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17 October 1979

USSR Report

BIOMEDICAL AND BEHAVIORAL SCIENCES

(FOUO 6/79)

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USSR REPORT
BIOMEDICAL AND BEHAVIORAL SCIENCES

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ADVANCED BIOTECHNOLOGY

UDC 612.85+599.537

ELECTROPHYSIOLOGICAL STUDY OF DIRECTIONAL ULTRASONIC PERCEPTION IN DOLPHINS

Leningrad FIZIOLOGICHESKIY ZHURNAL SSSR in Russian No 6, 1979 pp 820-825

[Article by I. M. Smosman and V. A. Voronov, Laboratory of Ecological Physiology (headed by A. I. Konstantinov) of the A. A. Ukhtomskiy Physiological Institute of the A. A. Zhdanov State University, Leningrad, submitted for publication 26 Jun 78]

Abstract. Electrophysiological experiments on dolphins of the species *Phocoena phocoena* studied patterns of directional perception of ultrasonic signals. The summary electrical responses were recorded in different auditory structures of the animal brain: cochlear nuclei, corpus trapezoideum, superior olive, acoustic lemniscus, inferior colliculi and inner corpus geniculatum. A shift is shown in the acoustic axis of the beam pattern from the side that is analogous to the location of the sound source (cochlear nuclei, corpus trapezoideum). Each of the aforementioned cerebral structures is characterized by a gradual constriction of the pattern observed during the transition from lower (30 kHz) to higher filling frequencies (120 kHz). A gradual constriction of the directional reception pattern was also found along the ascending auditory tract for all frequencies of the sonic stimulus.

Key words: ultrasonic signals, dolphin, on- and off-responses.

[Text] Study of spatial hearing in animals is one of the most urgent and intensively worked on problems of ecological physiology [1,3,4,11]. For the navigating animals, also including representatives of the Cetaceous order, the working out of this problem has especial meaning since the localization function in these animals is realized not only in passive, but primarily in active location. At the same it is necessary to consider that the functional organization of the auditory analyzer in the dolphin apparently differs for each of the location patterns [4,17]. In addition, the auditory range in the navigating animals covers the region of sonic and ultrasonic frequencies [1,4].

It is known that as a consequence of the short wavelength ultrasound possesses a number of features that include the possibility of creating sonic shadows from small objects, emission in the form of a narrow parallel beam, etc. [1]. Therefore, the functioning of hearing in the ultrasonic range permits the animal to form a sound field of directional

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perception, or in other words, to form a beam pattern. It is believed that the narrower the pattern the higher the resolution of the locator and the greater the intensification factor of the perceived signals [5].

In experiments on *Delphinus afalinus* it was demonstrated that for ultrasonic signals the width of the directional perception pattern is only several degrees [2, 10, 14, 15]. It can be assumed that the formation of such a narrow sonic beam occurs by means of the central nerve mechanisms. However, study of the latter is limited to a single work touching upon the characteristics of the summary electrical activity of the inferior colliculi in the dolphin with a change in the angle of presentation of the ultrasonic stimulus [16].

The purpose of this work was to study the perception directivity of acoustic signals in different links of the auditory analyzer of *Phocoena phocaena*. Here the perception system of the *Phocoena* locator functioned in a pattern of passive location in the frequency range 20-200 kHz.

Technique

Experiments were conducted in a hydroacoustic bath with dimensions 300 x 100 x 75 cm. The absorption coefficient of reverberation interferences in the frequency range 20-200 kHz was 0.8. The hydrophones used during the experiments were calibrated for reception of sonic signals.

Steel electrodes 0.1 mm in diameter, insulated to the tip with BEN-20 lacquer were used in the work. With the help of stereotaxic equipment they were inserted into various subcortical auditory formations: cochlear nuclei, corpus trapezoideum, superior olive, acoustic lemniscus, inferior colliculus and inner corpus geniculatum. The location of the tip of the electrode was verified by the Fox-Eichman method [18].

Tonal messages lasting 0.2-50 ms with frequency of filling 20-200 kHz were used as the stimulus. The messages were formed by a modulator; a tone from the G3-33 generator was fed to its inlet. Further the signal entered an attenuator and then a titanate-barium emitter. The latter was moved in an arc in horizontal and vertical planes in relation to the zero position; the axial line of the animal's head was taken as the zero position.

The induced potentials were recorded with the help of a biopotential amplifier UBP2-03 and a two-beam oscillograph Cl-18. A FOR-2 photorecorder recorded the electrical processes.

The experimental material was statistically processed. The technique of conducting the electrophysiological experiment on *Phocaena phocaena* has previously been described in more detail [9].

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Study Results

In the course of the experiments a study was made of the relationship of the value for thresholds of detection of summary electrical responses recorded in the subcortical nuclear structures of the Phocoena auditory analyzer with a change in the angle of presentation of the ultrasonic stimulus. Measurements were made both for reactions for engagement (on-responses) and disengagement (off-responses) of the sonic stimulus.

It was found that for the same structure the direction of the maximum sensitivity of both types of responses was the same, and for all structures was located in the sector of angles $0 \pm 30^\circ$ (fig 1). Here the curves for the off-responses were more compact, which is probably linked to the course of the frequency-threshold curves that have a smoother nature with peaks of sensitivity that are smaller in amplitude [8].

TABLE 1. MEAN VALUES OF WIDTH FOR DIRECTIONAL PERCEPTION PATTERN IN DEGREES (LEVEL 0.7) FOR AUDITORY CENTERS OF PHOCOENA ACCORDING TO DATA OF THRESHOLD REACTIONS WITH INDICATION OF STANDARD DEVIATION

(1) Название структуры	(2) Частота несущей (в кГц)			
	30	70	110	160
Кохлеарные ядра (3)	72±25	63±10	31±5	50±20
Трапециевидное тело (4)	60±20	42±15	27±5	40±10
Верхняя олива (5)	50±15	40±10	25±10	40±10
Латеральная цепля (6)	45±15	20±6	13±5	40±10
Нижний холм (7)	43±14	18±8	11±5	31±11
Внутреннее коленчатое тело (8)	24±9	20±10	8±1	22±10

Key:

- | | |
|----------------------------------|------------------------------|
| 1. Name of structure | 5. Superior olive |
| 2. Frequency of carrier (in kHz) | 6. Acoustic lemniscus |
| 3. Cochlear nuclei | 7. Inferior colliculus |
| 4. Corpus trapezoideum | 8. Inner corpus genticulatum |

It needs to be noted that as the afferent passages transfer from structure to structure the directivity of the pattern is altered. Thus, the maximum sensitivity in the cochlear nuclei and the corpus trapezoideum is on the same side as the presented stimulus and is at angle 15-30°. In the superior olive a shift in the maximum towards 0° occurs. For the auditory lemniscus, inferior colliculi and inner corpus genticulatum the acoustic axis of the pattern is shifted to the opposite side in relation to the position of the emitter. In the latter case the smallest thresholds were recorded at an angle of presentation 15°.

As the filling frequency of the stimulus increases a constriction occurs in the directional reception pattern, which is traced well on the graphs of the normed patterns plotted in polar coordinates. Data on the width of

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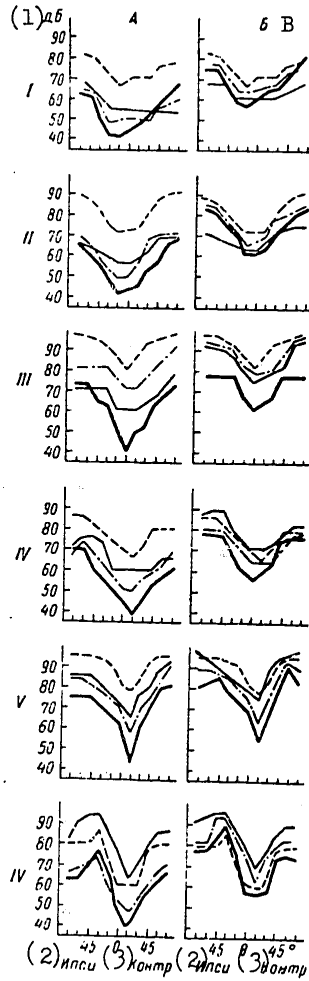


Figure 1. Threshold Curves of Directional Ultrasonic Perception of Subcortical Auditory Structures

Key:

On y-axis--level of sonic pressure in db in relation to 2×10^{-4} dyne/cm²
 On x-axis--angle of stimulus presentation

[Key continued on next page]

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- A. on-responses
- B. off-responses
- I. cochlear nuclei
- II. corpus trapezoideum
- III. superior olive
- IV. acoustic lemniscus
- V. inferior colliculus
- VI. inner corpus geniculatum
- 1. db
- 2. ipsi
- 3. counter

Thin solid line designates curves for filling frequency 30 kHz

Dash-dot line designates 70 kHz

Solid line designates 110 kHz

Dash line indicates 160 kHz

the beam pattern for different filling frequencies and levels of the auditory tract are presented in table 1. The distinct trend towards constriction of the patterns in the ascending links of the auditory tract is evident from the table.

The next peculiarity is associated with sharpening of the reception directivity at frequency 110 kHz that is manifest in the narrowest patterns at this filling frequency (table 1). The given law is traced well on the graphs for drop in threshold sensitivity (ΔP) between the points (angles) of maximum and minimum intensity necessary for the emergence of an electrical reaction (fig 2). The largest values of ΔP in all the studied structures, including the corpus trapezoideum, superior olive, auditory lemniscus and inferior colliculus were recorded at frequency 110-120 kHz.

Analogous results were obtained in a study on the dependence of the amplitude of on-responses on the angle of stimulus presentation. The strength of the stimulus in this case was 30-40 db above the reaction threshold. Measurements were made at the frequency of minimum thresholds for the given point of contact, as a rule, at 120 kHz. The aforementioned is well illustrated by the data of table 2. The previously established relationship of constriction of the width of the directional perception pattern in the ascending auditory tract is also correct in this case.

The question of localization of the resounding sources in a vertical plane has been investigated less in the navigating mammals. Studies of the threshold sensitivity of electrical reactions to ultrasonic stimuli were carried out in a vertical plane on the structure of the inferior colliculi. During the experiments it was established that the zone of optimal sensitivity is located in the region of the mandible, 2 cm below its upper edge. Above and below this point a gradual increase in the thresholds occurs. Figure 3 presents the averaged directional perception patterns in a vertical plane, plotted in Cartesian and polar coordinates. It is

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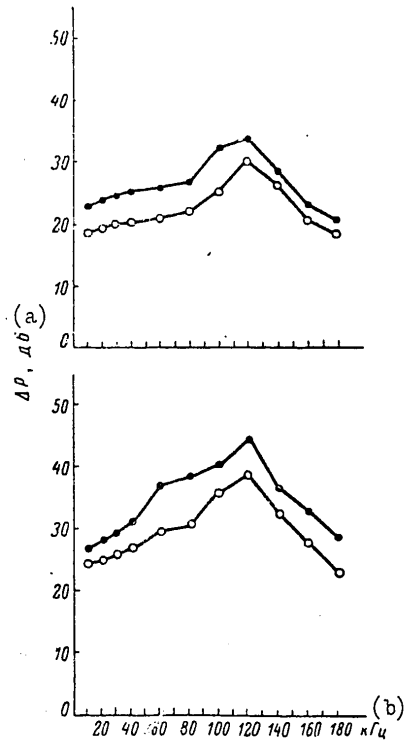


Figure 2. Maximum Difference in Threshold Sensitivity (ΔP) of On-Responses in Horizontal Sector of Angles of Stimulus Presentation Depending on Filling Frequency

Key:

- On x-axis--filling frequency of stimulus
- On y-axis--difference between maximum and minimum thresholds of on-responses in sector of angles $\pm 90^\circ$ of horizontal plane
- Black circles--corpus trapezoideum
- White circles--superior olive
- On upper graph--black circles--corpus trapezoideum
white circles--superior olive
- On lower graph--black circles--auditory lemniscus
white circles--inferior colliculus
- a. db
- b. kHz

