


Fig. 4. The fir-tree ramule scheme (elevational drawing and top view)

Needles on ramule are placed by numbers on conditional four sectors - upper, under, right and left sectors in relation to ramule if to look on it from apex to the stem basis.

The measurement results of needles, situated in the upper ramule sector from

northern limb direction, are represented in table 1.

Greatest ramule needle quantity is observed from the southern cardinal direction, and also in upper sector. In bedimmed conditions fir-tree needles is short.

Table 1. Results of measurements of length of needles, situated in the upper sector of ramule

Distance x_i , cm	Length l , cm	Distance x_i , cm	Length l , cm	Distance x_i , cm	Length l , cm	Distance x_i , cm	Length l , cm
0.15	2.11	4.80	2.48	2.40	2.40	7.80	2.14
0.25	2.14	5.15	2.47	2.60	2.53	8.10	2.09
0.50	2.16	5.40	2.44	2.80	2.68	8.15	2.08
0.70	2.06	5.70	2.43	2.90	2.57	8.60	1.95
0.80	2.16	5.75	2.38	3.10	2.60	8.65	1.95
1.05	2.18	6.00	2.38	3.20	2.48	8.95	1.89
1.20	2.34	6.15	2.42	3.45	2.51	9.20	1.86
1.30	2.26	6.50	2.30	3.60	2.58	9.30	1.89
1.50	2.48	6.70	2.37	3.75	2.47	9.60	1.85
1.60	2.45	6.85	2.29	4.00	2.61	9.75	1.74
1.80	2.50	7.00	2.26	4.10	2.53	9.76	1.68
1.90	2.43	7.30	2.22	4.30	2.44	9.90	1.66
2.10	2.48	7.60	2.23	4.55	2.55	9.95	1.63
2.30	2.44	7.75	2.21	4.70	2.40	10.00	1.42

From east accountable fir-tree direction, where the road is placed, needles are affected by contamination. Colour of some needles is chestnut brown, therefore they dry up.

In a software envelope Curve Expert-1.3 the graphs on the revealed needle length distribution regularities $l = f(x_i)$ depending on a distance along ramule were constructed. The mathematical equations of a kind $y = ax^b \exp(-cx^d)$ are obtained.

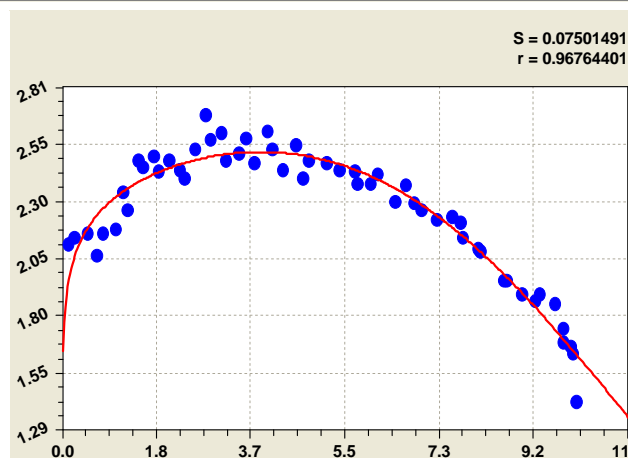


Fig. 5. Distribution of needle lengths on ramule from northern cardinal direction in upper sector

For example, in north from in upper sector of ramule length distribution (the fig. 5) has a kind:

$$l = 2.31476x^{0.081973} \exp(-0.00033881x^{3.20398}).$$

The needle distribution regularities from other cardinal directions and other sectors have a similar formula construction.

The graph of dependence of needle length on all four sectors together (the fig. 6), depending on ramule length, for example, from northern cardinal direction, has a formula kind:

$$l = 2.466396x^{0.096663} \exp(-0.00043716x^{3.151097}).$$

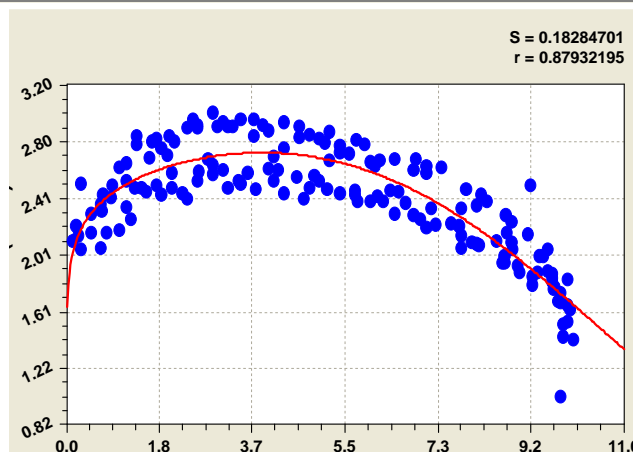


Fig. 6. The graph of dependence of needle length distribution on all four numbers

Greatest needle length is observed in upper sector on a comparison, for example, with the under sector, and also the characteristic figure of needle distribution is determined more precise in upper sector.

The analysis method of needle size change on fir-tree ramule length allows to define general biotechnical regularities of needle distribution.

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REGULARITIES OF WATER RETENTION PROCESS BY FIR-TREE NEEDLE SAMPLES

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For accuracy increase of the analysis of water retention ability of ramule needle samples collected from accountable fir-tree in various geodesic directions, and also evaluation of ecological conditions it is offered to use a criterion - time of full desiccation in needle samples. The needle sample weighing up to the constant room air-dry mass allows to determine water retention cycle time and mean plant sample deliquification rate. The offered method of ecological territory evaluation by accountable fir-tree needle mass dynamics, besides on an mean sample deliquification rate, allows to reveal tree groups. In the following the evaluation of effects on territory enclosing group of measured accountable fir-trees is executed.

Keywords: fir-tree, verticil, ramule, needles, mean deliquification rate, forest and urban territory, ecological evaluation

The growing trees are enabled to assimilate a plenty of impurities, intertropical in the atmosphere. Therefore during ecological monitoring [3] of environment use of tree sustainability parameters [1], in particular regularities of desiccation by fir-tree needle samples is possible.

Inaccuracy of the analysis of a water loss by fir-tree needle samples is defect of known methods of an estimation of desiccation by fir-tree needles. Thus the samples cut from an accountable fir-tree in different geodesic directions, isn't taken as whole chains. The reason is that the specific places at fir-tree verticils for sampling as ramules are not determined. It doesn't allow to conduct the analysis of environmental situation around of an accountable fir-tree on the statistical data, obtained in laboratory conditions on measurements of needle samples from ramules of each accountable fir-tree verticils legibly space-stabilized.

In brochure [1] the proposed criterion is needle moisture mass halves loss time. However, termination of needle sample weighings after loss more than 50 % of their initial mass results in impossibility of determination of such water retention process dynamics parameters both an initial mass of a moisture in sample, first passage time of a room air-dry mass and mean deliquification rate of sample. Thus, the existent methods of desiccation estimation don't allow to measure parameters of water retention and desiccation processes, and also to conduct analysis of

water retention ability of needle samples on the obtained data.

The purpose of the article - to show the basic regularities of water retention and desiccation by fir-tree needle samples, and on their basis briefly to state a technique of an ecological evaluation of territory of its habitat.

For consummation of the purpose in view the following problems were decided:

1) statistical characteristics of water retention process by separate ramule needle samples collected from an accountable fir-trees, growing on forest territory, that is in ecologically clean conditions of development and growth of forest trees are determined;

2) statistical characteristics of water retention process by ramule needle samples collected from an accountable fir-trees, growing on central square of Yoshkar-Ola, that is in conditions of foulness of fir-trees by the atmosphere are determined;

3) regularities of water retention by fir-tree needle samples are determined.

For environmental investigation of territories the fir-trees *Picea abies* [2] were taken. On territory of scientific-experimental forestry enterprise of Mari state technical university (46 compartment, 1 subcompartment, and distance from auto-road more than 50 m) four small fir-trees in the age of 15-20 years were selected. The trees were selected in proportion to increase of distance from a road (increasing number). On an accountable fir-tree verticil, then limb inside verticil in-

cluding measurement of a geodesic direction of its stem were selected, after basic sample as one ramule from the extremity of stem was snipped. For the analysis of water retention ability of needles after snipping each ramule was put into container as paper packets for transportation. In laboratory conditions on all cut ramules needles were separated from a stem, needle samples were pitted into paper open boxes for air drying. Each sample was multiply weighed including drying in room conditions up to achievement of a constant mass. The measurements of a needle sample mass were conducted on scales Vibra AJ-420 CE to within 0,001 ($\pm 0,0005$) g.

On each accountable fir-tree limbs were selected in four cardinal directions. From limbs for the analysis of water retention ability of needles ramules were snipped from the stem extremity approximately at the height 1,3 m from a root trunk collar. Besides samples were collected out of vegetation period in January, 2009.

In room conditions desiccation, contained in needle samples, was measured on the dynamics of needle mass. Besides at the first day the weighing was conducted in each hour at the first 6 hours after snipping, then through each three hours. At following days of the first week weighings were conducted also through each three hours, then some days the measurements were executed two - three times in day, further during several days - once per day, and then once in some days and at the end of experiences once per one week. Besides the measurements were conducted, while the sample mass didn't achieve constant significance for oscillation within weighing error.

On territory of Yoshkar-Ola centre the similar experiments for study of water retention by needles of fir-trees growing in conditions of potent pollution were conducted. For realization of experiences three sample areas were selected:

1) compartment № 1 - area near a building of theatre named after Shketan on

square named after Lenin on the one hand and auto-road along the street Komsomolsky - with other;

2) compartment № 2 - area near central entrance into bulk № 1 of Mari state technical university, where the accountable fir-trees stand in one line, besides crowns of fir-trees are densely closed, and from eastern direction of area the parking lot is situated;

3) compartment № 3 is situated along a street Sovetsky across sports complex Ubileynty, besides the tree № 1 on this sample area grows at traffic light on intersection of a street named after Panfilov from a street Sovetsky.

All compartments are directly situated near urban main roads, besides compartment № 3 is situated along auto-road and at the same time intersection is disposed from its southwest direction, and along compartment № 2 the parking lot is placed.

On each area also four fir-trees, from which ramules were snipped for study of water retention of their needles, were selected. Age of trees is 25-30 years. The samples were collected out of vegetation period in February, 2008. The analysis technique of desiccation by needle of fir-trees growing in pollution conditions is similar to an assay techniques of desiccation by needle of trees growing in a forest. Its difference was consisted only that from the extremity of a stem of a lateral wing three ramules were snipped, as for realization of experiment the less sensitive laboratory scales ELB 600 to within 0,05 g were used. Besides the measurements of needle sample mass were conducted under the following scheme: per the first day - in each three hours, in following some days - 2-3 times in day, and then during two weeks - once in day and further once per one week, while the needle sample mass didn't achieve constant significance.

The needle sample mass measurement data were subjected to statistical processing in a software envelope Curve Expert 1.3.

By identification water retention dynamics model as formula was revealed:

$$m = m_m + m_d = m_{m0} \exp(-a_1 t^{a_2}) + m_d, \quad (1)$$

where m - variable mass of sample during air drying process, g; m_m - variable mass of a moisture in sample, g; m_{m0} - initial mass of a moisture in sample after snipping, g; m_d - mass of dried needles, g; t - drying time from the moment of sample snipping, days.

In a fig. 1 the graph of water retention and desiccation by needle sample collected from ramule cut from the southern cardinal direction of an accountable fir-tree № 1 (compartment № 1) is represented.

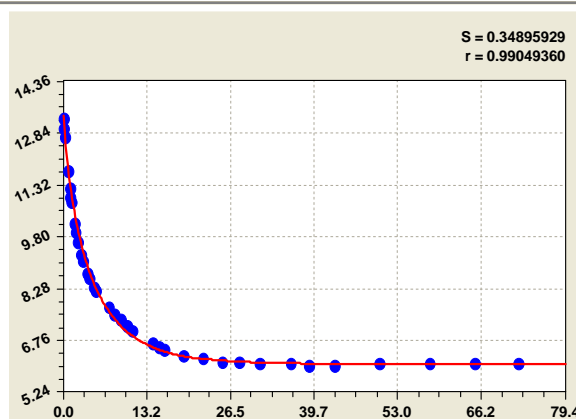


Fig. 1. The graph of dynamics of a moisture in needle sample collected from cut ramule of fir-tree № 1 from the southern cardinal direction

The dynamics graphs of water retention and desiccation by needle samples collected from ramules cut from other an accountable fir-trees are similar.

The first component m_m of biotechnical regularity formula (1) shows, that the process of air drying occurs by the death dis-

tribution in general form, and the second component m_d - that desiccation will be realized up to some constant significance of sample moisture mass [4, 5].

In a fig. 2 collected needle sample mass dynamics scheme is represented.