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TABLE 2. MEAN VALUES OF WIDTH OF DIRECTIONAL PERCEPTION PATTERN IN DEGREES (LEVEL 0.7) FOR AUDITORY STRUCTURES OF PHOCOENA ACCORDING TO DATA OF SUPRATHRESHOLD REACTIONS

Name of structure	Diagram width for frequency 120 kHz
Cochlear nuclei	46±4
Corpus trapezoidium	35±10
Superior olive	35±5
Auditory lemniscus	30±12
Inferior colliculus	21±7
Inner corpus geniculatum	15±5

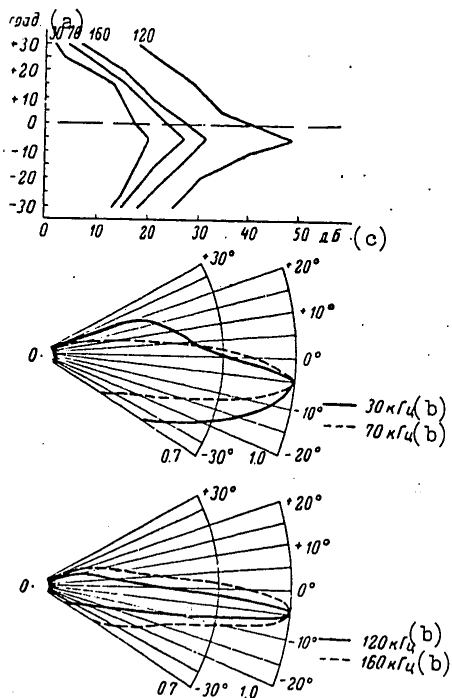


Figure 3. Threshold Curves of Directional Ultrasonic Perception for Inferior Colliculi in Vertical Plane

Key:

In Cartesian coordinates--curves plotted from mean value of on-responses with change in angle of stimulus presentation. Frequency of stimulus

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The question of the formation of directional perception in the vertical plane is more difficult [1, 12]. Possibly, this acoustic process is linked to the antenna properties of anatomical formations of the dolphin head and the peripheral section of the auditory analyzer. The position of maximum sensitivity to ultrasound in the lower hemisphere agrees with analogous data obtained on other dolphins [16, 22]. Probably this is related to the fact that the sound is conducted to the cochlea primarily along the tissues of the mandible [6, 16].

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EXAMINATION OF HUMAN SKULL BONES WITH DEFLECTED ULTRASONIC WAVES

Riga MEKHANIKA KOMPOZITNYKH MATERIALOV in Russian No 3, 1979 pp 508-514

[Article by V. V. Dzenis and Yu. I. Purin'sh, Riga Polytechnical Institute and Riga Medical Institute, submitted 27 Dec 78]

[Text] Methods have been proposed [1-4] for measuring human compact bone with deflected [deflecting?] ultrasonic waves by means of exponential concentrators. The virtually point contact of these piezoelectric transducers made it possible to turn to measurement of relatively small bases, to 8-10 mm, which is particularly important in examining biological objects with complex configuration, for example, the vertebrae [4]. The presence of a small base, in turn, made it possible to perform a comprehensive acoustical examination of an object by means of taking measurements at different points of the superficial layer; for example, in measurements in vitro the tibia was examined in 7 regions on the circumference and 28 vertical bands, with a total of 196 measured points [1]; the human spine was measured three times in 9 circumferential zones and three vertical bands, 27 places and 81 points [4]. The accuracy of ultrasonic measurements, evaluated by the coefficient of variation of measurements taken many times over in the same part of the specimen, was rather high and constituted $\nu_v = 0.8-1.2\%$ for the tibia and $\nu_v = 0.4-0.6\%$ for vertebrae.

A technique was developed in [2, 3] for taking measurements of man in vivo. The ultrasonic measurements were made on the medial surfaces of the right and left lower limbs in 10 vertical bands. The medial surface was chosen because the tibia is covered only by a thin layer of skin at this place. Experiments [2] revealed that, under such conditions, the skin, subcutaneous tissue and periosteum have little influence on time of ultrasound passage, and readings through the skin on the medial surfaces provide objective information about the acoustic properties of bone tissue. In all cases, the coefficient of variation was in the range of $0.5 \gg \nu_v \gg 1.2\%$.

Our objective here was to apply the above-described ultrasonic method to determine the condition of human skull bones.

We selected pairs of concentrators with natural frequency of 50 kHz and reading base of 200 mm for our measurements. A rubber cap was used, which

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the subject put on his head, was used to fix the measurement points on the skull. Holes were cut in the hat, in accordance with a specific grid, into which the tips of the concentrator were placed during the measurements (Figure 1). The measuring grid was selected as follows: the human skull was divided into two halves at the middle, right (R) and left (L). Seven measurement lines labeled *a* to *g* were drawn in each half. On each line, 4 to 15 readings were taken (each reading site in Figure 1 is designated by the sequential number for that line, for example, *a*--1, 2, ..., 14; *b*--1, 2, ..., 15, etc.). Thus, 81 readings were made in each half of the skull. In addition, 15 readings were made along the top of the skull between points on lines *a* in the R and L half of the skull, also on a 20-mm base (the sites of these measurements in Figure 1 are designated as *aa*'1', 2', ..., 15'). In all, there were 177 places measured on the human skull. The configuration of the skull of some subjects made it impossible to take readings for all of the indicated sites. In our experiments, the fewest readings constituted 168.

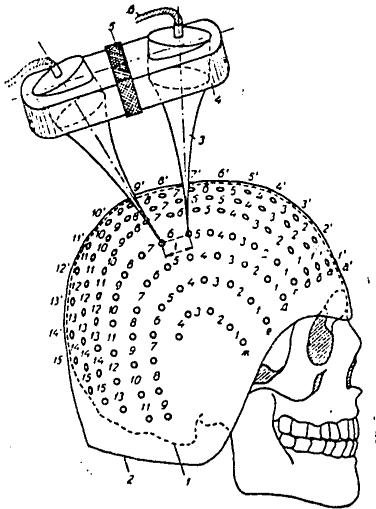


Figure 1.
Diagram of measurement of time of propagation of ultrasound by exponential concentrators on base $l = 20$ mm over the human head

- 1) configuration of skull
- 2) configuration of measuring cap
- 3) exponential concentrator
- 4) foam plastic connecting handle
- 5) felt insulation liner
- 6) coaxial cable

The measurements were taken by means of a pair of concentrators connected by a handle made of insulation material, which absorbs acoustical oscillations well. The time of propagation of the ultrasonic pulse τ was counted on the cathode-ray tube of a DUK-20 instrument, in microseconds, which is related to the velocity of the deflected wave through the following function:

$$c_H = \frac{20}{\tau - 42} \text{ [km/s]},$$

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where 20 is the measurement base in millimeters and $42 (\mu s)$ is lag Δt for the pair of concentrators used.

In order to assess the accuracy of measurements C_H , the same operator took measurements on the same subject three times, the cap being put on again each time. The coefficient of variation characterizing reproducibility of readings in the same place constituted a mean of $\nu_v = 2\%$. In spite of the fact that the measurement base was increased to upgrade the accuracy of readings [5], the values of ν_v were higher when measuring the skull than the tibia or vertebrae. This decrease in accuracy of readings is attributable mainly to errors in setting measurement base l . For the sake of convenience for taking measurements of the skull and to eliminate acoustical induction, the connective handle had a resilient felt insulation liner; for this reason the measurement base was fixed by the operator only visually, at the time of measurement, according to position of concentrator tips in the middle of the holes cut in the measuring cap, which could have led to errors in determination of l . Coefficient ν_v exceed 5% in 6 measuring points (3.4% of the readings). All these points are in the immediate vicinity of cranial sutures. Evidently, due to the difficulty of hitting the same spots when putting the cap on again, the measurements were taken both directly above the sutures and next to them, which could have led to a marked change in values of velocity C_H .

The results of our tests revealed that the velocity of ultrasound differs significantly, both when taking readings in different spots on the same object, and on different subjects. These readings were in the range of 0.76-2.47 km/s ($C_{(H)}\max/C_{(H)}\min = 3.25$ times). For this reason, for the sake of convenience of statistical calculations and graphic appearance of topological diagrams, the obtained velocities were broken down into eight classes (I, II, ..., VIII) with 0.2 km/s intervals between classes (Figure 2). On the topological diagrams, both halves of the skull are shown (π --right, μ --left) and each measuring point is shown, depending on the class of values of C_H , by a triangle with specific crosshatching in it (darkness corresponds to velocity C_H). The results of readings over midline aa' are illustrated in the figures above the right part of the skull (see, for example, Figure 2).

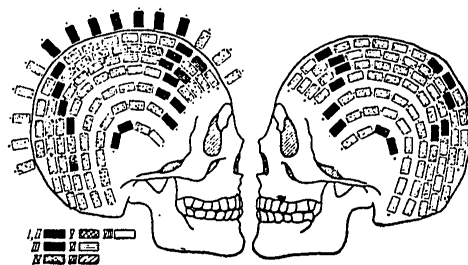


Figure 2.
Topology of velocities C_H over skull
(21-year-old male)

- | | |
|------------------------|---------------------------|
| I) $C_H \leq 1.0$ km/s | V) 1.601-1.8 |
| II) 1.001-1.2 | VI) 1.801-2.0 |
| III) 1.201-1.4 | VII) 2.001-2.2 |
| IV) 1.401-1.6 | VIII) $C_H \geq 2.2$ km/s |

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Studies of skulls of healthy individuals revealed that the ultrasonic method reacts to cranial sutures. In about 30 measuring points (17% of total) a decline in velocity of ultrasound was demonstrated. As a rule, these points were above the cranial sutures of man, which makes it possible to use the proposed method to determine the exact location of sutures. With the measurement grid we used we fixed the sagittal suture (line aa', measurement points 5-11) and, in part, the coronal, lambdoidal and other cranial sutures. According to our data, the location of the sutures varies in different people (Figure 3). The velocity of ultrasound above a suture $C_{(H)II}$ was considerably lower, by 20-40%, than the mean velocity of ultrasound $C^*_{(H)U}$ measured at cranial points without sutures (Table 1). We added two coefficients of asymmetry, $K_c = C_{(H)II}/C_{(H)I}$ and $K_\sigma = \sigma_{II}/\sigma_I$, where $C_{(H)II}$ and σ_{II} are the mean velocity and mean square deviation of readings on the right side of the skull, $C_{(H)I}$ and σ_I are the same, for the left side. As can be seen from our experimental data (see Table 1), these indices are close to 1 on the average for the subjects, but deviations of up to 6% for K_c and 18% for K_σ are observed in different individuals. The results of readings taken on 8 men ranging in age from 21 to 65 years indicate a tendency toward increase with age in both mean velocity $C_{(H)U}$ and standard deviation σ_U (see Table 1). It should be noted that we had previously demonstrated an increase in degree of acoustical heterogeneity with age in our in vitro measurements of the tibia [1] and vertebrae [4], but in the latter cases there was more marked increase in heterogeneity.

Table 1. Results of ultrasonic measurements of skulls of healthy males

Subject's code No	Age, years	Right side		Left side		Entire skull		Coefficient of asymmetry		$\frac{C_{(H)II}}{C^*_{(H)U}}$
		n	$C_{(H)II} \pm \sigma_{II}$ KM/S	n	$C_{(H)I} \pm \sigma_I$ KM/S	n	$C_{(H)U} \pm \sigma_U$ KM/S	K_c	K_σ	
H1	21	78	1.53 ± 0.19	81	1.49 ± 0.19	177	1.51 ± 0.21	1.03	0.98	0.68
H2	25	76	1.60 ± 0.26	79	1.66 ± 0.28	169	1.61 ± 0.27	0.96	0.92	0.68
H3	30	82	1.49 ± 0.19	76	1.48 ± 0.16	173	1.48 ± 0.18	1.01	1.18	0.76
H4	36	81	1.97 ± 0.29	80	1.95 ± 0.27	176	1.95 ± 0.29	1.01	1.07	0.79
H5	42	79	1.72 ± 0.21	80	1.74 ± 0.21	173	1.73 ± 0.21	0.99	1.01	0.83
H6	46	79	1.74 ± 0.29	78	1.73 ± 0.29	172	1.71 ± 0.30	1.01	1.00	0.62
H7	54	81	1.72 ± 0.29	79	1.63 ± 0.29	175	1.67 ± 0.31	1.06	1.00	0.63
H8	65	80	1.81 ± 0.29	77	1.80 ± 0.28	168	1.81 ± 0.29	1.01	1.04	0.68
Mean data for all subjects							1.68 ± 0.26	1.01	1.02	0.71

n — number of readings.

Table 2 and Figures 4-6 submit the results of examining patients with pathology of the head. The results obtained differ significantly from those on healthy individuals: 1) the patients presented generally slower rates C_G than healthy individuals C_3 (C_3 arbitrarily refers to mean rate for all subjects, $C_3 = 1.68$ km/s); 2) there was relatively less scatter of experimental data characterized by standard deviation σ_G than in healthy subjects

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($\sigma_3 = 0.26$); 3) in a number of cases, there was marked deviation from 1 of coefficients of asymmetry (K_c up to 1.22 and K_G up to 0.5), which was indicative of localization of the pathological process on one side of the skull. In some cases, in the presence of neoplasms of the brain, the measurement sites where low rates were demonstrated showed the localization of the process with rather circumscribed boundaries.

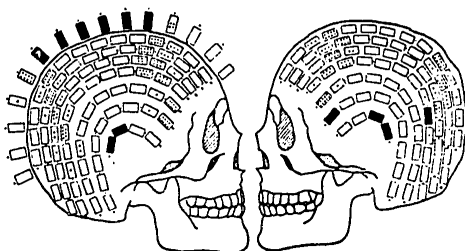


Figure 3. Topology of lowered values of velocity $C_{(H)III}$ over a cranial suture. The number of points corresponds to the number of people, in whom this decline was demonstrated at this measurement site. The black areas indicate that the velocity decreased at those points in all subjects.

The decreased velocity of the deflected wave in the case of examining cranial bones could be attributed to several causes. In the first place, changes due to pathology of mechanical properties--elasticity, hardness, solidity, etc.--of cranial bones proper (in our studies of the tibia we established that there is a correlation between hardness and velocity c_R , a 10% decrease in velocity means that hardness decreased by 15%). In the second place, when using exponential concentrators, the deflected wave (antisymmetrical wave of Lamb) in bone tissue is excited, and the rate of its propagation, other conditions being equal, depends on the thickness of compact bone tissue at the measurement site [2]. With change in thickness of a cranial bone, which may occur in the case of pathology, velocity C_H diminishes with decrease in h . In the third place, the velocity of ultrasound may change with both change in mechanical properties of the layer of brain adjacent to the cranial membrane and in conditions of skull--brain contact. At this stage of our investigations, we cannot unequivocally determine the causes of decreased velocity of ultrasound. However, analysis of the data obtained from examination of the patients suggests, in our opinion, that the third group of causes play the main role in lowering the velocity of ultrasound in the presence of the forms of pathology we have discussed.

Examination of different patients revealed the following. Two patients (P1 and P2) had severe contusions to the brain with effusion of blood into the brain matter. According to the ultrasonic studies, there was a significant decrease in mean velocity over the brain as a whole in both cases: $C_G/C_3 = 0.72$. In patient P1, the lesion was localized mainly in the right part of the skull, whereas in patient P2 (see Figure 4) both sides were equally involved.

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Table 2. Results of ultrasonic readings taken on skulls of individuals with cranial or cerebral pathology

Patient Code No	Clinical diagnosis	Sex	Age, years	Right side		Left side		Entire skull		Coeff. of asymm.		$\frac{\sigma_6}{\sigma_3}$		
				n	$c_{(n)} \pm \sigma_n$ KM/S	n	$c_{(n)} \pm \sigma_n$ KM/S	n	$c_{(n)} \pm \sigma_n$ KM/S	K_c	K_o			
P1	Brain contusion with effusion of blood into brain	M	30	82	1,09 ± 0,11	79	1,26 ± 0,17	175	1,19 ± 0,14	0,86	0,65	0,71	0,56	
P2	Same	M	30	81	1,24 ± 0,12	81	1,22 ± 0,12	177	1,22 ± 0,12	1,02	1,00	0,73	0,46	
P3	Pituitary tumor	M	31	70	1,20 ± 0,14	74	1,21 ± 0,13	169	1,19 ± 0,17	0,99	1,08	0,71	0,65	
P4	Extensive process in left occipital region of brain. Large hepatoma found there during surgery	M	37	81	1,44 ± 0,12	81	1,42 ± 0,23	176	1,42 ± 0,19	1,01	0,52	0,84	0,73	
P5	Primary: extensive process in left brain; secondary: chronic arachnoiditis	F	50	81	1,75 ± 0,21	78	1,43 ± 0,42	174	1,59 ± 0,36	1,22	0,50	0,95	1,38	
P6	Left meningioma in parietal region of skull	M	54	82	1,60 ± 0,22	79	1,39 ± 0,19	177	1,49 ± 0,25	1,15	1,16	0,89	0,96	
P7	Malignant glioma in left brain	M	48	86	1,47 ± 0,15	80	1,35 ± 0,29	177	1,41 ± 0,23	1,09	0,52	0,84	0,89	
Mean data for all subjects										1,36 ± 0,21	1,05	0,78	0,81	0,81

n - number of measurements.

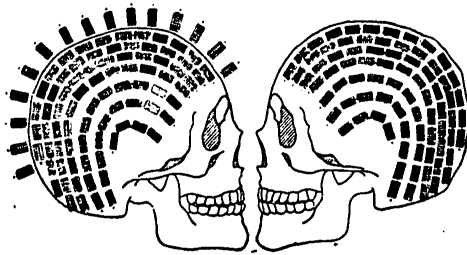


Figure 4. Topology of velocities c_n over skull of patient P2, 30 years old, with severe contusion to the brain and effusion of blood into brain matter

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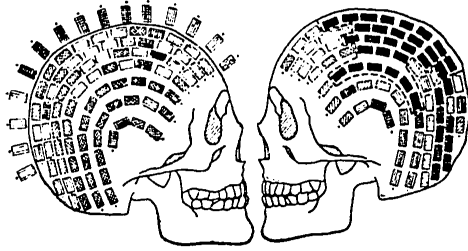


Figure 5.
Topology of velocities C_H over skull
of patient P5, 50 years old, with
chronic arachnoiditis

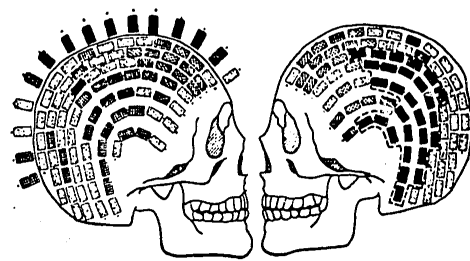


Figure 6.
Topology of velocities C_H over skull
of patient P7, 48 years old, with
malignant glioma in left brain

Ultrasonic examination of a patient with pituitary tumor (P3) yielded analogous findings: significant symmetrical decrease in velocity in both halves of the skull.

The primary diagnosis on patient P4 was an extensive process in the left occipital part of the brain, for which he underwent surgery. During surgery it was established that there was a large organized hematoma at this site, which developed after rupture of a cerebrovascular aneurysm, and this simulated a neoplasm of the brain. Ultrasonic studies conducted before the operation revealed lower values for velocity C_G than in healthy individuals and, in addition, considerable decrease in velocity of ultrasound at 16 measuring points in the occipital part of the left half of the skull (lines II-V, starting at measuring point 10). The area of localization of pathology was well-circumscribed according to ultrasonic data.

The initial diagnosis on patient P5 was an extensive process in the left brain. After subsequent neurosurgical work-up no neoplasm was found in the brain, and a new diagnosis was made, chronic arachnoiditis. However, ultrasonic examination revealed that there were rather sharp differences between this patient's two cranial halves: $K_C = 1.22$ and $K_G = 0.50$. While the right side presented no pathology, there was a distinct region on the right side, with 27 points measured, of low velocities (this area is indicated by dots in Figure 5).

Ultrasonic examination of patient P6, with the diagnosis of meningioma in the left parietal region of the skull, revealed lower average velocities over the skull than in healthy subjects: $C_G/C_3 = 0.89$. Moreover, a relatively small area of decreased velocities was demonstrated in the upper left skull, but outside this area the velocity on the left side of the skull was also lower than on the right and this, in our opinion, is

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indicative of the fact that the pathological process influences the entire left half of the skull.

A malignant glioma was diagnosed in the left half of the brain in patient P7. On the whole, ultrasound velocity was considerably lower than in healthy individuals. A relative larger area with low values of C_M (dots in Figure 6) was found on the left side of the skull.

These studies revealed that the ultrasonic method we used can determine the location of cranial sutures, as well as demonstrate pathological changes in the skull and brain, with relatively accurate definition of the boundaries of such changes. The method of ultrasonic monitoring that we propose is simple and safe; for this reason it will be useful in defining the boundaries of lesions to the skull and brain. After further refinement, the method can be recommended for preventive screening of the public, for the purpose of early detection of pathological processes in the head.

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ADVANCED BIOTECHNOLOGY

UDC: 575.173

PROSPECTS OF BIOORGANIC CHEMISTRY AND MOLECULAR BIOLOGY

Moscow VESTNIK AKADEMII NAUK SSSR in Russian No 6, 1979 pp 101-104

[Article by I. V. Torgov, corresponding member of the USSR Academy of Sciences]

[Text] The development of basic research in the field of the biological sciences and practical application of results achieved make it imperative to discuss the current status and prospects of future development of bioorganic chemistry and molecular biology at special international scientific conferences.

A symposium organized by the USSR Academy of Sciences and Uzbek Academy of Sciences became one of these major international forums; it was held on 25 September to 2 October 1978 in Moscow and in Tashkent. The symposium was convened under the aegis of the International Union of Theoretical and Applied Chemistry (IUTAC) and International Union of Biochemistry (IUB).

About 200 Soviet scientists and 70 guests from 19 foreign countries, including many scientists of worldwide fame, participated in the work of the symposium. D. Barton and Kh. Koran, recipients of the Nobel Prize, were unable to attend, and they mailed their papers to the symposium.

Opening remarks at the symposium were delivered by Academician A. P. Aleksandrov, president of the USSR Academy of Sciences; he indicated that the problems of utmost importance that are facing mankind and related to the limited energy and other natural resources, shortage of foodstuffs, requirements of medicine and public health can and must be solved only through the joint work of scientists and engineers of many nations. The president commented on the effectiveness of international scientific collaboration in the field of thermonuclear energy as an example that should be followed. Biological directions--biochemistry, biophysics, molecular biology--constitute the area of science which will probably have the greatest influence on the future fate of mankind. For expressly this reason, the president said that we wish great success to this symposium.

The next speech was delivered by Academician Yu. A. Ovchinnikov, vice president of the USSR Academy of Sciences, who stressed that the symposium gathered the greatest scientists from many countries, since the meeting

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dealt with a most complex and absorbing problem of modern science, learning the mysteries of life. Along this route, particularly great strides were made by physicochemical biology, which absorbed the ideas, methods and approaches of biology, physics and chemistry. Yu. A. Ovchinnikov described the outstanding scientific discoveries made recently in this field: discovery of double helical DNA, identification of the main forms of protein stacking, synthesis of the peptide hormone oxytocin, the alkaloids strychnine and reserpine and, later on, chlorophyll and cobalamine.