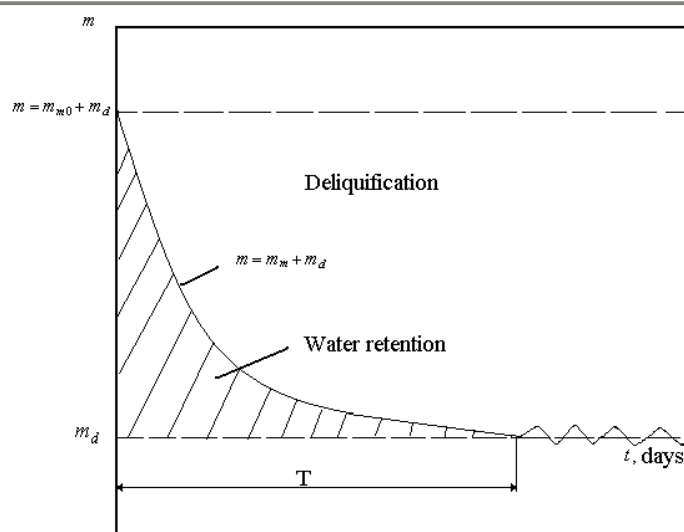


Fig. 2. Dynamics of a mass of needle sample from ramules of an accountable fur-tree

After snipping of ramule the initial mass of needle sample is composed of the initial mass of a moisture m_{m0} and dry needle mass m_d . During drying the moisture mass in sample is decreased by the exponential death distribution, and it in each time of a desiccation consists of the sum of a mass of a moisture, retained by cells m_m and mass of dry needles m_d . The moisture mass decreasing rate in the beginning is high, specially at the first six hours after snipping of ramule, and

then it decreases. The needle mass decreases up to constant significance and then there is its oscillation around it in connection with a modification of room moisture.

As it is visible in a fig. 2, the square under the graph shows process of water retention on the formula (1). And the process of sample deliquification is defined by square above the graph, therefore of desiccation dynamics is characterized by a difference $m_0 - m$ and formula:

$$m_0 - m = m_{e0}(1 - \exp(-a_1 t^{a_2})) . \quad (2)$$

Let's mark, that the time T also can be directly be defined on the table date of measurement dynamics. However significance of initial moisture mass in sample m_{m0} can be defined only after identification of biotechni-

cal regularity (1) concerning new experiment results.

For all samples mean deliquification rate is expected on expression:

$$\bar{V} = m_{m0} / T , \quad (3)$$

where \bar{V} - mean deliquification rate, g/day; T - first passage time of a room air-dry mass m_d , days. Both and this ecological parameter also characterizes mean rate of water retention by sample, however term «deliquification rate of needle sample» is more preferential. The derivative from the formula (2) will give a variable plant deliquification rate.

In table 1 the significances of mean deliquification rate \bar{V} of needle samples collected from cut ramule from all accountable fir-trees are represented.

In tab. 1 there are lines. They mean that there are no breathful limbs on accountable fir-trees № 2 and № 3 on urban compartment № 2 from the southern cardinal direction. Also in table 1 it is possible to note, that some fir-trees growing in Yoshkar-Ola, have pronounced differences in significances of mean deliquification rate of needle samples (for example, trees on a urban compartment № 2). It happens that the indicated accountable trees in the present geodesic direc-

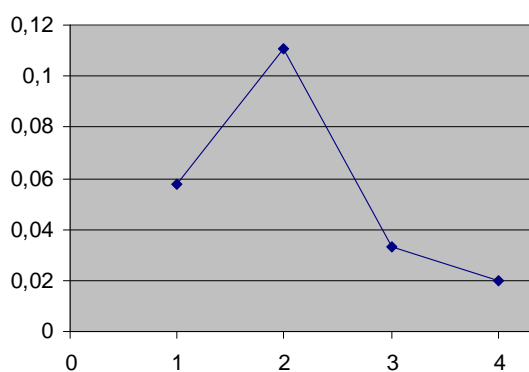
tions densely are closed by limbs of adjacent trees.

In a fig. 3 the graph, on which mean deliquification rates of needle samples from accountable fir-trees from northern cardinal direction on an urban compartment № 3 are shown, is represented. Besides the trees on the present sample area by the northern direction are situated near an auto-road, and are disposed in a line in proportion to increase of distance from intersection with intensive automobile movement. Numbers of trees are accepted in proportion to increase of distance from intersection. As it is visible from points in a fig. 3, the significance of deliquification rate for fir-trees from northern cardinal direction on a urban compartment № 3 reaches maximum significance on some distance from intersection with intensive automobile movement and further again decrease.

Therefore point of maximum concentration of pollutants also is situated on some distance from extremity of an auto-road.

Table 1. Mean deliquification rate by needle samples from cut fir-tree ramules

Tree number	North	East	South	West
Forest compartment				
1	0,026	0,014	0,034	0,026
2	0,019	0,024	0,030	0,022
3	0,013	0,011	0,020	0,019
4	0,020	0,022	0,025	0,010
Urban compartment № 1				
1	0,170	0,086	0,164	0,115
2	0,087	0,070	0,153	0,140
3	0,030	0,053	0,058	0,051
4	0,048	0,073	0,072	0,046
Urban compartment № 2				
1	0,091	0,100	0,046	0,066
2	0,062	0,087	-	0,081
3	0,062	0,170	-	0,069
4	0,033	0,042	0,123	0,083
Urban compartment № 3				
1	0,058	0,030	0,077	0,064
2	0,111	0,066	0,052	0,110
3	0,033	0,057	0,048	0,050
4	0,020	0,059	0,055	0,055

**Fig. 3.** Dynamics of mean deliquification rate for needle samples from northern cardinal direction of fir-trees on a urban compartment № 3

During analysis of the obtained significances of mean deliquification rate of needle samples on a t-Student's test for want of 5-percentage significance the substantial differences for different sample compartments were revealed. Results of a comparison show that the significances of deliquification rate

are essentially differ for needle samples of ramules cut from different accountable fir-trees.

On the basis of experiment results it is possible to make following conclusions:

1) The parameter of a mean deliquification rate can be applied for an ecological evaluation of pollutant effects on an environment because of a high sensitivity of needle samples to deliquification after snipping of ramules from fir-tree verticils;

2) The maximum significance of deliquification rate of needle samples collected from accountable fir-trees, is on some distance from a traffic intersection, that it is possible to use for an evaluation of emission status from automobile transportation, therefore it is necessary to put in experiments the parameter of distance from extremity of an auto-road;

2) By dint of a mean deliquification rate for needle samples from accountable fir-trees it is possible to reveal ecological conditions of forest and urban fir-tree growth.

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REGULARITIES OF WATER RETENTION PROCESS BY CUT FIR-TREE RAMULUSES

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In the known publications the processes of desiccation and water retention ability of fir-tree needles are insufficiently investigated, and also the estimated parameters for diagnostics of fir-tree habitat pollution are not developed.

The offered method of an evaluation of desiccation by the cut samples of fir-tree ramuluses allows to define such parameters, as an initial mass of a water in the samples, constant mass of dry sample particle, first passage time of constant mass. Using of a parameter of an average sample desiccation rate will allow to determine ecological conditions of fir-tree habitat.

Keywords: fir-tree, verticil, needle desiccation rate, water retention process, ecological monitoring

The plants, especially woody, are capable to occlude many industrial discharging components [1]. Therefore ecological evaluation of territories can be conducted by fir-tree needle properties. An ecological state of forest ecosystem is evaluated using physiological parameters [2]. However in the known publications deliquification and water retention ability of fir-tree needles are insufficiently investigated and the estimated parameters as applied to diagnostics of pollution about a fir-tree habitat are not developed.

The purpose of the given article - to show approach of fir-tree needle desiccation regularities analysis, and basis of this analysis to enunciate a technique of ecological fir-tree habitat evaluation.

For consummation this purpose problems sequentially were decided:

- 1) the statistical characteristics of desiccation process by cut fir-tree ramuluses were determined;

- 2) using methods of statistical modeling [4], model of the water retention by fir-tree needles process was developed;

- 3) theoretically availability of ramule deliquification parameters for ecological monitoring realization was justified.

For an environmental investigation of territory the fir-trees *Picea abies* [3] were taken. For experiments small fir-trees at the age of 12-15 were taken. Investigations were conducted on territory of scientific-experimental forestry enterprise of Mari state technical university: 46 compartment, 1 sub-

compartment (distance from a auto-road more than 50 meter).

From each small fir-tree from fourth verticil counting from above fir-tree, from four cardinal directions one ramule was collected from tip of lateral wings, then one lateral wing from northern cardinal direction was sniped about a stick.

In a fig. 1 two projections of a fir-tree are represented, from which control samples were collected (front elevation and top view).

As it is visible in a fig. 1, lateral wings, and also ramules are assembled in verticils. In a fig. 2 wing from which have sniped ramule R-0 for realization of experiment is represented.

As it is visible in a fig. 2 for realization of experiment only central ramule was sniped.

Samples were packed in paper packets, on which number of a tree, cardinal direction, and also time of sample snipping were fixed.

Ramules were weighed at intervals of an hour the after snipping in laboratory on laboratory scales ELB 600 to within 0,05 g. The next weighings were completed in every three hours per the first day, in the next some day - 2-3 times in the day, and then during two weeks - once in day and further once per one week.

In table 1 the obtained statistical data of desiccation by ramules of a fir-tree № 1 after snipping in four cardinal direction are represented.

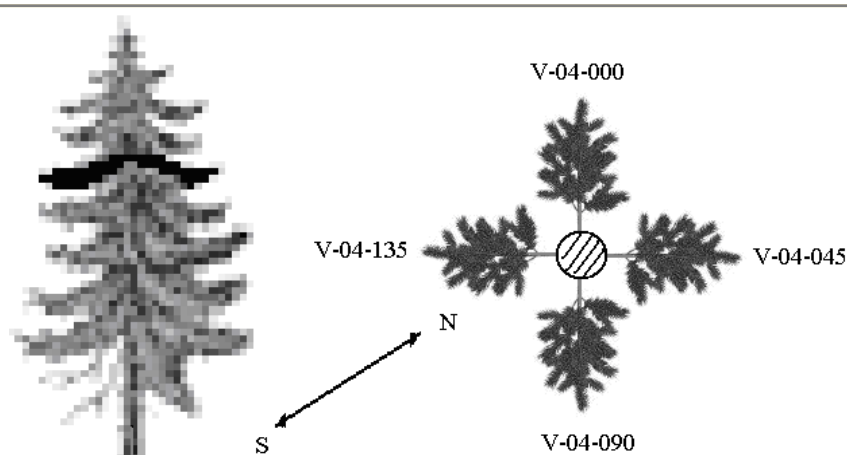


Fig. 1. A fir-tree, from which control samples were collected

Table 1. Dynamics of desiccation by verticil tips of a fir-tree № 1

Interval, days	Ramule mass, g				Interval, days	Ramule mass, g			
	South	North	West	East		South	North	West	East
0,04	1,45	1,00	1,00	1,05	11,00	0,70	0,45	0,40	0,50
0,17	1,35	1,00	0,95	1,00	12,00	0,70	0,45	0,45	0,50
0,29	1,30	0,95	0,90	0,95	13,00	0,65	0,45	0,45	0,45
0,42	1,30	0,95	0,90	0,95	14,00	0,65	0,45	0,45	0,45
0,54	1,30	0,95	0,90	0,90	15,00	0,65	0,45	0,45	0,45
0,67	1,25	0,95	0,85	0,90	15,00	0,65	0,45	0,45	0,45
0,79	1,25	0,90	0,85	0,90	18,00	0,65	0,45	0,40	0,45
0,92	1,25	0,90	0,85	0,90	20,00	0,65	0,45	0,40	0,45
1,04	1,25	0,90	0,85	0,90	22,00	0,65	0,45	0,40	0,45
1,17	1,25	0,90	0,80	0,85	25,00	0,65	0,45	0,45	0,45
1,79	1,20	0,85	0,75	0,80	27,00	0,65	0,45	0,45	0,45
2,14	1,15	0,80	0,75	0,80	29,00	0,60	0,40	0,45	0,45
3,79	1,00	0,70	0,65	0,70	35,00	0,65	0,45	0,45	0,45
4,00	1,00	0,70	0,65	0,70	36,00	0,65	0,45	0,45	0,45
5,00	0,95	0,65	0,60	0,65	43,00	0,65	0,40	0,40	0,45
6,00	0,90	0,60	0,55	0,60	55,00	0,60	0,45	0,45	0,45
8,00	0,80	0,50	0,45	0,50	63,00	0,65	0,45	0,45	0,45
9,00	0,75	0,50	0,50	0,50					

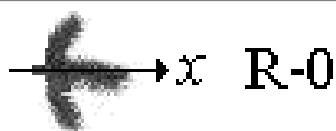


Fig. 2. Ramule R-0

On experimental data the formulas of a sample mass variation were obtained, the graphs of air drying are constructed by dint of software envelope Curve Expert - 1.3.

From the southern cardinal direction the model of desiccation by ramule, sniped from lateral wing tip of fir-tree № by the procedure [5] the form:

$$m = m_m + m_d = 0,7304 \exp(-0,1537t^{1,1028}) + 0,6313, \quad (1)$$

where m - mass of sample in the course of air drying process, g;

m_m - variable mass of moisture, which is lost by sample, g;

m_d - constant mass dry needles with ramule inclusive of their air-dry moisture, g;

t - air drying time from the moment of sample snipping, day.

The formula (1) shows, that a model of fir-tree ramule air drying process has two components. First component m_m shows, that air drying process occurs by the death distribution in the general form, and second component m_d - that desiccation will occur up to some constant value of sample moisture mass.

In a fig. 3 the graph of desiccation by cut ramule of fir-tree № 1 is represented.

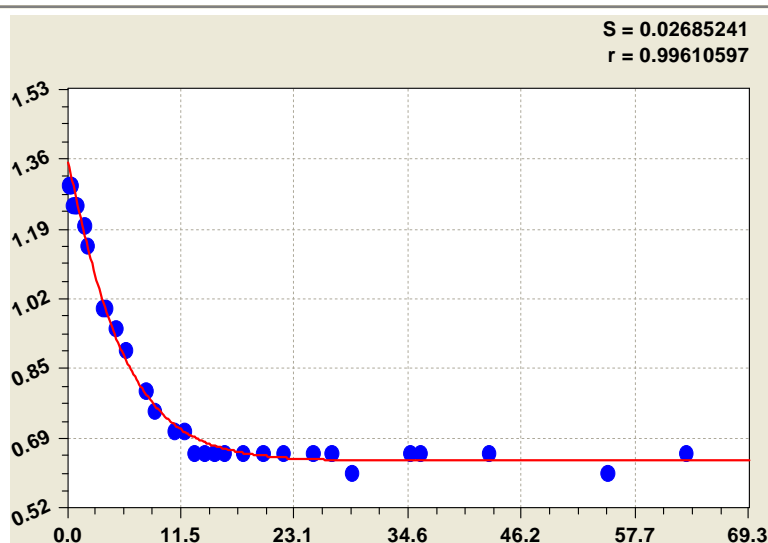


Fig. 3. The graph of desiccation by cut ramule of fir-tree № 1

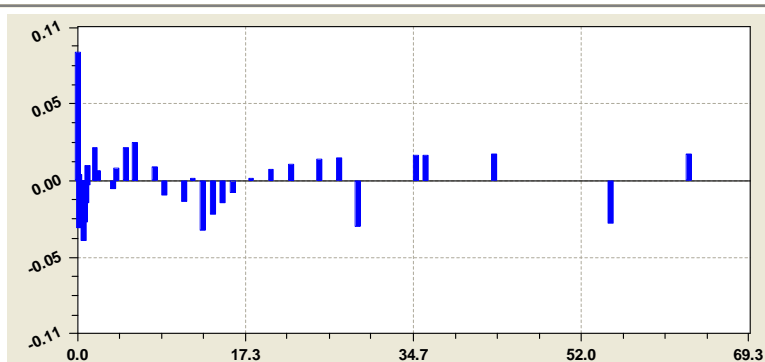


Fig. 4. The residuals or absolute errors of a statistical cut fir-tree ramule air drying model

As it is visible in a fig. 3 during desiccation by ramules of fir-trees moisture mass in test samples decreases, however deliquification rate is gradually reduced. The residuals or absolute errors of a statistical cut fir-tree ramule air drying model are represented in a fig. 4.

In a fig. 4 it is visible, that the residuals are almost equal to 0,025 g, that speaks about

high model adequacy. The adequacy of the deduced statistical model is equal to 6,31 % and, accordingly, probability belief of the formula – 93,69 %. Thus, the given formula of a statistical model can be applied for long-term forecasting [5].

The models of desiccation by ramules of fir-tree № 1 from northern cardinal direction, western cardinal direction and eastern

cardinal direction, and also the models of desiccation by ramules of other fir-trees have a similar character. The differences in moisture mass in tests from the all cardinal directions, the differences in activity and intensity of air drying of ramule tests, and also the differences in first passage time of constant mass by tests during air drying were revealed.

As it is visible from the formula (1), after reaching the certain time t the test mass becomes a constant. Because of the model has a high probability belief, it is possible theoretically to calculate a first passage time of a constant ramule mass t and initial moisture mass in ramule test m_{m0} .

In a fig. 5 the scheme of process of water retention by fir-tree ramule is shown.

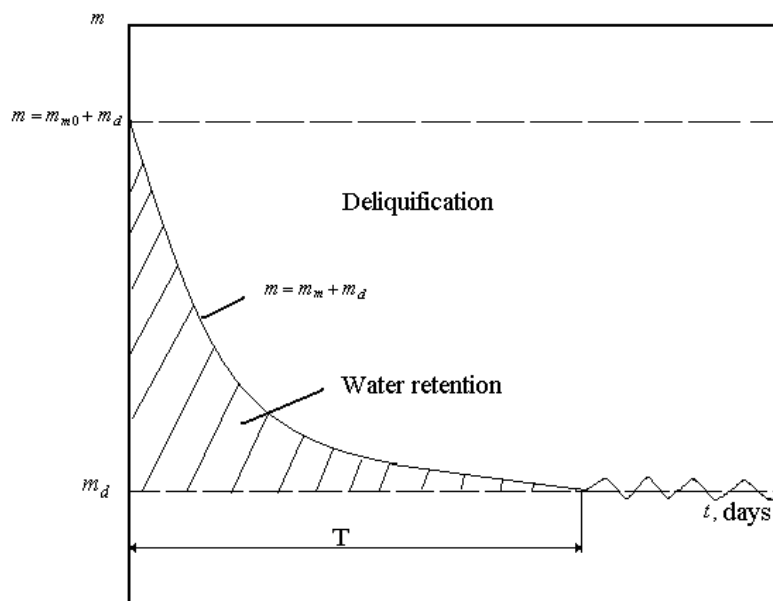


Fig. 5. The water retention process scheme

The square designated on the scheme by section lining, shows dynamics of decrease of ramule mass, and it is equal to:

$$S_{wr} = m_{m0} \exp(-a_1 t^{a_2}) + m_d, \quad (2)$$

where S_{wr} - test water retention significance, or moisture mass in ramule test, g;

m_{m0} - initial moisture mass in ramule test, g;

m_d - constant mass of dry residues, g;

a_1 - model parameter, indicating activity of air drying of test;

a_2 - model parameter, indicating intensity of air drying of test.

For all control samples mean deliquification rate was estimated on formula:

$$V = \frac{m_{m0}}{t}, \quad (3)$$

where V - mean deliquification rate, g/day;

t - the first passage time of ambient air - dry mass m_d , days.

In table 2 the deliquification rates of fir-tree ramules during air drying of all ramules for four fir-trees are represented.

Table 2. Mean deliquification rate of tests

Number of fir-tree	Mean deliquification rate, g/day			
	South	North	West	East
1	0,028	0,038	0,042	0,028
2	0,040	0,035	0,036	0,036
3	0,040	0,030	0,037	0,057
4	0,039	0,035	0,037	0,040
mean	0,03675	0,0345	0,038	0,04025

In a fig. 6 a histogram of significances of a deliquification rate of ramules from the all cardinal directions for each fir-tree are represented.

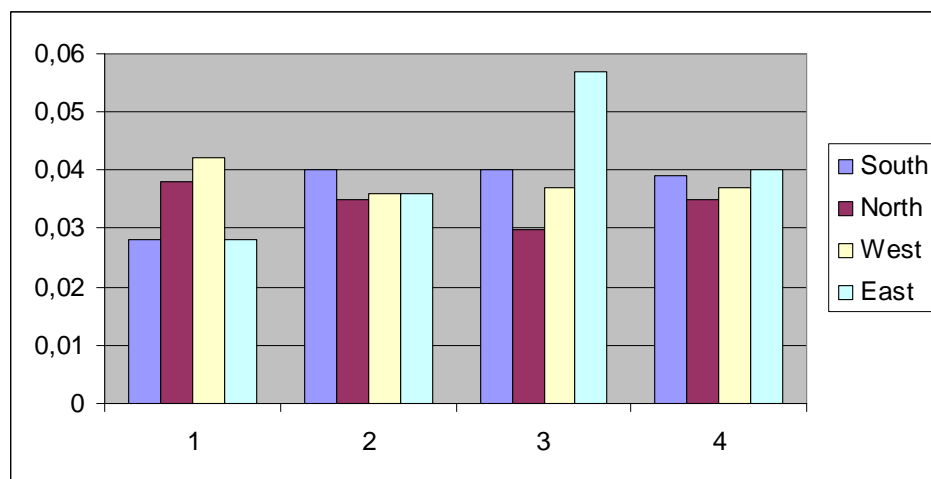


Fig. 6. Mean deliquification rate of fir-tree ramules

For comparison of obtained data Student's test for want of 5-percentage significance point was used. In table 3 the data of a comparison of deliquification rate of fir-tree ramules, cut from southern cardinal direction and northern cardinal direction are represented.

Table 3. Mean deliquification rate of ramules cut from northern cardinal direction and southern cardinal direction

Parameter	South	North	Student's test	Significance point
Deliquification rate	0,037	0,035	0,67	0,53

From table 3 it is visible, that both samplings among themselves have not significant differences (for want of significance point more than 0,05).

For comparison of significances of deliquification rate of ramules cut from other cardinal directions the similar findings were obtained. The process of desiccation by ra-

mules of fir-tree verticils occurs by law of decreasing up to a constant mass, and on which it is possible to define differences on ecological conditions of fir-tree habitat. The further analysis has shown, that the process air drying has wave constituents, which allow to estimate influence of the hydrometeo-

rological factors of an experiment realization place.

Feature of novelty of an offered method is:

At first, the fir-tree ramule air drying method allows to reveal a general tendency of desiccation process by cut fir-tree ramules;

Secondly, the use of processes statistical modelling methods rather than mathematical allows to define statistical performances of drying process such, as an initial moisture mass in tests, constant a mass of dry test residues, first passage time of a constant mass;

Thirdly, use of a parameter of mean deliquification rate of control samples allows to define persistence of fir-trees, and on persistence - ecological conditions of fir-tree habitat.

The positive effect consists that the revealed statistical regularities of desiccation process by fir-tree ramules will allow to operate wood plantations of fir-trees, to determine their persistence, and also ecological relations on investigated wood territories. Be-

cause of the fir-tree well adapts in urban environment, including a high level of pollution, the use of statistical given process regularities for ecological monitoring of urban environment is possible. The simplicity of an approach consists also that the measurements can be conducted on accountable trees, not carrying through harvesting of experimental trees.

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REGULARITIES OF DESICCATION BY NEEDLE SAMPLES COLLECTED FROM RAMULES OF FIR-TREES, GROWING ON TERRITORY OF FOREST ECOSYSTEM

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The trees as higher plants in any age are capable to accumulate annually a state information of territory, on which they vegetate. Therefore tree, in particular fir-tree, is a very good indicator, recording an ecological situation [1]. However now fir-tree needle properties are insufficiently investigated, and also the parameters of an ecological state and criterions of fir-tree needle evaluation are not determined, with the help of which it is possible adequately to carry out ecological monitoring of a fir-tree habitat.

The purpose of the article - to show regularities of desiccation by weight by needle samples collected from fir-trees growing in conditions of forest ecosystem.

For consummation of the purpose in view the following problems were decided:

- 1) the samples of needles of a fir-trees growing in forest conditions were selected;
- 2) fir-tree needle desiccation dynamics parameter variance regularities, such as an initial mass of a moisture in samples and the first passage time of a constant air - dry mass of needle samples were determined by the method of statistical modelling;
- 3) the mean deliquification rate for all needle samples was designed.

For realization of experiment four small fir-trees *Picea abies*, growing on territory of scientific-experimental forestry enterprise of Mari state technical university (46 compartment, 1 subcompartment) were selected. The distance from auto-road was more than 50 m. Besides the fir-trees were selected so that they were from each other approximately on a distance 10 m along across-the-grain section in proportion to increase of distance from a road.

Then verticil was selected on each accountable fir-tree, after selected a limb inside

selected verticil with a measurement of a geodesic its stem direction. Then basic sample as ramule for the analysis its water retention ability was snipped from a stem extremity. After snipping each ramule was put into a container for transportation, and then on cut ramules in laboratory conditions needles were separated from a stem. In the following in room conditions needle sample was many times weighed with drying before constant mass obtainment.

On accountable fir-tree limbs from which ramule samples have been cut, were selected in four light directions.

Ramules as samples for the analysis their water retention ability were cut from limbs from stem extremity approximately at height 1,3 m from a ground-level.

Containers for transportation of each sample from a snipping place to laboratory were produced as paper packets. On each packet sample snipping time, cardinal direction, and also accountable fir-tree number were marked. Weighed needle samples were kept in room conditions in other containers executed as open boxes, on which also accountable tree number and cardinal direction were noted.

During sample selection for realization of the water retention ability analysis on an accountable fir-tree from each cardinal direction only ramule was cut, and also snipping was conducted after vegetation period, in the beginning of January, 2009 and for the analysis ramules were taken only with annotinous needles.

In table 1 the significances of needle sample mass for an accountable fir-tree № 2 are represented.