Many major biochemical advances are to be credited to Soviet scientists: proof of presence of DNA in higher plants, discovery of enzymatic activity of muscle proteins, oxidative phosphorylation, mechanism of transamination. Yu. A. Ovchinnikov stated that the teaching on the origin of life became the foundation for development of biological science and biological scientific institutions in our country. The Institute of Natural Compounds (presently called the Institute of Bioorganic Chemistry imeni M. M. Shemyakin), Institute of Radiation and Physicochemical Biology (presently the Institute of Molecular Biology) and several institutes at the biological center in Pushchino were organized under the USSR Academy of Sciences. New centers for physicochemical biology appeared in Siberia, the Far East, Uzbekistan and elsewhere. The creative and organizational endeavors of Academician M. M. Shemyakin played an outstanding role in the inception and development of physicochemical biology; the symposium was scheduled to convene on his 70th birthday.

In our country, physicochemical biology is presently on the upswing; it is being given enormous attention by the Communist Party and the Soviet government. In 1974, a special decree was adopted by the CC CPSU and USSR Council of Ministers "On steps to accelerate development of molecular biology and molecular genetics, and application of their advances in the national economy." Today, the most complex structures of biopolymers, proteins, nucleic acids and polysaccharides are being identified; biologically active proteins and genes are synthesized, and mechanisms of key processes in the living cell are disclosed. Genetics and gene engineering, chemistry of biological regulators are developing rapidly, and there is noticeable progress in research on higher nervous activity.

Yu. A. Ovchinnikov dealt on the tasks for science with regard to solving such important problems as cancer, intensification of agriculture and environmental protection, and he expressed his hope that the symposium would make a contribution to these solutions.

The highest scientific award of the Academy of Sciences, the gold medal imeni M. V. Lomonosov, was bestowed upon L. Pauling, foreign member of this Academy, by Academician A. P. Aleksandrov, president of the USSR Academy of Sciences, in a solemn ceremony; the American scientist received this award for his outstanding achievements in biology and biochemistry.

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About 50 papers were delivered during the symposium, and they can be arbitrarily divided into four major cycles. The first refers to papers dealing mainly with the study of peptides and proteins, including research on the structure and mechanism of action of enzymes.

In a paper dealing with the nature of bonds formed by transitory metals in bioorganic and other compounds, L. Pauling concluded, on the basis of extensive material from chemical research and x-ray analysis, that such metals as cobalt, iron, nickel and osmium are capable of forming compounds with a nonacovalent atom. Estimates on valent angles coincide well with the experimental findings. This new conception will apparently play an important role in gaining understanding of the catalytic action of both the transient metals and metalloenzymes in biochemical reactions.

The paper of Academician A. Ye. Braunshteyn dealing with the main results of investigation of enzymatic transfer of amino groups summed up the findings of many years of studies of pyridoxal-dependent transaminases, as a result of which general theory of pyridoxal catalysis was expounded.

V. T. Ivanov, corresponding member of the USSR Academy of Sciences, told the audience about his successful attempt at synthesizing substituted peptides with the sequences of bee venom toxin (apamin) and snake toxins, α -bungarotoxin and neurotoxin of the Central Asian cobra.

The vast possibilities of x-ray analysis and electron microscopy in the study of structure of protein molecules, tertiary and quaternary structures thereof, were demonstrated in the paper of Academician B. K. Vaynshteyn. Use of these techniques is now a reality for the study of interaction between protein molecules with association thereof in crystals, as well as formation of membranes of spherical viruses. D. Hotchkin (England) defined the geometry of the A chain in insulin by the method of roentgenoscopy.

The second cycle includes papers dealing mainly with nucleic acids, ribosomes and the mechanism of protein biosynthesis.

Academician A. S. Spirin concentrated the attention of the symposium participants on the recently discovered informosomes which, as it was learned, are universally distributed in animal cells. Their protein-RNA composition and role in protein biosynthesis have been established.

Academician M. N. Kolosov delivered a paper on chemico-enzymatic synthesis of the gene of valine tRNA of yeast. Kh. Korana used similar methods to synthesize the gene of tyrosine suppressor tRNA and the gene of its precursor.

G. P. Georgiyev, corresponding member of the USSR Academy of Sciences, discussed the method he developed to study the genetic system. He demonstrated on three actively expressed drosophila genes that all copies of a structural gene are identical in the genome, but their environment is different.

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J. P. Ebel' (France) reported on completion of studies identifying the structure of 16 S RNA and start of analysis of 23S RNA which contains 300 nucleotides. H. Zachau (FRG) presented the latest data on the structure of chromatin, an extremely complex protein-nucleotide complex, which helped identify the organization of the chain of nucleosomes that are densely arranged on the strand of DNA.

The papers referable to the third cycle dealt mainly with the structure and mechanism of action of membranes: ion and metabolite transfer, generation of electric charges, etc.

The paper of Yu. A. Ovchinnikov described the current status of research on ion transport through biological membranes, particularly with the use of ionophores, and he expounded a conception that explains well the mechanism of action of ionophores, as well as the relation of this action to their structure and conformation in various media. Some convincing data were submitted on involvement of periplasmatic proteins and compounds similar to prostaglandins in transport of calcium and magnesium ions. The primary structure of one such proteins (so-called LIV protein) has been proven.

V. Stokkenius (United States) devoted his paper to investigation of a unique proton pump, bacteriorhodopsin, which is localized in membranes. Having compared the findings of electron microscopy to data on primary structure of this protein, defined by Yu. A. Ovchinnikov, Stokkenius proposed the comprehensive structure of bacteriorhodopsin and offered a model of proton transport in a purple membrane.

The transport of ions through membranes was the subject of several papers. E. Karafoli (Switzerland) demonstrated that mitochondria have two independent systems for transport of calcium ions, one of which is used to absorb them and the other, to release them. V. P. Skulachev, corresponding member of the USSR Academy of Sciences established that natural membranes produce a difference of electrochemical potentials that provide for transport of many water-soluble compounds and chemical work, for example ATP synthesis.

Academician P. G. Kostyuk drew the audience's attention to research on ion channels of the electroexcitable membrane of the neuron. He proposed a technique that measures ion current generated by microsegments of membranes and isolates, on this basis, processes that take place in a single ion channel.

The structure and mechanism of action of specific biordgulators were discussed in the fourth cycle of papers.

Much interest was aroused by the paper of B. Vitkop (United States) who considers the selectivity principle to be of utmost importance in modern organic chemistry. It is expressly by means of agents with selective action that one is able to separate a complex process into elementary stages, to split the macromolecule and then reconstruct it, by adding a modified fragment.

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B. Vitkop synthesized a number of analogues of pyrimidine nucleosides following such a principle, and he obtained antiviral agents.

There is something in common between these studies and those of E. Lederer (France), who obtained analogues of S-adenosyl homocystein, which inhibits methylation of tRNA and, consequently, transformation of cells by oncogenic viruses. Problems of selectivity were also reflected in the paper of J. M. Lene (France), which is not directly related to natural compounds and constituted a survey on chemistry of kryptates which, being macrocyclic molecules, behave like receptors and transporters of metal ions or anions. This author believes that some kryptates may be used to remove radioactive isotopes from the body.

The plenary paper of Academician A. S. Sadykov, president of the Uzbek Academy of Sciences dealt mainly with problems of synthesis on the basis of natural compounds. Alkaloids, terpenoids, flavones and gossypol have produced many important physiologically active products.

Problems of synthesis were discussed in the paper of D. Barton (France). Analyzing his own studies, he described, in a lively and absorbing way, how some photoreactions, molecular regrouping, reactions of ion and radical reduction were discovered according to plan (and in some cases by chance). Use thereof in synthesis made it possible to produce some important natural compounds, aldosterone and deoxysaccharides.

At the time the symposium began, the Nauka Publishing House published the book, "Results and Prospects of Development of Bioorganic Chemistry and Molecular Biology," which contained the material submitted by the participants at the symposium. This book has been translated into English, and it is published by the Elsevier Publishing House (Netherlands). The proceedings of the symposium will be published in the international journal, "Pure and Applied Chemistry."

Many of the foreign guests visited research centers in Moscow, Pushchino, Leningrad, Novosibirsk, Kiev, Tbilisi, Riga and other cities, where they delivered lectures and moderated scientific discussions.

In their speeches and informal talks, the leading foreign scientists commented on the good organization of the symposium, praised highly the achievements of Soviet science, proposed to organize joint research in a number of directions, and invited their Soviet colleagues to visit foreign institutes and laboratories. The scientific importance of bilateral symposiums on special problems of bioorganic chemistry and molecular biology, organized by the USSR Academy of Sciences, together with the scientists of France, Sweden, United States and FRG, was stressed.

It can be concluded that the symposium was a success, was very beneficial to Soviet scientists and aided in augmenting the authority of Soviet science. [546-10,657]

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AGROTECHNOLOGY

AT A REPORTING-PLANNING SESSION OF VIR

Moscow SELEKTSIYA I SEMENOVODSTVO in Russian No 3, 1979 p 63

[Article by N. Ryauzova]

[Text] A reporting-planning session of the academic council was held in March at the All-Union Scientific Research Institute of Plant Growing imeni N. I. Vavilov. Leading scientists and veterans of the institute, the directors and heads of the experiment stations and bases of VIR, academicians of VASKhNIL [All-Union Academy of Agricultural Sciences imeni V. I. Lenin], managers of selection centers, the most prominent selection specialists of the country, workers of the State Committee on Variety Testing and representatives of party and agricultural bodies participated in its work.

In his introductory speech, Hero of Socialist Labor, Academician of VASKhNIL D. D. Brezhnev noted the enormous significance of world plant resources in creation of new intensive varieties and the contribution of institute scientists to the most rapid introduction of them into production. He called on the VIR workers to multiply their efforts and to save the prestige of the institute, increase by tens of prominent scientists and by its founder Nikolay Ivanovich Vavilov.

Doctor of Biological Sciences N. P. Chuvashina gave an official report on the work carried out in 1978 and on the tasks faced by the collective of the institute and its experiment stations and bases. She talked about the tempos of work of the entire VIR network in mobilization of world plant resources, study and development of measures for efficient and more effective use of them in selection. The scientist dwelled on the organization and work of 35 expeditionary detachments to investigate and gather the plant resources of different regions of the USSR, about special attention of the institute management to work on investigation and gathering of specimens of crop plants and their wild relatives in a number of regions of the Nonchernozem area and especially in the construction zone of BAM [Baykal-Amur Mainline Railroad] and of the Far East. Ten foreign expeditions, noted the reporter, made it possible not only to bring in more than 29,000 specimens to the collection, but to expand and reinforce exchange contacts with scientific institutions and seed companies of a number of countries of the world.

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Expansion of contacts with leading scientific research institutions of the world and on recognition of the vanguard role of VIR in worldwide agricultural science, emphasized the scientific secretary, are also indicated by the joint investigations of the institute with scientific institutions of 20 foreign countries on 36 topics.

Characterizing the work of the departments, N. P. Chuvashina reported to the conferees on completion of theoretical and scientific-practical work. Reports on extensive investigations on genetic control of the most important economically valuable features, on development of methods of winter rye selection on a sterile basis with high potential yield (80-90 qt/ha) and with low stalks, on completion of investigations on analysis of corn varieties and hybrids under conditions of the Nonchernozem area and regions of BAM, on determination of new fixing agents of sterility in sugar beets and so on were of special interest in her report.

The reporter devoted a great deal of attention in her report to one of the most important tasks of workers of the genetic stock of the country -- to long-term storage of the embryo plasma of plant resources and development of a scheme for packing seeds for long-term storage under permafrost conditions (Yakutsk). N. P. Chuvashina also talked about measures which contribute to introduction of scientific achievements into production. These are holding "field" seminars in different zones of the country with indication of the best specimens for collection, intensifying work to supply scientific research, selection and experiment institutions with initial material for selection, allocation of large lots of valuable specimens of individual crops to the virgin-land regions, to assist selection centers in selection of genetic sources, expansion (with these institutions) of joint developments of the most important theoretical problems, attaching the leading specialists of VIR to specific selection centers and so on.

The report on the emerging role of automation and the information-computer system developed and introduced at VIR was interesting.

The conferees heard with great interest the report of acting member of the USSR Academy of Sciences and Academician of VASKhNIL V. N. Remeslo "Selection of Wheat and the Role of Worldwide Plant Resources," read by A. A. Mel'nikov, the talks of Academician of VASKhNIL V. G. Konorev on the new principle of recording the genetic resources of plants, of Doctor of Agricultural Sciences G. Ye. Shmarayev on exotic corn races of Latin America -- a valuable source of material for selection for heterosis -- and so on.

Section meetings were held on business matters at which the results and plans of the scientific and production activity of branches, departments, experiment stations and bases of VIR were discussed. The manager of the Moscow Branch of VIR candidate of agricultural sciences A. M. Medvedev, directors of experiment stations, candidate of agricultural sciences I. N. Dashchevskiy and candidate of agricultural sciences N. A. Afanasenko gave talks at them.

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The session participants were acquainted with great interest with reports of expedition managers through the Soviet Union and abroad. Not only the talk itself, but also a slide demonstration were cognitive.

I would like to note in conclusion that the contribution of scientists of VIR in creation of highly productive varieties, which are also needed by today's agricultural production, was emphasized in all the talks.
[465-6521]

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AGROTECHNOLOGY

MEETING OF SEED GROWERS IN THE NONCHERNOZEM AREA

Moscow SELEKTSIYA I SEMENOVODSTVO in Russian No 3, 1979 p 62

[Article by A. Novikova]

[Text] A meeting-seminar to exchange work experience and to further improve seed growing of grain crops in light of fulfilling the decrees of the CPSU Central Committee and USSR Council of Ministers "On measures for further improvement of selection and seed growing of grain and oil crops and grasses" (1976) and also "On measures for further development of agriculture of the Nonchernozem zone of the RSFSR" (1974), was held on 22-23 March at the Exhibition of Achievements of the National Economy of the USSR.

It was organized by the Sortsemproms [Expansion unknown] of the USSR and RSFSR and also by the "Grain" and "Agriculture" pavilions of VDNKh of the USSR.

Managers and specialists of variety and seed-growing associations of Belorussia, Lithuania, Latvia, Estonia, oblast agricultural administrations, specialized seed-growing farms of oblasts of the Nonchernozem zone of the RSFSR, scientists of VASKhNIL [All-Union Academy of Agricultural Sciences imeni V. I. Lenin] NIISKh [Scientific Research Institute of Agriculture] of the central regions of the Nonchernozem zone, the All-Russian Scientific Production Center for Organization of Production, Labor and Administration in Agriculture and so on participated in the work of the seminar.

The deputy chief of Sortsemprom of the USSR G. P. Zhinov opened the seminar. He talked about some results of restructuring the organization of seed growing during the past 2 years, the experience accumulated during this time and about routine problems.

The deputy chief of Sortsemprom of the RSFSR Yu. A. Simonov reported on the concentration and specialization of seed growing of grain crops in the Nonchernozem zone. He concentrated main attention in his talk to problems of organizing seed growing in the zone, developing variety and seed-growing associations and special seed farms locally and organization of a number of specialized associations.

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The reporter noted the more active work of the variety and seed industries of Bryanskaya, Orlovskaya, Moskovskaya and Sverdlovskaya oblasts in concentration and specialization of seed growing.

The seminar participants heard with great interest the talks of managers of the Kalinin Oblast Sortsemprom Yu. V. Bublikov and of the Belorussian Republic Sortsemprom N. S. Karako, who shared the experience of the leader in seed growing of grain crops on an industrial bases.

The chairman of the Kolkhoz "Luch revolyutsii" A. N. Artyukhov talked about organization of seed production on a special seed form of Uritskiy Rayon of Orlovskaya Oblast; S. A. Kuodis talked about work and measures carried out to improve seed growing in the Lithuanian SSR; Ya. P. Gozitis talked about specialization of seed production in the Latvian SSR; V. F. Levshanov talked about development of the material-technical base for industrial seed growing in Gomel'skaya Oblast and S. A. Trishkin talked about the same thing in Moskovskaya Oblast. Candidate of Economic Sciences M. V. Boldyrev (NIISKh of the central regions of the Nonchernozem zone) acquainted the conferees with the scientific basis of grain crop seed production under conditions of concentration and specialization of the Nonchernozem zone. He talked about the feasibility of arranging special seed farms in zones more favorable for cultivation of one or another crops and on the optimum combination of sectors on farms which grow seeds of higher reproductions and of the need for organizational-economic justification for converting seed growing to an industrial basis.

The chief specialist of Glavsel'stroyproyekt [Main Administration for the Planning of Rural Buildings and Structures at the State Committee for Construction, USSR] of MSKh [Ministry of Agriculture] of the USSR G. S. Genkin acquainted the conferees with the main standard projects of complex stations (plants) for afterharvest treatment and storage of seeds and also with the project for treatment and storage of seeds for the Nonchernozem zone.

G. P. Zhinov gave the final talk. He talked about completing organization of variety- and seed-growing associations in all the union republics (except the Moldavian SSR), review and confirmation of the network of scientific research institutions and academic-experimental farms of vuzes and technical schools on production and organization of seeds of elite and first reproduction, development of a network of specialized seed-growing farms for cultivation of seeds for production plantings on kolkhozes and sovkhoses and procurement of them for state resources and measures implemented to strengthen the material and technical base of seed growing. He also turned attention toward the appreciable expansion of plantings of regionalized varieties in the zone as a result of improving seed-growing work.

Talking about deficiencies in seed growing, G. P. Zhinov pointed out the need to create insurance and transient seed stocks for all grain crops, strict fulfillment of production plans for elite and first reproduction seeds, improving the seed growing of a number of crops, specifically winter rye,

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buckwheat, peas, vetch, lupine and other grain-legume crops and also to expand specialization and refinement with regard to the structure of planting plots and crop rotation and to create the necessary conditions (to provide equipment, fertilizers, chemicals and so on) for more efficient operation of special seed farms.

The present meeting of seed growers to exchange work experience under new conditions will contribute to further improvement of seed growing according to the decisions of the party and government on the question.
[465-6521]

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MECHANIZING THE GATHERING OF SELECTION SEED SAMPLES

Moscow SELEKTSIYA I SEMENOVODSTVO in Russian No 3, 1979 pp 59-60

[Article by P. M. Zaika, doctor of technical sciences, A. V. Bogomolov, engineer, and Yu. V. Musiyenko, candidate of agricultural sciences]

[Text] To accelerate the gathering of selection samples, we used a vibrating seed-cleaning machine (Figure 1). Its working member is an unperforated friction surface 500 mm long and 350 mm wide, covered by a waterproof polished abrasive cloth on fabric with grain mark of 14 A. The working member is installed in the longitudinal direction at an angle of 10° and in the transverse direction at an angle of 2°. The longitudinal angle of the surface slope, like the transverse angle, is regulated by special mechanisms (9 and 3). The working surface is attached by them to a vibrating table which is installed on elastic suspension springs symmetrically arranged on the support plate of the frame. The feed device is attached to the vibrating part of the machine to prevent dome formation of the seeds. An unbalancing vibrator, mounted so that the line of action of the disturbing forces makes an acute angle with the direction of increase of the surface lift, is attached to the working surface. Fourteen hoppers are used to gather the separation products. The technological process of machine operation (Figure 2) is as follows. The mixture of nutrient is fed to the working surface due to the effect of directional vibrations. The components of the oscillation amplitude are 1.2 mm horizontal and 1.0 mm vertical; the oscillation frequency of the working member is 200 rad/s. The components of the mixture are moved in different trajectories and are separated as a function of the physicomachanical properties. Thus, seeds having high flexibility and lesser coefficient of instantaneous impact friction and more rounded shape than pieces of stalks are rolled along trajectories 11 into the different separation hoppers I-VI; pieces of stalks are moved along trajectories 12 and are fed to hoppers IX-XIV. The intermediate fraction which requires manual preseparation is moved along trajectory 13 and is gathered in hoppers VII and VIII. The mixture is fed so that there is one-layer motion of its components on the working member.

The initial material in our experiments were for artificially compiled mixtures of seeds and stalks of single-seed Yaltushkovskaya and polyhybrid Belotserkovskiy varieties of the 1976 harvest. They were taken so as to

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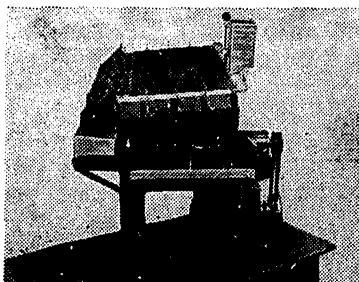


Figure 1. Vibrating Seed-Cleaning Machine

have a wide range of sampling. The seeds of single-seed Yaltushkovskaya were contaminated with stalks up to 7.5 and 3.75 percent by mass or 1 kg of the mixture had 12,000 and 6,000 stalks, respectively. The seeds of the Belotserkovskiy polyhybrid were also contaminated, but the stalks were larger and therefore 1 kg of mixture had 9,000 and 4,500 pieces, respectively. Comparatively small stalks were taken to compile the artificial mixtures. The mass of 1,000 stalks was equal to 1.25 grams for seeds of 1-seeded Yaltushkovskaya and the mass of 1,000 pieces was equal to 1.67 grams for Belotserkovskiy polyhybrid. The mass of the seeds separated on the table comprised 200 grams. Ten experiments each were conducted for each mixture. The delivery of seeds to the working surface was varied in this case. The total separation time of the sample, the machine productivity and the process of seed separation were determined by calculation with regard to the time for manual preseparation and the coefficient for increasing productivity during machine separation.

A total of 115 and 105 min, respectively, was required for manual separation of the samples of 1-seeded Yaltushkovskaya seeds with stalk contamination of 12,000 and 6,000 pieces/kg and 96 and 76 min was required for Belotserkovskiy polyhybrid with stalk contamination of 9,000 and 4,500 pieces/kg.

The experiments showed that the minimum total time for separation of the seed sample of 1-seeded Yaltushkovskaya with stalk contamination up to 12,000 and 6,000 pieces/kg of the mixture comprised 22 and 19 min, respectively, on the vibrating seed-cleaning machine; the time required was 15 and 14 min for seeds of Belotserkovskiy polyhybrid with stalk contamination up to 9,000 and 4,500 units/kg of the mixture.

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THE RESPONSE OF WINTER WHEAT VARIETIES TO TUR PREPARATION

Moscow SELEKTSIYA I SEMENOVODSTVO in Russian No 3, 1979 pp 33-35

[Article by V. N. Garmashov, doctor of agricultural sciences]

[Text] Three variants of field experiments with Kavkaz, Odesskaya 51 and Priboy varieties were organized in 1974-1976 at the All-Union Selection-Genetic Institute to determine this problem. The seeds were treated with the tur preparation prior to sowing, the plantings were treated at the beginning of shooting and both the seeds and plantings were treated in the same way.

The plantings were sown on bare fallow and after corn for silage on southern and heavy loam chernozem with humus content of 4.5 percent in the plowed layer. The plantings were sprayed (by using a knapsack sprayer) at the rate of 4 kg/ha of dry matter of the preparation dissolved in 20 liters of water. The seeds were treated (simultaneously with semi-dry disinfection) with a 15 percent tur solution (at the rate of 4 kg of dry matter of preparation per 1 ton of seeds). The experiments were set up by the generally established method. The recorded area of the plantings was 50 m² and the repetition of the experiments was 4-fold. The crop was harvested by a Sampo-25 combine.