Table 1. Desiccation dynamics by needle samples of a fir-tree № 2

Interval, days	Needle sample mass, g			
	North	South	East	West
0,028	0,430	0,431	0,687	0,580
0,077	0,410	0,409	0,661	0,559
0,119	0,399	0,395	0,643	0,546
0,161	0,389	0,388	0,629	0,536
0,203	0,382	0,377	0,617	0,527
0,245	0,374	0,368	0,605	0,519
0,350	0,354	0,349	0,580	0,498
0,475	0,339	0,334	0,553	0,479
0,933	0,289	0,283	0,472	0,410
1,058	0,277	0,271	0,455	0,397
1,100	0,275	0,269	0,446	0,390
1,225	0,267	0,259	0,435	0,382
1,392	0,255	0,249	0,416	0,366
1,517	0,251	0,244	0,406	0,357
1,85	0,238	0,230	0,380	0,336
2,142	0,227	0,220	0,367	0,320
2,392	0,221	0,211	0,353	0,309
2,934	0,211	0,202	0,335	0,290
3,476	0,205	0,194	0,323	0,280
3,789	0,205	0,195	0,319	0,274
4,226	0,204	0,193	0,314	0,272
6,039	0,195	0,190	0,300	0,256
7,976	0,193	0,189	0,296	0,253
9,976	0,190	0,187	0,293	0,251
12,455	0,191	0,191	0,296	0,253
19,392	0,192	0,190	0,295	0,251
28,017	0,193	0,192	0,297	0,253

In room conditions study of dynamics of desiccation contained in samples on needle sample mass measurements was conducted. Besides at first six hours after snipping the weighing was conducted in each hour, then through each three hours, and on second and per consequent day of week - also through each three hours. Then some days of samples were weighed two - three times in daylight, and further during several days - once in day, after once in some days and in an extremity - once per one week. Besides the measurements were conducted,

while their mass didn't achieve constant significance for mass oscillation within weighing error.

The fir-tree needle sample mass measurement data were subjected to statistical processing [2, 3] in a software envelope Curve Expert 1.3.

By dint of statistical modelling model of dynamics of desiccation by needle sample, for example collected from a fir-tree № 2 from northern cardinal direction have revealed as the formula:

$$m = m_{m0} \exp(-a_1 t^{a_2}) + m_d = 0,247497 \exp(-1,011468 t^{0,838073}) + 0,19196, \quad (1)$$

where m - dynamic mass of sample during of air drying process, g; m_{m0} - initial mass of a moisture in sample, g; $m_{m0} \exp(-a_1 t^{a_2})$ - variable mass of lost moisture by sample changed on the death distribution, g; m_d - constant the mass of air - dry needles including their hygroscopic moisture and their dry

wood pulp, g; t - air drying time from the moment of sample snipping, days.

In a fig. 1 the graph of desiccation by needle sample collected from an accountable fir-tree № 2 from northern cardinal direction is represented.

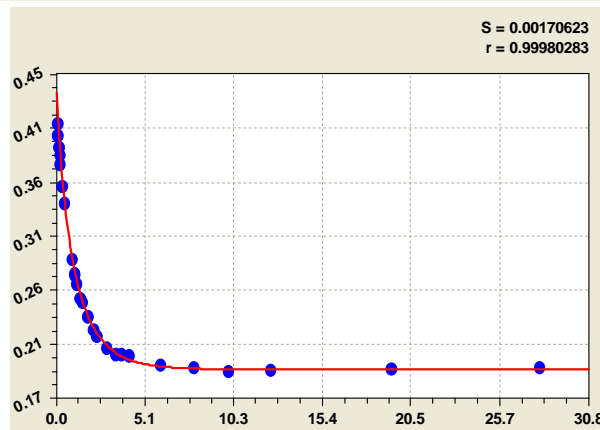


Fig. 1. The graph of desiccation by needle sample collected from cut ramule of fir-tree № 2 from northern cardinal direction

As it is visible in a fig. 1, the process of desiccation by fir-tree needles flows on the exponential death distribution up to a constant air - dry needle mass m_d .

During modelling of desiccation dynamics by the needles collected from other cardinal direction, and also for other accountable fir-trees similar results were obtained.

On obtained statistical models of desiccation a first passage time of a constant needle mass T and initial mass of a moisture in sample m_{m0} were estimated.

For all samples mean deliquification rate was estimated on expression:

$$V = m_{m0} / T, \quad (2)$$

where V - the mean deliquification rate of needle sample, g/day; T - the first passage time of room air - dry mass m_d , days.

In table 2 the mean deliquification rates of fir-tree needle samples are represented.

In a fig. 2 the graph on experimental point, on which the modification of deliquification rate of collected fir-tree needle samples on four cardinal directions for four accountable fir-trees is shown, is represented.

Table 2. Mean deliquification rate of fir-tree needle samples

Number of an accountable fir-tree	Cardinal directions			
	North	South	East	West
1	0,026	0,034	0,014	0,026
2	0,019	0,030	0,024	0,022
3	0,013	0,020	0,011	0,019
4	0,020	0,025	0,022	0,010

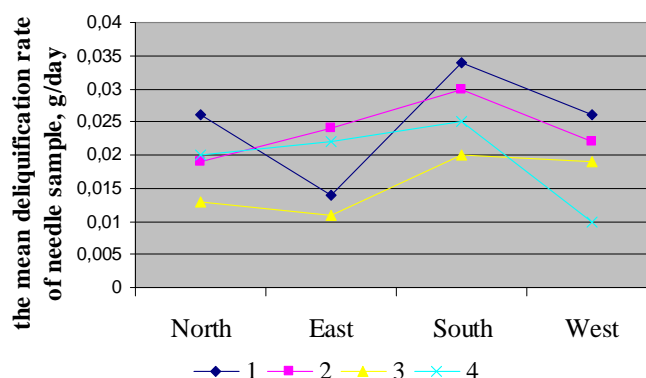


Fig. 2. The graph of a modification of accountable fir-tree needle sample deliquification rate

As it is visible in a fig. 2, the mean deliquification rate of the collected needle samples is unequal on cardinal directions. Apparently, on an azimuth the regular modification of a mean deliquification rate of needles occurs, that requires experiments on the all verticils at one height of fir-tree.

The indicated ecological parameter at different fir-trees changes considerably, that denotes good ecological informational content of an accepted parameter of a mean

deliquification rate. Especially it is noticeably difference of a mean deliquification rate for trees № 2 and tree № 3. They can be compared on conditions of a habitat, influence of solar luminance and wind loading.

The obtained calculated significances of a mean deliquification rate of needles for fir-tree № 2 and fir-tree № 3 were compared on the Student's test. In table 3 the results of a both sampling comparison are represented.

Table 3. Mean deliquification rate of needle samples at fir-tree № 2 and № 3

Mean deliquification rate		Student's test	
Fir-tree № 2	Fir-tree № 3	estimate d	table
0,0238	0,0158	2,4937	2,4469

As it is visible from data of table 3, an a mean deliquification rates for fir-tree № 2 and fir-tree № 3 differ considerably (for want of significance point more than 0,05).

Thus, in proportion to increase of distance from a road to fir-trees the mean deliquification rate of needle samples decreases considerably, that allows to use the given parameter for an evaluation of an ecological state of their habitat and other tree kinds growing about accountable fir-trees. And also on a mean deliquification rate of needle samples collected from fir-tree verticil ramules it will be possible judged about per-

sistence of growing fir-trees and ecological relations on the ground areas of their habitat.

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*Materials of Conference***INVESTIGATION OF CANNED CLAM PRODUCTS USED AS SPECIAL DIET**

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New kinds of canned products from clam “Buckweat soup with spisula meat” and “Paste from Anadara with peas” have been investigated by the scientists of the Pacific State University of Economics (PSUE). Canned products have been found to have positive influence on the irradiated living organisms. Pacific State University of Economics is one of the leading institutions dealing with the development of functional food products on the basis of natural raw materials of the Far East region of the Russian Federation. Health has been found by different scientists to depend directly on the diet. One of the effective ways to make population healthy is to consume products of the raw material containing natural regulators of human organs and systems functioning.. Anadara bivalve mollusks (*Anadara broughtoni*) and spisula (*Spisula sahalinensis*) are the unique objects of the marine fishery. Clams are delicate products. They contain thermally stable and biologically active substances. The technology of new canned products on the basis of clams and plant raw material has been developed by the University scientists. Optimum ratio of the canned products components has been defined by the methods of the systems mathematical counting and modeling. The preservation of the raw material useful properties and safety is ensured by the technology. For example the content of thaurine is 40mg and 100mg per 100g. of the canned product. Canned products medical and biological testing under the ionizing irradiation influ-

ence on the laboratory animals has been carried out. The blood indices of the laboratory animals in the experiment have been found to improve in comparison with those of the control group. Resistance rate to the erythrocytes peroxide hemolysis increased by 24.5% at an average in relation to the group which got traditional feeding. The differences in the reticulocytes amount indices were less and made up 11% only. The thrombocytes amount increased by 10% during the experiment process. It has been found that the concentration of immunoglobulin A of the animals fed with the paste increased by 15% and the concentration of immunoglobulin M of those fed with the soup increased by 11%.

The processes of antioxidant protection activation have been confirmed. For example total oxidant activity increased by more than 50% and total antioxidant activity increased by 28.7%. Decrease of malon aldehyde concentration in erythrocytes made up 10.17%.. The results of the investigations substantiate the application of the new products in prophylaxis and complex therapy of the patients exposed to ionizing irradiation.

The investigations have been carried out on the basis of the contract with the Federal Agency for Science and Innovations in the framework of the Federal Target Program “Investigations and developments in the priority trends of the Russian scientific and technical complex development for the years of 2007-2012”.

The work was submitted to the International Scientific Conference «Technologies - 2009», Kemer (Turkey), May 20-27, 2009. Came to the editorial office on 27.05.2009.

*Materials of Conferences***THE GOLD – COPPER – MOLYBDENUM – PORPHYRITIC DEPOSITS EXPLOITATION POSSIBILITY**

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To the number of the most significant tasks, having provided by the social and economic development Strategy of the Tuva Republic for the period up to 2020, and having demanded the immediate solution, are regarded: the scientifically substantiated guidelines development on the mineral and raw materials sources rise of the noble metals; the efficient geo – technologies and the concentrating apparatuses creation for the gold extraction for the purpose of the gold – mining multiple volumes gain in the region. All these tasks are being decided by the TuvICDNR CO RAS staff in the process: the specialized prognostic and metallogenic explorations conducting on the exposure in the known Tuva's districts gold – mine deposits, which are the perspective ones for the Au – Hg – argilliferous, Au – berezovite and Au – carbonaceous – sulfide formations on the industrial ore objects exposure; the designed efficient processes introduction of the small and fine – dispersed gold and the secondary constituents industrial extraction from the oxidized and semi – oxidized ores. It is necessary to emphasize, that the maximum accessible degree of the gravitational small, fine and dispersed fractions extraction of the noble metals without the environmentally dangerous chemical agents use, has, as usual, been left one of the most complex challenges in the economic efficiency rise at the ore deposits mining. At the first stage, the research engineering works and the development activities have been done, having had the purpose of the experimental installations creation for the parametric characteristics estimation of the heavy particles travel into the pulp's flows, having the different density. The minerals and the metals distribution of the raised specific gravity takes its place at the restricted fall in the heavy medium, and also in the vortex and upward streams, in the centrifugal field and so on. The Institute has continued the research engineering works and the development activities, having oriented to the centrifugal and vortex principle use of the mineral raw materials enrichment with the heavy thin metals concentration, the minerals with "the funnel effect" use and the others, at the same time, with successful tests of the tray – type concentrating apparatuses of the various efficiency. The «Kyzyl – Chadyr» deposit ores enrichment process half – industrial tests (The Table 1) have been carried out with the 5 tonnes initial ore processing at the TuvICDNR CO RAS at the testing ground by the manufacturing scheme.

The ore test material constitution study has been carried out with the spectral, chemical, granulometric and also mineralogical analysis methods use. The obtained data are testified to, that the main industrial ore's value is defined by the gold, the content of which is made up 14,6 gr./ton. 9,2 gr./ton. silver, and 4,3 % copper are present among the other secondary valuable constituents in the ore. The thin and the scattered elements are contained in the quantities, which are not quite presented the industrial interest. The sulfide sulfur content is made up 0,42%. The presented results have been shown, that the gold great bulk (e.g. 93,5%) in the ore is found just in the free form; the 5,3% gold is present in the splices; a little more 1% gold is connected with the copper oxides and sulfides; the 0,1% gold is consisted in the quartz. The initial ore particle size analysis with the above – mentioned constituents content definition just in each class has been carried out for the purpose of the gold and the silver distribution study by the size classes. The gold great bulk (e.g. 99,1%) and the silver great bulk (e.g. 94,6%) have been concentrated in the large and the medium classes in the range from 0,074 mm and higher. In these classes – 0,074 mm are found about 1,5% gold and 5,4% silver. The quartz is found the predominant mineral in the engineering test material, by the given data of the semi – quantitative mineralogical analysis. The chlorite, the sericite, and also the calcite, the ankerite, the dolomite – in the singular granules and in the not numerous splices composition are present just in the non – metallic part of the test. The quartz is also, mainly, registered just in the splices composition, but the sulphides, the malachite, and the chlorite are observed in the less quantity. Thus, the copper sulphides – the chalcocite or the copper – glance, the chalcopyrite and the others are the main ore minerals. The sulphides, in the form of the very thin and sparse dispersion, are observed in the quartz and in the chlorite.