The observations showed that the effect of tur on the seeds varied as a function of weather conditions. With good moisture provision, the sprouts appeared 1-3 days later than in the control and field germination was reduced by 2-8 percent. Under dry conditions when sprouts (according to nonfallow precursors) appeared during the winter-spring season, germination was reduced by 15-19 percent. The plants which grew from seeds treated with tur lagged somewhat behind the control plants in growth at the beginning of vegetation during the spring season (on fallow land), but developed better by the time of harvest in winter. Their leaves were darker, wider and shorter; therefore, the plants did not spread along the ground. Varietal differences were also manifested. Kavkaz variety responded less than Odesskaya 51 and Priboy varieties to the effects of the preparation. The weight of the plants grown from seeds, treated with tur, increased by 10.2 percent for Kavkaz, 28.7 percent for Odesskaya 51 and 36.4 percent for Priboy on the average by the end of spring vegetation during 2 years. It should be noted that the Kavkaz variety changed color and shape of the leaves less than the other varieties.

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The plants became very thick during vegetation during the winter thaw period by the time of spring regrowth.

Plants grown from seeds treated with tur preparation also tolerated unfavorable overwintering conditions. Their mortality comprised 4.3 percent compared to 8.4 percent in the control during 1974-1976.

During the spring season, the plants of all the investigated varieties, especially Odesskaya 51 and Priboy, were characterized by higher growth rates compared to the control. But this difference was smoothed out during the shooting phase and all the plants were identical by the onset of heading.

Pre-planting treatment of the seeds with the preparation affected the development of the root system: the tillering node deepened due to reduction of the length of the subcrown internode and was especially strong in varieties of the steppe ecotype. Thus, the subcrown internode was shortened so much that the nodal and embryo roots were joined in plants of the Priboy variety on bare fallow; the tillering node was located 0.8 cm deeper in Kavkaz plants, 1.3 cm deeper in Odesskaya 51 and 1.8 cm deeper in Priboy. Deepening of the tillering node had a positive effect on the growth of roots, while the latter had a positive effect on formation of the underground mass. As a result, it became thicker by the end of the fall and the beginning of the spring vegetation.

The effect of tur preparation on formation of nodal roots was manifested more under conditions of good moisture provision. Thus, the difference in formation of nodal roots between control and experimental plants was less upon sowing of plantings after corn, that is, with worse moisture provision than by bare fallow on a background of $N_{80}P_{80}K_{80}$ and in the variant without fertilizer.

The experimental plants of all varieties grew more rapidly than control plants, especially Odesskaya 51 and Priboy, during the spring period, but the difference was gradually smoothed out during the shooting phase and they were all approximately identical by the onset of heading.

Tur had no positive effect on the root system under dry conditions of the fall-winter season of 1975-1976, when the sprouts appeared in spring, while the experimental plants lagged behind the control plants in the growth of above-ground mass.

The data presented in the table convincingly demonstrate the highest manifestation of the positive effect of tur during any years on plantings (with different types of treatments) located on bare fallow.

During wet years, spraying the plantings was more effective than treating the seeds, while the reverse was true during dry years. The increase of yield in the latter case was achieved by increasing the root mass.

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Grain Yield of Different Winter Wheat Varieties (qt/ha) as a Function of Methods of Treatment with Tur Preparation, Pre-cursors and Nutrient Backgrounds

Сорта (1)	Варианты опыта (2)	(3) По пару			После кукурузы, убранный на сенок					
		1975 г.	1976 г.	(6) в среднем за два года	(4) N ₀₀ P ₃₀ K ₃₀			(5) без удобрения		
					1975 г.	1976 г.	(6) в среднем за два года	1975 г.	1976 г.	(5) в среднем за два года
Кавказ (7)	Без обработки (8)	48,8	38,4	43,6	40,5	29,3	34,9	25,5	25,2	25,4
Одесская 51 (9)	То же (8)	48,7	40,6	44,7	38,0	31,0	34,5	24,9	23,3	24,1
Прибой (10)	»» (11)	48,9	41,5	45,2	39,4	31,7	35,6	25,4	25,7	25,8
Кавказ	Обработка семян (11)	50,4	40,5	45,6	42,7	28,9	35,8	25,6	21,2	23,4
Одесская 51	То же (11)	51,6	43,9	47,8	42,8	29,1	36,0	26,4	21,0	23,6
Прибой	»» (12)	51,3	44,1	47,7	43,7	30,4	37,1	26,2	23,1	24,7
Кавказ	Опрыскивание посевов (12)	49,8	38,1	44,0	42,9	29,8	36,4	25,1	24,0	24,6
Одесская 51	То же (12)	56,8	42,4	49,6	41,9	32,5	37,2	25,7	23,1	24,4
Прибой	»» (13)	56,1	43,8	50,0	42,0	34,9	38,5	26,2	25,8	26,0
Кавказ	Обработка семян и посевов (13)	50,9	40,2	45,6	42,2	30,4	36,3	25,0	25,1	25,1
Одесская 51	То же (13)	58,6	45,2	51,9	42,8	30,9	36,9	28,5	23,7	26,1
Прибой	»»	59,8	45,3	52,6	43,2	32,1	37,7	28,2	24,9	26,6
P (%) (14)		1,34	1,07		3,12	3,0		1,87	2,57	
HCF _{0,98} (т/га)		2,3	2,2		4,2	1,1		1,5	1,0	

Key:

- | | |
|------------------------------------|--------------------------------------|
| 1. Varieties | 8. Without treatment |
| 2. Variants of experiment | 9. Odesskaya 51 |
| 3. By fallow | 10. Priboy |
| 4. After corn harvested for silage | 11. Treatment of seeds |
| 5. Without fertilizer | 12. Spraying of plantings |
| 6. On the average during 2 years | 13. Treatment of seeds and plantings |
| 7. Kavkaz | |

Double treatment with the preparation (both the seeds and plantings) had no advantages over spraying. Consequently, this procedure may be used in the case when conditions have been created for timely sprouting.

Biometric analysis of the sheaf material showed that the structure of the yield is predetermined by the characteristics of the variety and by the conditions under which it was formed. The productive bushiness was increased during pre-sowing treatment of seeds in varieties of the steppe ecotype by bare fallow. The ear productivity remained unchanged in 1975, while it increased somewhat in 1976 due to an increase in the number of spikelets and grains in the ear. The yield was increased when the plantings were sprayed with tur, mainly by increasing the ear productivity (a number of grains in the ear increased with a simultaneous number of spikelets) and an increase

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of the grain mass. The elements of the yield structure varied to the least extent after corn harvested for silage on both backgrounds. The weight of the ear increased somewhat in 1975 with all methods of treatment with tur. The yield decreased due to the lesser thickness of the plant stand in 1976 with pre-planting treatment of the seeds.

The investigations permit one to conclude that tur preparation has a greater effect on increasing the grain yield in varieties of steppe ecotype than the forest-steppe ecotype. This is related not only to the higher resistance of the stem of these plants to lodging, but also to the selective capability of different varieties to the effects of the preparation. Therefore, the roterdant concentration should be changed. We achieved the highest increase of yield upon treatment of the seeds and spraying of the plantings on highly fertile plots. Pre-planting treatment of the seeds should not be done in the absence of moisture in the soil during the spring season.

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KORMOVOYE 45 MILLET

Moscow SELEKTSIYA I SEMENOVODSTVO in Russian No 3, 1979 pp 32-33

[Article by N. F. Basil'chenko, senior scientific worker of the Altay Scientific Research Institute of Agriculture and Selection of Agricultural Crops]

[Text] Kormovoye 45, a variety of millet for fodder, was derived by the method of individual sampling from a specimen of the VIR [All-Union Scientific Research Institute of Plant Growing] collection K-2473 at the Altay Scientific Research Institute of Agriculture and Selection of Agricultural Crops.

It successfully passed state trials in 1974-1976 and was regionalized in 1978 in Altayskiy Kray and Omskaya Oblast. The botanical diversity is regular. The plant is tall, the height of the stem is up to 2 meters, well leafed, has a thick root system, is capable of maintaining a large vegetative mass and is drought resistant. The panicle is branchy, slightly droopy and of medium length. The seeds are elongated, of medium size and cream-colored. The mass of 1,000 grains is 6.5 grams. The length of the vegetation period is 87-100 days, including from sprouts to ripening (cutting maturity) of 45-55 days. The variety is resistant to drought and to downy mildew. It is not inferior to foxtail millet and sudan grass by fodder advantages. One kilogram of hay contains 0.70 kg of nutrients, 94 grams of available protein, 4.1 grams of phosphorus, 6.3 grams of calcium and 19 milligrams of carotene. The green mass is well eaten by livestock.

The average yield of the green mass of Kormovoye 45 comprised 320 qt/ha and that of hay comprised 87.6 qt/ha during 1970-1973 during competitive strain testing. The yield of hay of the new variety was 30.8 qt/ha, while that of perennial grasses was only 5 qt/ha in 1974 under production conditions on the Kolkhoz imeni Mamontov of Rebrikhinskiy Rayon of Altayskiy Kray. A total of 230 qt/ha of green mass and 63 qt/ha of hay was produced on the average during 1975-1976 on the Sovkhoz Komsomol'skiy of Pavlovskiy Rayon.

The agrotechnics of the millet for fodder does not differ from that used for grain varieties. But in this case one should especially turn attention

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to the complex measures on accumulation and retention of moisture in the soil: creation of windbreak strips, snow retention, the location of cultivation should be limited by multiple disking in spring on low-weed plots and the soil should be rolled before and after sowing. Pre-sowing cultivation for sufficiently compacted soils should not be carried to a depth of more than 5-6 cm. If the spring is cold, it is best to wait a short while before sowing to give weeds an opportunity to sprout and then to destroy them.

It is better to sow this variety for hay by the solid row method using the SU-24 seed drill. The rate of application is 25-30 kg/ha. If there are weeds, it is recommended that the plantings be sprayed with 2, 4-D (ammonia salt) herbicide during the tillering phase at the rate of 0.8 kg/ha of dry matter, while it is not desirable to spray them during the other stages of development. The dose of herbicide should be reduced to 0.5 kg/ha of dry matter in case of severe weeds.

Harvest for green mass and hay should be carried out at the beginning of blooming. Since the panicles and leaves in the hay mass comprise 45-50 percent of the yield according to analytical data, it is better to delay harvesting a little while to increase its quantity and quality.

The height of the stubble should not be below 10-15 cm for good drying of the windrows and for satisfactory operation of the harvester.

The results of our experiments during several years differing in weather conditions and also data of state, ecological and production tests indicate that the new variety should be introduced more extensively in kolkhos and sovkhos practice.

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VALUABLE VARIETIES OF MEADOW AND PASTURE GRASSES

Moscow SELEKTSIYA I SEMENOVODSTVO in Russian No 3, 1979 pp 30-32

[Article by Z. Yu. Pavlyk, candidate of technical sciences]

[Text] Eleven new varieties of meadow-pasture grasses, eight of them regionalized in 23 oblasts of the country, have been isolated and turned over for state trials as a result of joint selection-seed growing work of the Ivano-Frankovsk Pedagogical Institute imeni V. S. Stefanik and of the Ivano-Frankovsk Agricultural Experiment Station during the past few years by mass sampling from wild-growing varieties formed on natural meadows of Drogobychskiy Rayon of L'vovskaya Oblast. Five varieties are discussed below.

Karpatskaya meadow Timothy. The variety was regionalized for 1980 in Ivano-Frankovskaya Oblast for field grass sowing and meadow-pasture use for hay and grazing. It is related to the central European ecological type. The shrub is straight, rarely low-branched and brittle. The stems are round and up to 1 meter in height. Bushiness is average. Leafing is uniform -- 45-50 percent. The seeds are small and oval. The variety is medium-early for hay-pasture use. The vegetation period for grazing is 77-88 days and that for hay is 89-114 days.

The new variety is used for hay and grazing as a component of legume-cereal meadow and pasture grasses. It provides a good stand suitable for 1-2 cycles of use during the year of sowing. It is distinguished by good leaf formation, aftergrowth and resistance to trampling during grazing.

Karpatskaya is also characterized by high potential capabilities in formation of high yields and responsiveness to increased doses of nitrogen fertilizers.

The seed yield comprised 6-8 qt/ha 4-5 years running; the variety is resistant to diseases and pests and tolerates both excess moisture and temporary flooding well.

The average yield of the green mass of the variety during hay use comprised 386 qt/ha and that of hay comprised 113.5 qt/ha and it exceeded the standard

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Kalushskaya local by 116.0 and 39.5 qt/ha, respectively, during the years of testing at the Kaluga Strain-Testing Station of Ivano-Frankovskaya Oblast (1975-1978).

The high yields of the variety confirm the perennial data of its testing at Kolkhoz 50-ricchya Zhovtnya of Hadvornyanskoye Rayon of Ivano-Frankovskaya Oblast. A total of 5.6-6.2 qt/ha of seed and 35-40 qt/ha of straw was gathered here from an area of 5 hectares in 1978. The average yield of the green mass of a grass mixture with spiked Dakota vetch during pasture use with the 3-4 cycles of grazing was 426-qt/ha, including that of a new variety of Timothy --284 qt/ha.

In Timothy production, Karpatskaya should be sown for hay with red or pink clover, alfalfa and sainfoin; for pastures it should be sown with spiked Dakota vetch and white clover.

Predgornyy 1 multiyield rye grass is related to the central European ecological type. The bush is low branching and brittle. The stems are round and 100-120 cm with medium coarseness. Leafing is uniform and good. The leaves are soft. The root system is well developed.

Predgornyy 1 is characterized by high fodder and seed productivity. The yield of green mass in clean sowing comprised an average of 583 qt/ha during 1973-1976 testing at the Ivano-Frankovsk Agricultural Experiment Station, and yielded 609 qt/ha mixed with winter rape and 600 qt/ha mixed with winter rye. The yield of seeds is 8-12 qt/ha. It exceeds the standard Mar'inskaya 23 in regrowth intensity after grazing or mowing. It grows up rapidly in the spring and after mowings. The yield of seed is 8-12 qt/ha. It produces 7-8 aftergrowths suitable for grazing during the pasture season. It easily tolerates soil packing and trampling; it is resistant to cold and drought.

It is recommended that the new variety be used for accelerated regrassing and for improvement of natural fodder lands. It is a valuable component for green silage and intermediate and afterharvest winter sowings. It also deserves important attention as a repair plant for sowing on sparse plots of perennial grasses, especially red clover.

Predgornyy 1 was regionalized in 1978 for hay use in Ivano-Frankovskaya Oblast.

Tall Karpatskiy 1 rye grass was regionalized in 1978 in Ivano-Frankovskaya Oblast for hay use. It is related to the central European ecological type. The bush is branchy and brittle. The stems are round, of medium coarseness, green and with height of 160-170 cm. Bushiness is strong. Leafing is uniform. The leaves are soft and without a waxy coating. The bloom is a lax panicle 20-25 cm long and barbate. The seeds are lanceolate, light green, 8-9 mm long and 1.3-1.5 mm wide. The root system is dense.

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It is related to the group of early ripening varieties of hay-pasture type by the length of the vegetation period. It matures 6-14 days earlier than the standard Pridesnyanskiy and 5-10 days earlier than the local population of rye grass, which makes it possible to develop and efficiently utilize early mowings. It is distinguished by rapid development, multicutting, fast ripening, high yield, resistance to grazing and trampling and also by winter and drought resistance. It gives a good stand even during the year of sowing. With abundant fertilization, one can produce 3-4 cuttings of good quality hay. It regrows rapidly during all cycles of use.

Hay of this variety in high-quality grass mixtures is eaten well by livestock; its green mass, both in the cut form and in pasture, make good fodder. Karpatskiy 1 has high capability of forming sprouts. It is a desirable component in field and fodder crop rotations, in development of cultivated pastures and also in regrassing and improvement of mountain meadows and pastures. The new variety is also distinguished by high seed and fodder productivity. It exceeded the standard Pridesnyanskiy in hay usage (during hay usage) by an average of 16 qt by yield of green mass (281 qt/ha) and by 10.5 qt by yield of hay (69.5 qt/ha) during 1974-1976 at the Kaluga Strain Testing Station of Ivano-Frankovskaya Oblast. As the best adapted to local conditions, Karpatskiy 1 variant began to be introduced into agricultural production as early as 1973 in the Pre-Carpathian area and the Carpathian mountains of Ivano-Frankovskaya Oblast. An average of 5-6 qt of seeds, 25-35 qt of straw and 50-60 qt of hay was produced from 5 hectares during 1977-1978 on the Kolkhoz 50-ricchya Zhovtnya of Nadvoryanskiy Rayon.

Stanislavskaya 1 mixed orchard grass was regionalized in 1979 in Ivano-Frankovskaya Oblast and for 1980 in the Transcarpathian oblasts for hay and pasture usage. It is related to the central European ecological type. The bush is low-branched, brittle and straight. The stems are round, of medium coarseness, with height of 120-125 cm. The bushiness is strong (29-38 stems per bush), leafing is good and the leaves are soft. The bloom is a 1-sided branched panicle, lax and awnless. The seeds are elongated, oblate and 5-6 mm long. The root system is thick. This variety is less demanding of the soil than other varieties, grows satisfactorily on soils poor in humus and with low moisture reserve; it is drought resistant, shade-tolerating and more resistant to lodging, diseases and pests than the standard Chernigovskaya.

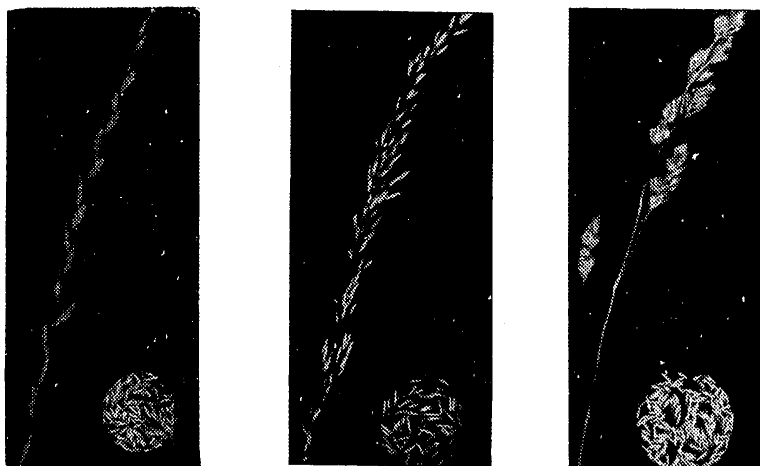
Stanislavskaya 1 not only has high fodder but also seed productivity. It develops early in the spring and rapidly regrows after grazing or mowing in all cycles of use. It is distinguished by high aftergrowth and by rapid development. It produces a good stand suitable for 2-3 cycles of use even during the year of sowing. It assimilates nitrogen well. With abundant fertilization, it produces 3-4 cuttings of good quality hay -- 80-120 qt/ha. In 1978 the yield of seeds from the first cutting comprised 7.4-84. qt/ha, 2-3 times higher than that of other varieties.

The hay of the new variety is of high quality and is eaten well by different livestock.

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When developing pastures, it is recommended that mixed Stanislavskaya 1 orchard grass be sown with white clover or spike Dakota vetch and for haying, it is recommended that it be sown with alfalfa or red or pink clover.

The yield of green mass of Stanislavskaya 1 during hay use comprised an average of 288 qt/ha and the yield of hay comprised 65.5 qt/ha, i.e., higher than the standard Chernigovskaya by 53.0 and 10.7 qt/ha, respectively, during the years of testing (1974-1977) at the Kaluga Strain-Testing Station of Ivano-Frankovskaya Oblast; the yield of grain mass was 405 qt/ha, 74 qt/ha higher than that of the standard during pasture use.



Plants and Seeds of Perennial Grasses: left -- multiyield rye grass of Predgorniy 1 variety; center -- tall rye grass of Karpatskiy variety; right -- mixed orchard grass of Stanislavskaya 1 variety

Dnestrovskiy meadow foxtail was regionalized for 1980 for hay and pasture use in Ivano-Frankovskaya Oblast.

This variety is related to the central European ecological type. The bush is straight, brittle and low-branched. The stems are round, of medium coarseness and with height of 115-120 cm. Bushiness is medium. Leafing is high

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(70-76 percent). The bloom is a false ear, cylindrical, compact and awnless with length of 5-7 cm. The seeds are average size, oblate and egg-shaped. The root system is strongly developed.

Dnestrovskiy is related by length of vegetation period to the group of early ripening varieties of hay-pasture use. It is distinguished by good adaptability to soil-climatic conditions of the Pre-Carpathian area and the Carpathian mountains.

It regrows earlier in spring than other varieties, develops very rapidly and produces highly nutritious fodder during the first grazing cycle, which is of important significance in development of early pastures and efficient use of them. It is related by blooming and maturation to the earlier grasses, but blooms and matures for a long time and irregularly and part of the seeds is always resown, which contributes to propagation and retention of it in the stand. It forms a large number of radicle leaves and vegetative shoots. Its green mass consists primarily of leaves.

The plant is moisture-loving and tolerates long flooding well, but suffers severely from drought and heat. The variety is resistant to winter frosts and is shade-tolerant. It grows well in loamy, clay soils and on drained peat bogs. It develops excellently on soils with close deposition of ground waters.

The variety is rapidly growing, multicutting, durable, fast ripening and resistant during grazing and trampling. Its green mass and hay are eaten excellently by all livestock. According to data of the State Committee, the variety yields two cuttings per summer during hay usage.

It is characterized by high fodder and satisfactory seed production. It is responsive to application of nitrogen fertilizers and is resistant to diseases and pests.

The yield of grain mass during pasture use comprised 232 qt/ha and the yield of hay comprised 64.8 qt/ha during the years of testing at the Kaluga Strain-Testing Station of Ivano-Frankovskaya Oblast (1976-1978) and it exceeded the standard (Serebristyy variety) by 27 and 8.4 qt/ha, respectively; the yield of Dnestrovskiy was 208 and 56.2 qt/ha, respectively, during hay usage, which is 47 and 13 qt/ha higher than that of the standard. The yield of seeds was 1.5-2 qt/ha, that of straw was 25-30 qt/ha and that of hay was 35-40 qt/ha from an area of 2 ha on the Kolkhoz Ukraina of Kalushskiy Rayon of Ivano-Frankovskaya Oblast in 1978.

The new variety of orchard grass should be planted in a mixture with white clover or spiked Dakota vetch for pastures and in a mixture with pink clover for hay.

[465-6521]

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SELECTION OF MILLET FOR QUALITY

Moscow SELEKTSIYA I SEMENOVODSTVO in Russian No 3, 1979 pp 27-28.

[Article by V. N. Komarov, candidate of biological sciences, and A. T. Sergeeva, candidate of agricultural sciences]

[Text] The All-Union Institute of Plant Breeding imeni N. I. Vavilov now has more than 8,000 varieties of millet collected from all the main millet-growing regions of our and other countries.

In 1968 the entire collection was sown at the Ustimovskaya Experiment Station of VIR [All-Union Scientific Research Institute of Plant Growing] (Poltavskaya Oblast). A large number of varieties was isolated by a number of morphological, biological and economically valuable features and technological properties as a result of this study. Detailed characteristics of them are given in the reference catalogs of VIR, published in 1975.

However, the problem of developing varieties which combine high yield with individual technological and consumer properties of the grain has not yet been solved.

The results of a 3-year study of the technological properties of 200 low-film varieties cultivated at the Ustimovskaya Experiment Station in 1968, 1972 and 1975, are outlined in this article compared to the best regionalized variety Veselopodolyanskoye 38.