The mechanical tray – type lock has been inserted into the equipment layout, for the purpose of the technological process kinetics rise, in order to extract the valuable heavy constituents, as much as possible, in the relatively quiet weighed medium. This method is included the initial material preparation, having contained the clay quantity in the classification process and the dilution on the sieve by the sizing movement and by the water atomizers, the pulp transportation along the platform, having consisted in the enrichment chambers cascade. The enrichment every chamber's working surface is consisted in the plane surfaces of the Siberian tray, the conical surface of the Korean tray, the cylinder's internal surface, having fastened on the plane bottom and with the fastened on the bottom by the second cylinder, having the concentric external surface and with the sprinkler attachment. The platform is subjected to the circular movement.

The pulp is subjected to the centrifugal forces influence for the fine fraction pressure to the conical underlying surfaces, at the getting into the flushing trays deepening. The inclined platform has the box – type wall construction, which are the hammer – stones and the supported member for all the units. The concentrate is come through the hose into the capacity, having designed for the concentrate collection, and having had the branch pipe. The vibration amplitude and frequency is regulated by the imbalance selection and also by the electric motor's number of revolutions. The drive mechanism can be also made in the form of the eccentric mechanism, having installed, motionlessly, on the basis of the platform mounting. Thus, the received concentrate is thrown over the branch pipe to the bottom of the tray with the upward current [1], which has been brought closer to it.

The pulp slime removal and the heavy fractions concentrations have been carried out on the centrifugal and vortex slime removal mechanism [2]. The solid phase deposition on the conical surface of the separator body of the lower part with the continuous passing to the discharge hole of the sanding nozzle at the constant washing out just from the light mud fraction by the pulp of its liquid part takes its place under

the centrifugal forces influence. A part of the dehydrated small particles is caught just on the conic motionless lower part of the separator body for the subsequent extraction, as the thickened product through the branch pipe with the sanding nozzle. The pulp of its liquid part just after the circulation by the walls of the separator's bowl is displaced through the vortex bleed funnel with the downcomer by the center at the expense of the forced energization and also the water by means of the blades, having fastened to the external side of the separator's bowl for the untwisting and the initial raw materials pushing downright with the pulp vortex flow formation. For all this, they are receiving the thickened product in the form of the fine and thin small particles of the sanding fraction with the small particles of the valuable constituent, having washed out from the clayey fine small particles, having contained in the initial raw materials. The sanding fraction is received to the centrifugal and vortex concentrator, which is related to the field of the wet separation of the specially fine and thin small particles by their density. This method and the apparatus are permitted efficiently to catch the especially fine and the dispersed small particles of the heavy minerals and the metals. [3,4].

Table 1.

Product	Output, %	Content, gr./ton.		Extraction, %		
		Au	Ag	Au	Ag	Cu
Gold Head	0,043	25940,46	8729,3	76,4	40,8	16,3
Gold & Copper <u>к-т</u>	0.561	593,37	826,52	22,8	50,4	63,9
Tailings	99,4	0,12	0,814	0,8	8,8	19,8
Initial Ore	100	14,6	9,2	100	100	100

The gravitational enrichment results of the «Kyzyk – Chadyr» deposit ore have been given in the Table 1. The concentrate just from the centrifugal and the vortex concentrates are received for the supply to the concentration tables. The two concentrates – e.g. the gold head and the gold and copper concentrate have been received. The common extraction into the concentrates are equal to: Au – 99,2 %, Ag – 92,0 %, Cu – 80,2 %. It is recommended the above – described the manufacturing scheme of the «Kyzyk – Chadyr» deposit ores enrichment, by which the gold, the silver and the copper extraction high indices have been provided, in the result of the carried out semi – industrial tests of the ores processing technology. The gold, the silver, and more 50% of the copper of the large quantity are contained just in the received gold and copper concentrate that is permitted to relate this concentrate to the copper concentrates of the highest KMO trade mark (the State Standard Specification 48 – 77 – 74). Their leaching is quite economically unreasonably, having judged by the gravitation tailings.

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THE PERSPECTIVE INFORMATION TECHNOLOGIES EFFICIENT REALIZATION AT THE GRAPHICS PERFORMANCE FOR THE MEAT SYSTEMS COMPONENTS SIMULATION

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The “Microsoft Windows 7” perspective operating system (OS) arrival has become a new step in the realization efficiency rise of the profiling new graphics models of the force – meat structure. The new operating system (OS) is distinguished by the high reliability, the large – scale productivity, the advanced graphical interface, and the advanced operation facilities, as in the global area, well as in the local area networks (LANs).

The application of the 64 – bit computations in the “Windows 7” operating system (OS) is permitted to use a more 4 gigabit main memory, owing to the “Core i7” platform by three exchange channels (DCC) on the basis of the 45 – nanometer technological process of the DDR3 type. The conversion to the parallel computing is practically provided the following core sets expansion in the computer processors. The new generation programs of the “Windows” operating systems (OS) are optimized the multi – nuclear computer processors possibilities (e.g. 2–, 4–, and 8 – nuclear ones). It is expected the following expansion from 16 up to 64 cores sets in the computer microprocessor in the near – term outlook. So, it has been obtained the PC higher productivity of more, than four teraflops

(TFLOPS) at one graphics processing unit (GPU), and 240 data flow processors, having the 16 gigabytes memory capacity, on the basis of the “Nvidia Tesla” computing systems, and without the main computer processor operation.

The “Core i7” new generation chips of the 45 – nanometer technology on the basis of the “Nehalem” micro – architecture with the built – in memory controller into the processor have increased the operation velocity of the main memory for 50 per cent that resulted in the computer power has been increased for two orders more. The “Nvidia GeForce GTX 280” graphics card, at the multi – data flow processors and one gigabyte display memory on the frequency of 1,296 megahertz, has provided the graphic presentation efficiency of the rheological and structural profiles of the meat system for 50 per cent higher, than at the present “Nvidia GeForce 8800” graphics card on the basis of the “GT 200” new graphics processing unit (GPU), having performed by the 65 – nanometer technological process.

These graphics cards of the high definition (XHD) on the wide screen monitor within the ultra-high resolutions are being provided in 7 times brighter and more sharp presentation image of the meat profiles and the histological sections, in comparison with the screen monitors, having their less resolution, and they are printing in 2 times more sharp image, than at the displays of the existing park.

The “NVIDIA CUDA 3” technology is being opened all the possibilities of the GPU main core sets, thus, having accelerated the most exacting system tasks, for example, the video conversion, and, having provided almost the sevenfold increase in productivity, in comparison with the traditional GPU.

The “NVIDIA HybridPower 5” technology is provided automatically to switch from the “GeForce GTX 280” graphics card to the “GeForce” graphics processing unit (GPU), which has been integrated into the system board, in a case of its operation with so called “not difficult” graphics applications. This operation is, practically, resulted in the noise reduction and also the considerable energy conservation.

Table 1. The “GeForce GTX 280” Specifications

Data flow processors	240
Core set frequency (MHz)	602 MHz
Shader unit frequency (MHz)	1296 MHz
Memory frequency (MHz)	1107 MHz
Memory capacity	1G
Memory interface	512-bit
Memory bandwidth (Gb/sec.)	141.7
Textures mapping velocity (bln./sec.)	48.2

The «Super Speed USB 3.0» new technology has been provided the graphics files communication of the time history image of the functionally and technological parameters of the meat systems between the peripheral units and the computer, having memory ca-

capacity more, than 30 gigabytes, in 10 times fastly, than the “USB 2.0”, which is now existing. For all this, the maximum data transfer rate (DTR) on the biochemical – and functional –, and technological parameters of the meat product at the “USB 3.0” application, simul-

taneously to the both sides (e.g. the duplex data exchange) has been made up 5.0 gigabits per second. This new "USB 3.0" standard is being supported only by the new "Windows 7" operating system (OS).

Thus, the new "Windows 7" operating system (OS) realization will be permitted to carry out the new qualitative and quantitative conversion to the productive systems (PS) of the present generation hardware control and software control devices of the graphics and the data processing (DP) with the high levels performance of the reliability and efficiency meat system component composition designing at the meat products production with the specified food and biological parameters.

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THE THYRISTOR TRANSDUCERS WITH THEIR CAPACITIVE SWITCHING

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The thyristor inverters with the capacitors in the power circuit are designed for the electronic welding apparatuses, the plasmatrons power sources and so on. All these inverters are efficient and functional only in the limited load range, that is the essential defect, and this is restricted by their use range. In particular, such inverters are non – serviceable at the idle running and in the small loads range. It should be noted, it is talked on the inverters on the reverse – blocking thyristors, which are being blocked at the natural current fall down to the zero, or they are needed the reinforced switching [1]. The thyristor inverters of such type, which have been suggested earlier, for the load range extension are used the additional block, having provided the latitudinal and pulse control of the load current in the wide range [2]. The linear external characteristics are needed for the stable work of the welding load. So, it is quite possible to provide the linear external characteristics in the power sources of the inverter type with the capacitors in the in the power circuit at the latitudinal and pulse control, having only the 2 – 3 – multiple stress factor [1], that results in the proportional increase of the apparatus rated capacity. Besides, the two parallel circuits presence of the switching capacitor (SC) recharge, inevitably, results in the constant component appearance in the transformer current, which has been described in the [2] diagram, that it is needed the considerable increase of the transformer overall dimensions, in order to avoid its saturation. The new diagram of the thyristor inverter with the capacitors in the power circuit has been suggested in [3], and it has been given in the figure 1.

The suggested apparatus diagram is consisted in the $1 \div 4$ thyristor bridge, having connected to the direct current (DC) diagonal to the power source 5, having shunted by the filter capacitor 6. The primary winding 7 of the transformer 8 has been inserted into the $1 \div 4$ thyristor bridge of the alternating current (AC) diagonal, sequentially, with the switching capacitor 9. The secondary winding 10, sequentially, with the load current sensor 11 has been connected to the diode rectifier 12, the direct current (DC) outputs of which have sequentially been connected to the choke 13 to the load 14. Besides, the apparatus is contained the expansion range control block 15 and the control system 16, having made with the latitudinal and pulse control, and having closed by the negative feedback along the current by the signal from the above – mentioned load current sensor 11, having connected to the corresponding control system input 16, the corresponding outputs of which are connected to the thyristors' driving points of the $1 \div 4$ thyristor bridge.

The expansion range control block 15 has been made by the principle of the transmission, having accumulated in the electromagnetic energy inductance from the source to the receiver, and it, moreover, is contained, as the electric power source, the additional winding 17 of the transformer 8, having connected to the diode bridge 18, the direct current (DC) diagonal of which has been shunted by the smoothing capacitor 19 and the voltage sensor 20. Besides, the above – mentioned the direct current (DC) diagonal of the diode bridge 18 has been loaded on, sequentially, the joining circuit from the current sensor 21, the inductance 22, and also the transistor switch 23, having connected to the direction of the conducting current. The corresponding filter capacitor 6 outputs have been connected to, in parallels, the transistor switch 23 through the pick – off diode 24. The driving point of the transistor switch 23 has been connected to the microcontroller 25 output of this switch control. The corresponding microcontroller 25 inputs have been connected to the current sensor 21 output and also to the differential amplifier 26 output, the direct input of which has been connected to the voltage sensor 20 output, but the inverting input has been connected to the load current sensor 11 output.

Firstly, the circuits are absent, which are in parallels of the primary winding 7 of the transformer 8, in the suggested apparatus, that is provided the constant component absence in the above – mentioned winding. Secondly, it is being observed the $I_d / f = \text{const}$ ratio, where f – the inverter frequency, I_d – the load current, at the load current increase, that it is provided the linearity and the high rigidity of the external characteristics at the voltage control at the expense of the power source.

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THE THYRISTOR CONVERTERS' PREVENTIVE PROTECTION

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The thyristor converters have already been found the wide application in the various electro-technological installations, which are needed the energy batching constancy at the loading variations. Such loadings examples can be served the ion nitriding furnaces, the electroarc vaporizers for the metal deposition and so on. The transistor and condensing converters of bridge – type are usually applied for the powers, which are more, than 15 kwt.

The protection system of such converter is contained the voltage sensor on the direct current diagonal of the thyristor bridge, having connected with the pick – off signal comparator and to the reference voltage signal, and the above – mentioned comparator is connected with the control input of the thyristor switch off [1] through the pulse – duration selector in series connection, and the switching on pulse former.

The insufficient protection reliability from the overloads at the thyristors' switching disturbance is the general shortcoming of the above – mentioned converters.

The new protection diagram, having eliminated this shortcoming, has already been developed in [2], and it has been presented in the Fig.1. The diagram is contained the thyristor bridge 1 – 4 with the dispensing capacitor 5 in the alternating current diagonal, having connected in series with the loading 6, and the thyristor current switch off 7. The loading 6 jointly with the common – anodes of the thyristor bridge 1 – 4, e.g. with the thyristors anodes 1 and 4, and it has been shunted by the first bypass diode 8. The loading 6 jointly with the thyristor current switch off 7 has been shunted by the second bypass diode 9, having connected with the anode and the power supply minus U_n . The standard control system 10 has been connected by its outlets to the corresponding control inputs of the thyristor bridge 1 – 4 and the thy-

ristor current switch off 7. The protection system has been made in a form of the triple – wound transformer 11, the first winding 12 of which has been included between the power supply plus U_n and the common – anodes of the thyristor bridge 1 – 4, and that the number of turns of the second winding 13 is twofold, than the number of turns of the first winding 12, and all these windings have been included from the opposite sides towards to each other. The centerpoint of the second winding 13 is divided the whole indicated winding into the first and the second half – windings with the same number of turns, and it has been formed one of the conclusions of the alternating current diagonal of the thyristor bridge 1 – 4. The third winding 14 of the above – mentioned transformer 11 has been connected with the switching off pulse former 15, the outlet of which has been connected with the control input of the thyristor current switch off 7.

The suggested diagram is being functioned by the following way.

The current of the power supply U_n must be passed through the first winding 12 and the whole of the second winding 13 of the triple – wound transformer 11, at the switching breakdown, for example, at the simultaneous unblanking of the thyristors 1 and 3. This current will not be exceeded the magnetization current, e.g. the short circuit will be, practically, locked out, while the triple – wound transformer 11 is being saturated. It is quite enough to choose the parameters of the triple – wound transformer 11 such ones, in order the time of its saturation would be quite equal to the break time of the thyristor current switch off 7, on which the disconnection signal is being got from the third winding 14 through the switching off pulse former 15 in the emergency operation. And the similar situation takes its place at the short circuit through the thyristors 2 and 4. In this case, the magnetization current is being passed only through the first winding 12 of the triple – wound transformer 11. For all this, we note, as the turnoff time of the thyristor current switch off 7 is not much (e.g. only tens of microseconds), then the dimensions of the triple – wound transformer 11 are too small, and its further connection into the power circuit of the thyristor and condensing converter is not quite the drawback. At each disconnection of the thyristor current switch off 7, the demagnetization of the triple – wound transformer 11 takes its place at the return of the electromagnetic energy of the loading into the power supply plus U_n , e.g. the triple – wound transformer 11 is being applied by the full hysteresis loop, but the suggested protection is quite non – inertial, and it is also limited the current at the insignificant level.

Thus, the diagram (Fig.1) has been permitted to be excluded the comparator, having had in the analogous converters, and, the main thing, the pulse – duration selector and, the next best thing, to provide the operation velocity and the protection high – level reliability. And all the more, the suggested in [2] solu-

tion is provided the preventive character of the protection: the current is not, practically, being increased at

the switching breakdown of the thyristor bridge.

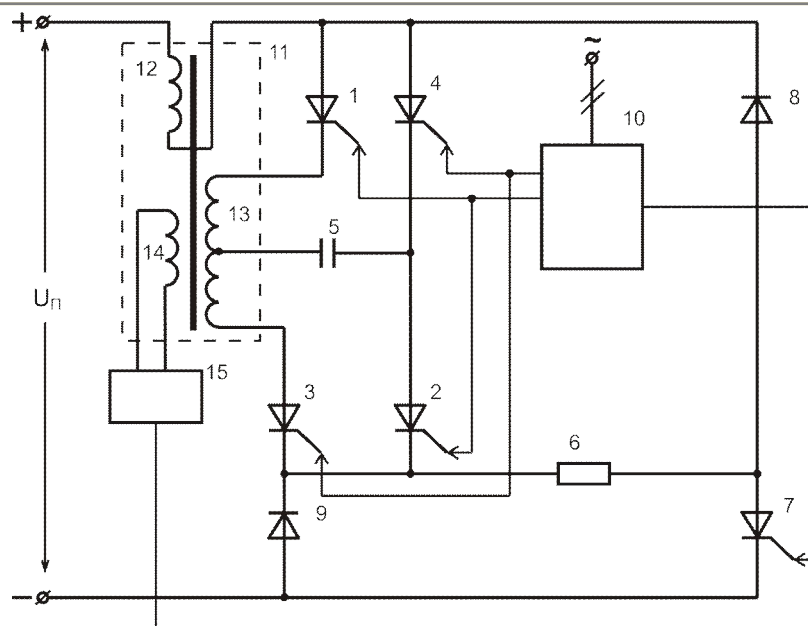


Fig.1.

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WIDENING FREQUENCY PASS-BAND OF A HALF-BRIDGE CONVERTER AND INCREASING ITS PROTECTION AGAINST THROUGH-FAULTS

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Single-phase half-bridge converters are being widely used in different secondary power sources, for example, in some inverter welding transformers [1]. Such converters contain a half-bridge in its power part; a diagonal of the bridge's direct current is connected with power source U_p via a choke [2]. The choke is a typical unit in the structure of the common converters and reduces the steepness of current build-up in transistors during through-faults, i.e. when transistors are being triggered simultaneously. But, while reducing the steepness of current build-up, the choke

cuts at the same time, the frequency pass-band of the converter. That is why its inductance should be relatively small, which in its turn lowers the protection level during through-faults. All these deficiencies were eradicated in the developed appliance [3], scheme see on pic.1.

The device works as follows.

As in the common half-bridge single-phase converters, the output of control system 13 is a common pulse-width modulator that sends antipodal signals to transistors 1 and 2. Pulse duration of these impulses depends on the signals (current, voltage); frequency in modern converters that supply, for example, welding transformers, reaches 100 kHz.

Let assume, that power source U_p is on, and capacitors 8, 9 are charged each till about $0,5 U_p$ voltage. Then the first signal from the output of control system 13 reaches, for example, transistor 1, causing transistor 1 to trigger, and capacitor 8 discharges to load 10. Through winding 11 and winding 6 of transformer 5 flows equal current. As the windings have the same number of loops and opposite ones, they form a bifilar and do not bring reactance to load circuit. Capacitor 9 is being charged at the time. If the load is enough for capacitor 8 to discharge fully, then by the end of the converter's operation half-cycle, the capacitor 9 will receive the voltage U_p . during the triggering of transistor 2, bifilar is formed by windings 11 and 7 of transformer 5.

So, when the converter is in the operating mode, transformer 5 does not cause reactance in the load circuit, and the maximal converter frequency is limited only by parameters of transistors 1 and 2. As the magnetic flow of transformer 5 is zero during con-

verter operating, the voltage of winding 12 also equals zero.

If transistors 1 and 2 trigger simultaneously because of a defect in the control system or, for example, longer recovery of the cut-off during the transistor warm-up, or due to some other reasons, through-fault occurs, and the current flows through all three primary windings 6, 7, 11 of transformer 5 by-passing the load (completely or partially). Uncompensated magnetic flow arises, inducing voltage on winding 12 of transformer 5. Until transformer 5 is not full, the let-through current equals the magnetization current, i.e. it is negligibly small and is not dangerous for transistors.

So, protection against through-faults does not let the current grow till a dangerous level during the saturation of transformer 5. This time period could be

set longer for a transformer, than the time of protection response to the switch-off signal from winding 12. Moreover, there is no need to exaggerate the recovery time for the transistors cut-off, as during the short-term «blockage» the let-through current is negligibly small, and the short output impulses on winding 12 could be blocked with the help of a duration selector, without switching off the converter. The size of the additional transformer 5 is negligibly small, its weight does not exceed 0,07 kg. The excluded from the device choke weights considerably more.

To sum up, the new appliance (fig.1) let reduce the through-fault current, widen the frequency pass-band of the converter, use it voltage properly, as well as make the converter more reliable in general and reduce its weight and size.

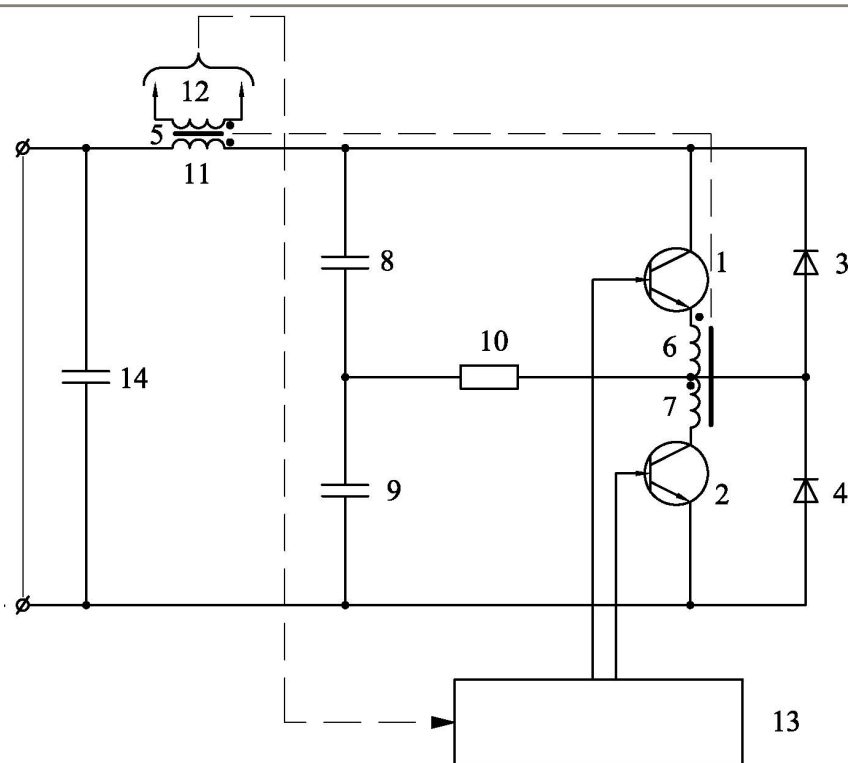


Fig. 1.

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FLUID REGIME OF GRANITOIDS OF THE BELOKURIHINSKY COMPLEX (ALTAI MOUNTAINS)

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This article presents a results of study of fluid regime of granitoids of the belokurihinsky complex. The meanings of ferrous ($f = ((Fe + Mn) \div (Fe + Mn + Mg)) \times 100\%$) and aluminous ($l = (Al \div (Al + Fe + Mg + Si)) \times 100\%$) compositions, octahedral coordination of aluminium are determined by means of study of composition of

biotite. Taking into account the features of the fluid regime and of calculated rare metal index had determined potential ore mineralization.

The gabbro-granitic Belokurhinsky complex includes a number of intrusions which earlier were considered independent [4]. Among them are the Aisky massif located to the east of the petrotypical Belokurhinsky massif as well as the Tadzhilinsky, Tarkhatinsky, Aturkolsky massifs located in the south-east of the Altai Mountains. The intrusives of the Belokurhinsky complex can also be found in the Rudno-Altai structure-formation zone (the Tigireksky, Savvushinsky massifs) and in the Salair (the intrusives of the earlier distinguished Zhernovskoi complex) [2].

The matter composition and occurrence conditions of granitoids of the Belokurhinsky arial are typical for granite-leucogranitic formation (peraluminous granites) [1].

The fluid regime of the Belokurhinsky complex differs by openness in a fluorine mode. P-T conditions of granitoids crystallization show that the initial phases of the Belokurhinsky massif formation were characterized by relatively increased crystallization temperatures (790-760°C), at the lowest possible concentrations of fluorine in the magmatogene fluids and their low redoxation. Biotites of these granitoids are characterized by decreased ferrous and increased aluminiferous composition. General pressures during the solidus of the granitoids initial phases did not exceed 1-3 MPa (by relation Al_{IV} and Al_{VI} in the hornblende of granodiorites and melanogranites). On the whole the rocks of the Belokurhinsky arial crystallized in the extremely oxidizing conditions and their solidus was carried out above the magnetite-hematitic buffer.

The moderate-alkaline granites and leucogranites of the Osokinsky, Zhernovskoi and Kuranovsky shoots crystallized at much lower temperatures (640-660°C). The magmatogene fluids of the leucogranites contain much higher concentrations of a fluoric acid. This acid is probably responsible for the decrease in the solidus temperature of these rocks as well as the potential ore mineralization. The oxy-fluoride ligands and complexes are known to influence significantly on the transfer of such metals as tungsten, molybdenum, beryllium, rubidium and others. The composition of biotite of the above-mentioned shoots differs by the high concentrations of octahedral coordination of aluminium (0,34-0,39). Unlike them the biotites of leucogranites of the Belokurhinsky massif have deficiency of octahedral coordination of aluminium (to – 0,04). The pegmatites have even greater deficiency of octahedronic aluminium. The latter underwent a contrast inversion of the fluids redoxation (0,39). The concentration of the

fluoric acid in the fluids of pegmatites increased 10 times. The leucogranites of the Osokinsky massif crystallized in the highest oxidizing conditions.

The fluid regime of the Aisky arial granitoids was characterized by the abundance of various volatile components (fluorine, water, boron, phosphorus). Experimental data got during the silicate melts study [3] showed that saturated with water and fluorine granitic magmas do not finish crystallization at the solidus temperature of usual granites. As a result they become low-temperature melts that crystallize at a temperature of $575 \pm 25^\circ\text{C}$ (at the pressure of 101 MPa). Our data on the finishing phases of the Aisky leucogranites with fluorite are close to the above-mentioned parameters.

Taking into account the features of the fluid regime and the concentration of volatile components, potential ore mineralization of the intrusive formations can be determined by the rare metal index calculation according to L.V. Tauson – $F(Li + Rb) \div (Sr + Ba)$. According to our data [2], the concentration of fluorine and the rare metal index increase considerably from monzogabbro to leucogranites with fluorite. Herewith, the figure of the latter (6178,3) and petro-geochemical parameters of moderate-alkaline leucogranites are rather close to those of peraluminous rare metal leucogranites (6800). Similar parameters for leucogranites with fluorite come nearer to lithium-fluoric granites with which greisen and pegmatite mineralization of tin, tantalum, niobium in the studied area are connected spatially and paragenetically.

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Short Report**THE GEOINFORMATION APPROACH**

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The geoInformatics has much in common with computer science, the geoinformation approach is close to the information approach.

The information approach includes use: information technologies, information systems, information units, information models, information monitoring, information modeling, information flows - as means for the decision of practical tasks, reception and accumulation of knowledge.

The feature of the geoinformation approach is caused by a line of the factors, among which we shall note the following. The ideology of geocomputer science is ambiguous. The integration of the information is based on the spatial data. The integration of technologies is based on technologies of systems of the automated designing with addition to them of cartographical transformations.

To processing in geoInformatics apply the specific data and models: the geodata, digital models and digital maps.

The digital models and digital maps have integrating function, uniting the references diverse information resources.

The integrating function enables creations гипертекстовой of gipertextual structure hiding behind the graphic and cartographical image extensive information space. This space includes set of the relations between objects of the real world and their attributes

Some kinds of the geoinformation have not analogues in computer science.

They require application of the special information systems (GIS), special methods of processing, special methods of modeling.

The processing of the information received in the different periods of time is characteristic for geocomputer science.

The volumes both complexity of the geodata are great also traditional methods of the analysis of the information become unacceptable.

The reduction of information loading on the user is reached by use of visual means of representation and analysis.

In geoInformatics the certain task of revealing and use of the spatial relations is put. All this defines specificity of the geoinformation approach.

At processing the spatial information is great of weight of interactive modeling.

The geoinformation approach includes application of common information and special

geoinformation methods, but in different combinations. At first we shall stop on the common or combined methods and technologies:

Use both information, and geoinformation technologies. Use of information and geoinformation systems. Use of logic information units for the description of processes of processing and storage both usual information, and geoinformation.

Use of technologies of designing within the framework of systems of the automated designing and in frameworks GIS. Use of the interface of communication(connection) between databases for communication(connection) between GIS and other information system.

Application as a specification - geodata. The tax of the information with prevalence of technologies of the tax from area of sciences about the Earth.

Use of databases both in a usual mode, and in a mode of associative communication(connection) with графикой. Visualization of the information with wide use of cartographical images. Use of integration of the data and integration of technologies. Use of satellite technologies as tool of monitoring and management of real objects.

Adaptation of telecommunication technologies for a storage and transfer of the geodata. Combination of technologies of the automated designing and mapping. Reception of cards, decision of practical tasks and reception of new knowledge.

Revealing of spatial heterogeneity at the expense of a finding of the spatial relations between real objects and territories.

The discrepancy of the geoinformation approach consists in, following

Integration of the data on the basis of a cartographical basis, and integration of technologies on the basis of systems of the automated designing.

The information approach is directed on processing of the information in general and decision of any tasks. The geoinformation approach is directed on processing of the spatial information, geodata and decision of tasks connected to a situation by accommodation and moving of objects on a terrestrial surface.

It is directed on the decision of tasks connected with by occurrence, course both disappearance of various processes and phenomena on a surface of the Earth

The information approach plays a role of the intermediary in processing initial yes collected by the user and decision of tasks by the put user.

The geoinformation approach plays a role of the applied tool at the decision of tasks of the user.

The information approach in the greater degree is focused on processing, regardless to the appendices. It determines its tool character and allows to consider as the tool of the intermediary (programmer).

The geoinformation approach is focused not only on processing, but also on generalization and analysis of the information with a target output - reception of the administrative information or information for support of acceptance of the decisions.

It defines its close communication with the appendices and allows to consider as the tool of the user.

Historically geoinformation approach has appeared later and in it the lacks of the information approach are taken into account and on the contrary the specificity allowing to find and to use of the spatial relation, for the decision of a complex of tasks is added.

The factor of coordinate environment in the information approach is absent also its account demands adjustment of application of special, rather difficult algorithms

The factor of coordinate environment is present in the geoinformation approach. In it the tasks combining local cartesian coordinates with криволинейными геоцентрическими in coordinates are solved.

The information approach is directed on revealing and modeling of communications. The geoinformation approach is directed on revealing and use of the relations, among which a conducting role play spatial.

In the information approach the binding aspect is characteristic. In the geoinformation approach is characteristic интеграционный aspect.

Thus, the geoinformation approach has the specificity and orientation. From here it is necessary to choose in what cases more effective geoinformation approach, in what cases it is necessary to apply the information approach.

Materials of Conferences

**APPLICATION OF INFORMATION-
COMMUNICATION TECHNOLOGIES
AND COMPUTER SOFTWARE MEANS FOR
FOREIGN LANGUAGES TEACHING
AS AN ESSENTIAL PART OF TRAINING
ENGINEERS IN THE TECHNICAL
UNIVERSITY WITHIN THE FRAMEWORK
OF THE BOLOGNA AGREEMENT**

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Signing the Bologna Agreement in 1999, Russia entered a new phase in the reformation of the education system. Due to globalization the following objective was developed: to create an integrated extent European education system. «An incorporated association in the education system is an essential part of the cooperation community, united in different regional organizations to achieve the goals in economic integration, social unity and political security» (HSE, 2005).

According to the national policy in the higher education system, it is critical for an engineer to be capable of adapting to variable living conditions, analyzing situations, evaluating and finding solutions to initial problems, possessing communication skills and developing intercultural relations (Sorokovikh, 2004). This would make it possible for the future engineer to tackle professional problems not only in the native language, but also in the foreign language (in our case in English).

Under conditions of educational globalization, many Russian universities develop and implement modern multilevel educational programs, covering both a good command of the foreign language and professional-oriented communication and suggest improvement of computing base.

Development of computer technologies and telecommunication means of search, handling and information exchange radically influences the content and ways of organizing future professional activity of engineers. Computer-mediated communication (including the foreign language) is highly demanded in the society, which requires the skills of competent oral and written speech, self-presentation, an effective deal with different information and critical evaluation of information recourses (Evdokimova, 2004).

Information community formation results in the development of the computer environment of business, scientific and everyday communication. According to this, when formulating objectives of training technical specialists, it is necessary to take into account changes in the professional field peculiarities in computerization conditions. Besides, in the communication engineer training the emphasis is often placed

on special features of communication by means of educational computing.

Newly designed courses application in engineering professional-communicative teaching as an integrated part of the engineers' curriculum enhances implementation of such educational programs, which suggest application of combination of teaching programs based on the ideas of computer software training with other means of teaching. Information-communication technologies are connected with television, computers, projectors or text-, audio-, television- and computer environments.

One of the computing technologies fulfilled in practice is an interactive board. It successfully combines possibilities of projective technologies and a sophisticated touch-sensitive device, which allows not simply displaying information, but also operating the process, i.e. adjust and correct the data, make notes and remarks. Thus, the following major facilities are realized in the interactive board: slide show, audio- and video-information representation, text and image edit and display, the Internet connection, teleconference, etc.

Consequently, original engineering problems, encouraging creation of professional-communicative situations and meeting the current engineering demands to develop their communicative skills, win new bright and vivid sides. The educational program acquires a new language-teaching approach, which stimulates language motivation of future engineers, their creativity and independence.

Thus, application of computer technology as an integrated part of engineering curricula reinforces the introduction of a new curriculum course. Engineering problems and situations can be challenging in designing professional-communicative situations and meet the needs of engineering students in the development of their communication skills.

The Bologna Agreement encouraged dynamic development of the new education programs for intercultural professional-oriented communication with application of computer technology, which raise highly qualified Russian engineers who can communicate effectively in a multicultural professional world and growing global marketplace.

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PEDAGOGUE PROFESSIONAL FORMATION AND DEVELOPMENT MONITORING

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The idea of continuing educational process and professional pedagogue work effectiveness tracking arose and practically carried out in the end of 80-s and in the beginning of 90-s in XX century [1]. At the same time, the term "monitoring", which meant continuity, scientific character and diagnosing of this process, became widespread in our country.

Monitoring gives an opportunity to find out the effectiveness of pedagogue professional formation and development process, to get information about object state and to provide with feedback. Taking part in pedagogical monitoring raises the level of teachers culture, stimulates self-examination of their professional formation and development. Pedagogue professional formation and development monitoring was considered as a continuing science-based process of noticing the changes in pedagogue professional work with a purpose to get a clear picture of changes, which happen in the process of professional formation and development at the particular moment. Besides, monitoring gave an opportunity to trace tendencies, to fore-know possible ways of administrative work, directed at positive tendencies support and development. To our mind, monitoring arrangement lets use more effectively a zone of proximal teacher development, understand its weak and strong aspects, and provide necessary administrative assistance.

One of the most important goals in monitoring process is to choose a criterion, which allows to assess the level of pedagogue professional formation. The rule is to distinguish criteria for pedagogical and methodological teacher's grounding and his practice results estimation. At the present time the following pedagogical professional work diagnostics methods are extensively used: qualitative teacher work results evaluation (Y. K. Babanskiy, A. D. Dementcev and etc.); diagnostics of pedagogue work development level (E. A. Fedorova); teacher practice effectiveness determination (V.P. Simonov), self-diagnosis (E. I. Rogov and etc.) and etc.

The pedagogical monitoring technology of pedagogue professional formation and development, that we presented, was realized on the basis of Stavropol Institute of educationalists advanced training, and consisted of seven interrelated stages:

1. A preparatory stage expected an organization and realization of purposeful, systematic information collection according to the criteria of professional work effectiveness (methods: questionnaire poll, observation, testing, document analysis, qualimetric methods).

2. On the stage of preliminary diagnostics there were distinguished initial indexes of pedagogue

professional work, tendencies, which changes will be tracked in future, and also there were revealed the levels of pedagogue professional formation, the degree of the correspondence between pedagogue professional characteristics and eligibility requirements, also there was distinguished the level of pedagogue professional formation (methods: observation, conversation, documentation analysis).

3. Qualifying stage. The main goal of this stage was to distinguish objective and subjective reasons, determining pedagogue professional work effectiveness. There was studied pedagogue employment history, distinguished professional crises and its influence on master formation process, examined colleague, parents, students opinion about the pedagogue professionalism level (methods: sociometric test, conversation, observation, documentation analyses).

4. Prognostic stage. Its task was to distinguish the tendencies of pedagogue formation and development process, planning and projection his professional work. There were marked out positive tendencies in pedagogue formation and development process, showed the conditions, according to which, the positive elements would be dominant.

5. Occupational and organizational stage meant the organization of the work with a pedagogue, directed on problems liquidation, which were exposed in the professional formation and development. Also there was studied methodological literature, organized arrangements, due dates and reporting documentation. There was organized pedagogue's participation in different kinds of methodological work (seminars, pedagogical reading and etc.), his study outside of educational institution.

6. Correcting stage. For provision pedagogue formation and development process with right course, it was necessary to correct combined actions of pedagogue and educational institution leadership.

7. The task of analytical stage was to distinguish the effectiveness of intensional-organizational arrangements with the goal to improve pedagogue professional formation and development process.

In the process of the monitoring technology practical realization we systematically and particularly examined the work of one and the same pedagogues, which illustrated the process of their professional formation and development. This methodology included the following: primary conversation, observation in the process of professional work, final results analysis, consultation, planning of actions, directed on pedagogue professional formation and development perfection.

We have studied thirty professional pedagogue biographies and made up their individual characteristics. We noticed that every specialist in the process of professional formation and development overcame crises, connected with the work, amount of which was purely individual. The distance, which means the transition from the one professional formation level to an-

other, depends on the number of objective and subjective factors.

Basing on the pedagogue eligibility requirements, we chose the indices that showed the correspondence between pedagogue professional formation and development level of teachers in comprehensive school and qualification characteristics: subject knowledge, psychological and pedagogical teaching basis knowledge, organizational forms of diagnostic work with students, approach to the students in the learning process, the ability to define works goals, the ability to plan works, creative relation to teaching, proficiency advancement work, self-development requirements realization. We distinguished three correspondence levels.

First level- minimal, but insufficient (34,76 % of questioned pedagogues, maximum amount of points is 16). A pedagogue knows school subject in programme volume, but admits distortions and mistakes in subject teaching and in examination; has only general notion about modern psychological and pedagogical concepts; efficiently makes changes in the lesson, taking into consideration diagnostic results; does not practically fulfill individual approach to students, sometimes uses additional out-of-school works with poor achievers; the ability to set a goal is poorly formed; plans lesson system, according to the subject, the plans stipulate the achievement of set goals; teaches in compliance with educational program requirements; shows interest in pedagogics, psychology, subject theory novelty, is situated on the stage of stopped self-development.

Second stage- necessary and sufficient (50,12% of questioned pedagogues, maximum amount of points is 40). A pedagogue knows school subject in programme volume very well, follows special and methodological literature; focuses on modern psychological and pedagogical teaching concepts; organically joins diagnostics with teaching material; generally uses individual approach to students; can distinguish only general goals; while planning the work takes into account previous work results, plans the ways of fixation and further development; brings in novelty elements in certain parts of program; uses different kinds of teaching preparation for skill advancement; the existing system of self-development is absent.

Third stage – ultra sufficient (15,12% of questioned pedagogues, maximum amount of points is 60). A pedagogue deeply and variously knows his subject in addition to the program, easily uses special, methodological literature in various fields of knowledge; easily uses in modern psychological and pedagogical teaching conceptions, uses them as a basis of his pedagogical work; knows different kinds of diagnostic methods, technologies of their use, can modify and devise his own diagnostic methods, using scientific approach while making them; systematically studies students' behavior and uses individual approach in education questions; can clearly formulate concrete

goals; the planning character is determined by hard self-adjustment, directed on guaranteed program realization and on achieving results up to level by students; is able to create a new author's program, concerning academic subject, give it pedagogical explanation and experimental test; deals with research and experimental work; self-development stage is pressing forward.

The main idea in our methodic is determining of weighing up the average rating of pedagogue professional work in comprehensive school. In compliance with it, teacher's work is planned according to the following functional ways: set task, methodological, pedagogue's public activity.

The average weighed up rating is calculated by multiplication of each total index of all kinds of work by percentage content in the general activity structure and dividing by 100.

The received results surprised both administration and teaching staff, because everybody supposed their staff as dynamically developed, without different professional problems. The wish to evaluate his work impartially, to reveal the reasons, which cause its result, makes the teacher work on professional problems decision. That is the movement on the way to achieve the mastery by every pedagogue. The speed of this movement will be different, but the most important thing is – this process will follow the path, which will be chosen by the pedagogue.

The realization of pedagogue professional formation and development monitoring technology establishes a success situation for a pedagogue, and it favours humanization and objectification of changes lurking in the process of its professional formation.

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METHODICAL ASPECTS OF APPLYING OF THE PEDAGOGIC INTERACTION IN THE PROCESS OF EDUCATION

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Intensification of the process of education and the quality of education has great importance now. Quality of education has relation with professional abilities of postgraduates and with the process of action of the educational system. Quality of educational process depends on quality of the educational technologies and the potential of the staff of educational departments.

Author applied the next methodic of fulfillment of the lessons taking into account pedagogical interaction «teacher-student»:

1. Mutual analyses of situation in the beginning.
2. Definition of the common (teacher and student) aims of education.
3. Planning the work (for teacher and student).
4. Selection of educational literatures.
5. Fulfillment of the educational operations, organization of the educational process.
6. Check and correction of the process of the work.
7. Analysis and evaluation of the results of education.

One can say that the optimal method of designing and organization of educational process of the practical works on physics is the next:

- the main accent of the action of the teacher is aimed on the cognitive actions of students;
- the teacher is the educationist-organizer and producer of education, who can propose to students the necessary selection of the means of education not only render educational information;
- educational information is used as the means of the organization of cognitive action;
- trainee is the subject of the action altogether with the teacher and his personal development is the main aim.

Applying of the citing method allows to intensification of the educational process.

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SOCIO-ECOLOGIC EDUCATION OF STUDENTS IN CONTEXT OF THE BOLOGNA AGREEMENTS: THE CONTENT ASPECT

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The purpose of the Bologna declaration, signed also by Russia, is to create the common European higher education area, as well as to develop new goals, content and conditions of its functioning.

This also refers to the socio-ecologic education of young people, addressed by the Magna Charta Universitatum (18 September 1988, Bologna). This document calls for the universities to provide such education of the future generations, which would develop respectful attitude towards the environment and life, and their harmonization (1).

Our studies let us define *the multi-level structure of goals (strategic, tactic, operative) of the socio-ecologic education of students*: education, upbringing,

development. *A particular place among the goals* takes the development of socio-ecological readiness at students, i.e. readiness to establish effective relations with the environment during the professional activities. Moreover, if students also learn some basics of teaching, then they will be able to provide socio-ecologic education to the next generations themselves: in the family, at school and professional education institutions, at the stage of self-education (2).

In order to fulfill the goals, we should talk about another element of the educational process – *content of the socio-ecologic education of students*. Considering this question, we took into account the opinions of V.A. Slavenin and A.I. Mishenko who stress, that it is necessary to distinguish the concepts of «content» and «process» (4). In our case and in general, the *content* is represented, firstly, by a system of knowledge about the relations between people, society and nature; about the ways that let develop an integral idea about the surrounding world and learn the methods of cognition of a socio-ecologic reality and practice. This system includes the knowledge about the main environmental objects: nature, society, human and technique. Secondly, the content includes intellectual and practical skills that help establish relations with all environmental elements and form a basis of one's future activity in this environment. Thirdly, it includes accumulated creative experiences, determined by the diversity of the reality, which calls for extraordinary approaches to its understanding and development. The fourth element is the experience of emotional, evaluative and determined attitude to the socio-ecologic reality, its elements and himself. Learning of the above mentioned elements will make a personality psychologically ready for an optimal interaction with nature, convince a person of the necessity to preserve and restore nature, teach socio-ecologic values.

It is significant, that, currently, there is a need of a further ecologization of the *content*. It means, that the idea of socio-ecological relations should penetrate different sciences, as, in one way or another, it is related to a human, his health and health of the humanity in general. It should also be mentioned, that ecological ideas are revealed in natural sciences: geo-ecology, bio-ecology, technical sciences related to environmental management. At this point, we also agree with Mamedov N.M., that the social aspect of ecology has not been studied yet, with exception of ecology law and ecology economics. Though today, the biggest part of ecological education should be given to social ecology, which reveals the laws of a sustainable development of the society-nature system (3). This, in its turn, requires to include other scientific disciplines into the *content* of the socio-ecologic education (motivational, cognitive and active parts). The potential of other branches of science with respect to teaching youth a balanced interaction with nature and a stable functioning of the socio-environmental system, is at

the moment hardly being used (or isn't being used at all).

In this respect, it is essential to introduce different ecological courses into the content of professional education, including the higher education. This can be confirmed by the results of the experiment, aimed at analyzing the educational content at the Belgorod State University. Its results showed, that the majority of ecology courses are present in the curriculums at the biology and geological geography departments. Curriculums at other departments sometimes contain one ecology-related course. These facts prove, that there is a need of further ecologization of the higher education, it is essential to use the potential of all study courses, develop special courses, optional courses, ecology practicums and other forms of teaching. This will let students to attend not only the courses related to their future profession, but also learn from professional science to optimize the socio-ecologic relations.

As for the *process* of the socio-ecologic education, it includes teaching and upbringing. **Teaching**, as we know, is one of the main elements of an integral education, and is determined by cooperation between a teacher and students. Its goal is, first of all, to gain knowledge and skills provided by study programs. The learning process is always bilateral and consists of teaching and learning, which assumes active participation of the both sides. The peculiarities of learning in universities are relatively fully studied by the science, including its different aspects: historical, personal, active, managerial, professional, creative, innovative and etc. Recently, technologies take a particular place in professional education: computer, educational, research, organizational, module and others.

On our context, ecologization of the higher education's *content* requires an appropriate organization of its learning, i.e. an optimal combination of methods, tools and forms. This combination includes the methods and tools from the toolkits of other sciences. For example, an effective cooperation between a teacher and students is only possible, if both sides have a clear idea about each other. It can be formed, if at the pre-communication stage psychological methods are being used, which let reveal student's personality, his individual reactions, and develop a successful cooperation. The established understanding is a basis for the future cooperation, aimed at learning the society-nature-system, studying its past and planning its future. Among the educational methods, dialogue, discussion and research are the most suitable for this cooperation. At the era of global computerization, computer and media technologies are also a must.

As for the interaction ways during the socio-ecologic education of students, individual forms are being actively used nowadays, although the collective forms are not an exception. Another important element of the interaction between a teacher and students is its monitoring and results control. It involves a

number of educational, psychological, mathematical and evaluation methods, modern computer technologies and technique.

Beside the general sides of the educational process at the universities, one should take into account specific parameters of the professional education aimed at getting professional skills (or retraining) according to their interests and abilities. Ecology is an important aspect of professional training, as any professional activity is to some extent related to nature and changes it. That is why students should learn to bear responsibility for the nature in the framework of their professional activities, preserve it for the coming generations.

Another component of the process of the socio-ecologic education is **upbringing**. Recently, components of the ecologic upbringing are being actively developed. The upbringing of students in the sphere of the environmental communication is not simple to define. *As a social function, the socio-ecologic upbringing of students* prepares them to establish optimal relations with the environment during their professional activities; it is a process of social ecologization, integration of an individual into socio-ecologic relations, learning the norms and rules of these relations, learning the main socio-ecologic values (natural, economical, labor, social, psychological, educational, ethnic and other). *In the broad sense, the socio-ecologic upbringing of students* is a purposeful activity of educational institutions. *In the narrow sense*, this process means a specially organized upbringing activity aimed at development of socio-ecologic skills at students: responsibility, economical attitude towards nature; kindness to all living beings; wise use of natural resources; desire to preserve nature for today and future generations; socio-ecologic world view. *The socio-ecologic upbringing of student is regarded not only as a process* of getting socio-ecologic experience from older generations, but also as a process of getting their own. It includes harmonization of their needs with those of nature, needed for a sustainable development of the society and environment.

It is obvious, that "the socio-ecologic education of students" is a complex and a many-sided term. Its diverse character is determined by the complexity of the existing socio-ecologic reality, the way the experience of relations between the society and nature is being learned and transferred from older to younger generations, taking into account the peculiarities of professional activity.

To sum up, considering the multi-level goals of the socio-ecologic education, its content and principles of its organization and management, let the students learn professions, as well as develop a balanced socio-ecologic relations today and tomorrow.

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COMPUTER ALGEBRA SYSTEM AND THE MATHEMATICAL TRAINING FOR STUDENTS OF TECHNICAL HIGH SCHOOLS IN RUSSIA

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I. Introduction. This paper is based on results of article [1]. As noted in the book [2], international competition, the increasing numbers of experienced and high quality requirements compel to automate owners the design and manufacture. Modern enterprises are unable to survive in the global competition if they do not produce new products of better quality, lower cost and in less time.

These words are fair and in the preparation of technical specialists. As it follows from the article [3], with the introduction in 1992 multilevel system of higher education problem of entering to the education system begin is solved. This system adopted in many countries around the world. Earlier the specialists with diploma were issued in 5-6 years, i.e. there was an one-stage scheme.

And now the scheme is multistage. Many state high schools both prepared and prepare specialists only. Some high schools, except for the traditional scheme, have also the multilevel scheme. Till now intensity in a question of prestige of the bachelor's degree is kept. Employers are not always wanted to take they for the job. There is a difference in programs of training. Specialists are prepared on a concrete specialty, as though in unique area. Programs of a bachelor degree have general scientific and general professional character. The bachelor receives fundamental preparation without any narrow specialization and spends for training only 4 years. Not belittling advantages of preparation of specialists, we shall tell on advantages of preparation of bachelors in our country.

The first advantage becomes more and more actual in modern Russia. The person receives the diploma and finds economic independence in 4 years after receipt in high school. Further, fundamentality of

preparation, its general training allows to replace a job easily if necessary. From here one more advantage follows. For office work person is needed in next qualifications: formed person, able to work with the information, with the people, capable to prepare every possible documents.

II. Computer algebra systems. (CAS) The rapid development of all computer mathematical applications [4] led to a paradoxical situation is not yet properly assessed. On the one hand, the computer solutions are faster. Analytical computation of many standard, but cumbersome problems can no longer be regarded as rational. On the other hand, the computer solutions are not accepted as full. We want to show the advantage of an integrated approach in studying the foundations of higher mathematics of students technical skills. If there is a possibility, we get the solution of mathematical problems with CAS. The proof of the correctness of the solution we carry out analytically in the first stage. When you experience the connection of computer solutions and analytical evidence, it is possible to carry out the proof with CAS, or a combination of CAS and analysis. But the final word always rests with the person. About the transition from technical problem to the mathematical model it is detailed in [5].

III. Examples of applications.

1. Fundamentals of Algebra. You can obtain the solution of linear algebraic systems of equations with a computer. Then you can obtain the values of residuals vector solutions analytically or with a computer.

2. Mathematical Analysis. You get more convenient initial solutions of tasks to the limits, the point of break and continuity of functions, graph functions, calculate the sums of convergent series and infinite products with CAS. Then you get a rigorous mathematical solution. The next, you will again receive computer solutions based on analytical solutions already found. Calculation of indefinite and definite integrals is difficult, not only among students but also professionals, especially when it is required to obtain an analytical solution. CAS simply are irreplaceable in this problem. Initially, you receive analytic solution with CAS (assuming it exists). Then, using the inverse operation of integration, i.e. on the basis of differentiation you sure the correctness of the obtained solutions.

Particular technical difficulties (laboriousness and the time spent) are the decision of the initial and boundary value problems for differential equations. In this case you can be recommended the following scheme solutions. Initially you apply the theorem of existence and the theorem of uniqueness of the solution if the problem is allowed. Then you define the required solution on the basis of CAS. The third stage is linked to the verification of the obtained solutions. This verification can be analytical or using CAS.

3. Linear Programming. The traditional problems of linear programming, such as canonical form,

production planning optimization, diet problem, in terms of the principles set forth in [2], it is easier and much faster to solve using the computer. The proof of the correctness of the obtained solutions can be made as follows. You can do the final operation of the simplex method for obtained computer solutions: check compliance with a criterion of extreme solutions to the objective function. The same is applied to the transport problem. You can use one of the methods for solving the transport problem to optimal computer solutions.

You can find more information about the problems in this article at the personal site <http://nit21-eng.narod.ru>.

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