Weather conditions during the years of conducting the experiments were unfavorable for growth and development of millet and less precipitation than the mean perennial value fell. The year 1975 was especially dry and hot: 53 days during the vegetation period had relative air humidity below 30 percent, whereas the vegetation period of specimens under 1979 conditions comprised approximately the same -- 50-65 days. As a result, most specimens produced a very low grain yield.

The most favorable conditions for high productivity and formation of good technological properties of grain were present in 1968, which made it possible to more fully characterize the potential capabilities of the varieties.

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Conducted analyses revealed significant diversity of varieties in filminess, uniformity and groats formation. The highest yield of the latter (80.2 percent on the average) was produced due to reduction of grain filminess. It comprised an average of 76 percent in 1975 due to the extremely unfavorable weather conditions. It should be noted that the grain was very severely affected by bac teriosis during this year, which sharply reduced the yield and especially the quality and groats formation. The infected nuclei were brittle and disintegrated upon hulling; therefore, the varieties had a very low yield of grain and high yield of flour and crushed grain.

However, we isolated varieties which provided high indicators in groats formation (≥ 81.0 percent) and exceeded the standard Veselopodolyanskoye 38 by 5-9 percent during 3 years (see Table).

Best Local Varieties of Millet from VIR Collection on Groats Formation

№ по кат. геног. ВНР	(2) Происхождение сортов	(3) Агроэкологиче- ские группы	(4) Выход крупы (%)				(6) Цвет крупы
			1968 г.	1972 г.	1975 г.	в среднем за три года (5)	
8401	Брестская область (7)	Северная (8)	87,8	85,6	84,8	86,0	Желтый (9)
8411	Львовская область (10)	Северная	83,0	86,2	82,0	83,7	Ярко-желтый (11)
2691	Курская область (12)	Лесостепная (13)	84,5	83,0	81,6	83,0	Ярко-желтый
7343	Астраханская область (15)	Передне-азиатская	81,6	81,6	84,1	82,8	Светло-желтый (14)
9201	Северо-Восточный Китай (16)	Восточно-азиатская	83,0	83,6	82,0	82,8	Светло-желтый
764	Могилевская область (17)	Северная	86,4	81,2	80,6	82,7	Светло-желтый
8413	Волинская область (18)	Лесостепная	81,0	83,6	83,0	82,5	Ярко-желтый
770	Гомельская область (19)	Лесостепная	82,8	82,8	80,4	82,0	Ярко-желтый
8433	Брестская область	Лесостепная	81,0	81,8	82,5	81,7	Ярко-желтый
8565	Узбекская ССР (20)	Среднеазиатская низинная (21)	84,2	81,0	79,2	81,4	Светложелтый
8645	Веселоподольское 38 (стандарт) (22)	Лесостепная	78,0	78,0	77,0	77,6	Желтый

Key:

- | | |
|------------------------------|---------------------------------------|
| 1. Number by VIR catalog | 12. Kurskaya Oblast |
| 2. Origin of varieties | 13. Forest-Steppe |
| 3. Agro-ecological groups | 14. Light yellow |
| 4. Yield of groats (percent) | 15. Northeastern China |
| 5. Average for 3 years | 16. East Asian |
| 6. Color of groats | 17. Mogilevskaya Oblast |
| 7. Brestskaya Oblast | 18. Volynskaya Oblast |
| 8. Northern | 19. Gomel'skaya Oblast |
| 9. Yellow | 20. Uzbek SSR |
| 10. L'vovskaya Oblast | 21. Central Asian lowland |
| 11. Bright yellow | 22. Veselopodolyanskoye 38 (Standard) |

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It must be noted that the determined varieties with high groats yield have insufficient grain size and produce a lower yield compared to the standard; therefore, they require additional selection development. They can be used only in synthetic selection for crossing with regionalized varieties, more adapted to local conditions and high-yielding.

Varieties isolated by a complex of technological features compared to the standard are of greatest interest for derivation of large-grain varieties. These are K-2843, K-2865, K-3768, K-3891, K-7297, K-7327 and K-8647 (the steppe Kazakhstan ecological-geographical group); K-7937 (steppe Volga group); and K-8181 (pre-Tyan'-Shan'). They exceeded the standard by 2-3 percent on the average in groats yield during 3 years.

Varieties which also produce high yields compared to the standard, along with a complex of high technological properties of grain, are also of great interest. They include K-2908 (Sayan-Altay ecological-geographical group); K-262, K-823, K-8857 and K-9359 (Ukraine steppe group); K-2867 (forest-steppe); and K-225, K-1703, K-2843, K-8566 and K-9363 (Kazakhstan steppe group).
[465-6521]

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WINTER WHEAT SPECIMENS VALUABLE IN A NUMBER OF FEATURES

Moscow SELEKTSIYA I SEMENOVODSTVO in Russian No. 3, 1979 pp 26-27

[Article by V. A. Karavaytsev, agronomist]

[Text] Winter wheat has become widely distributed during the past few years in the Volga area. However, winter-resistant varieties are necessary for this zone where the winters are severe. In this regard, evaluation of 200 specimens of winter wheat from the collection of VIR [All-Union Scientific Research Institute of Plant Growing], conducted during 1974-1976 in Kubyshvskaya Oblast (on unirrigated land) may be of interest to selection specialists. The sowing was carried out on bare fallow during the optimum period (20-30 August) at the rate of 500 grains per 1 m². The standard (Mironovskaya 808) was distributed every 10 numbers.

The necessary phenological observations and recordkeeping were carried out during the vegetation period according to the VIR method (1967). Meteorological conditions during the investigations were varied. The most severe was the winter of 1973-1974: the mean monthly air temperature in January was 2 times below normal and on some days it dropped to -30 to -40° in January and February, while it decreased to critical temperature at the depth of deposition of the tillering node. The snow cover did not exceed 15-20 cm. All this led to significant dying of the plants and sparse stand of the plantings.

A severe drought was observed during the spring-summer season of 1975. Varietal specimens of the USSR, Canada, the United States and some Scandinavian countries were the best in winter resistance under such varied conditions (Table 1).

Ul'yanovka, Al'bidum 114, Al'bidum 11, Velyutinum 97, Triticale 201 and Triticale 206 tolerated the winter more stably compared to the standard and plants of varieties Veselopodolyanskaya 499, Volna, Kalininskaya 11, Succula, Sideten, Purdus, Rego and Caddo survived less well. The experiments showed

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Table 1. Most Winter-Resistant Varieties of Winter Wheat (Average Data During 1974-1976)

(1) № каталога ВМР	(2) Название сортов	(3) Проис- хождение	(4) Перезимовка по растениям (%)	(5) Масса зерна с 1 м ²
	(6)	СССР (7)	74	680
43 920	Лютесценс 39	»	85	677
(8)	Мироновская 808	»	84	679
46 732	Альбидум 10	»	83	624
46 731	Альбидум 11	»	87	615
(9)	Тритикале 201	»	91	696
(10)	» 206	»	94	705
44 338	Волна (11)	»	70	640
41 147	Веселоподолян- ская 499	»	70	650
46 957	Камышинская (12)	»	69	650
(13)	Велютинум 97	»	86	610
(14)	Альбидум 554	»	85	615
(15)	Велютинум 485	»	84	620
(6)	Лютесценс 492	»	85	615
42 703	Szulona (15)	Польша	85	680
42 663	Bagadan 50	Румыния	67	650
42 668	Bagadan 34 (16)	»	66	650
42 665	Вака	Финляндия	68	640
19 311	Succula (17)	»	67	630
41 903	Badosinska	Чехосло- вакия	70	600
40 573	Sideten (18)	»	70	620
44 423	Purdus	»	68	630
44 425	Columbia	»	81	650
44 398	Rego	»	70	600
45 313	Caddo	»	72	640
44 397	Monon	»	82	600
45 079	Apache	»	74	640

Key:

- | | |
|---|-------------------------|
| 1. Number of VIR catalog | 10. Triticale |
| 2. Name of varieties | 11. Volna |
| 3. Origin | 12. Veselopodolyanskaya |
| 4. Overwintering plants (percent) | 13. Kamyshinskaya |
| 5. Grain mass from 1 m ² (grams) | 14. Velyutinum |
| 6. Lyutestsens | 15. Poland |
| 7. USSR | 16. Rumania |
| 8. Mironovskaya | 17. Finland |
| 9. Al'bidum | 18. Czechoslovakia |

that the resistance of the plants to low temperatures decreases with an increase of water content in the tillering nodes.

The most typical for Kuybyshevskaya Oblast is drought during the first half of the summer. During these years the yield of early grain crops drops catastrophically. However, there are frequent cases of a decrease of yield due to sukhoveys and premature drying during the phase of grain ripening. Some varieties survive the drought due to rapid maturation while others, on the other hand, slow their growth and development, while still others have a well-developed root system and high water-retention capability which serves as protection. Drought is most dangerous to winter wheat during the early spring season prior to tillering and during the heading and grain forming phase.

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Table 2. Resistance of Winter Wheat Varieties to Drought During 1976

(1) Название сортов	(2) Вегетаци- онный пе- риод (дн.)	Засухо(3) устойчи- вость (балл)
Мироновская 808 (4)	298	4
Альбидум 11 (5)	293	5
Альбидум 114	295	5
Мироновская 10	295	5
Sfuloma	300	5
Тритикале 206 (6)	292	5
Тритикале 201	290	5
Волна (7)	290	4
Веселоподольская 499 (8)	295	4
Калининская 11 (9)	290	5
Вакка	310	5
Sideten	314	4
Columbia	316	4
Моноч (10)	314	3
Арасче	317	4
Лютесценс 39 (11)	293	4

Key:

- | | |
|-------------------------------|------------------------|
| 1. Varieties | 7. Volna |
| 2. Vegetation period (days) | 8. Veselopodolyanskaya |
| 3. Drought resistance (units) | 9. Kalininskaya |
| 4. Mironovskaya | 10. Monon |
| 5. Al'bidum | 11. Lyutestsens |
| 6. Triticale | |

The characteristics of the drought resistance of some varieties by the degree of leaf drying are presented in Table 2. The evaluation was made during the tillering phase by a five-unit scale. Each unit corresponds to 20 percent of the area of the assimilating surface of the leaf plate. The United States varieties were distinguished by reduced drought resistance.

Al'bidum 114, Mironovskaya 10, Sfuloma and Bakka varieties were isolated by intensity of dry matter accumulation in the grain and domestic varieties which were not inferior to the standard (Mironovskaya 808) and in the size of yield per plant by early ripening. The use and selection will contribute to derivation of varieties with short vegetation period which are stable to soil and atmospheric drought.

The efforts of selection specialists are now directed toward deriving short-stemmed varieties of wheat 70-80 cm high which have complex resistance to diseases and high yield. Specimens of Succula, Sfuloma and Butler have received high marks in resistance to lodging and Mironovskaya 808, Mironovskaya 10, Triticale 201 and Triticale 206 and Priyekul'skaya 481 among domestic varieties have received high marks (Table 3).

The resistance of the plants to lodging also depends on the thickness of the internodes. Varieties which have a tendency to lodging usually have the second lower internode smaller in diameter compared to varieties resistant

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Table 3. Resistance of Winter Wheat Varieties to Lodging (Average Data for 1974-1976)

(1) Название сорта	(2) Высота растения (см)	(3) Устойчи- вость к полега- нию (балл)
Мироновская 808 (4)	122	5
Альбидум 11 (5)	66	3
Альбидум 114	68	4
Sfuloma	102	5
Мироновская 10	103	5
	72	5
Тритикале 206 (6)	70	5
Волна (7)	68	4
Веселоподольская 499 (8)	74	4
Вакка	96	4
Sideten	99	4
Монон (9)	87	4
Арасче	89	4
Saddo (10)	91	4
Бутлер (11)	77	5
Суккула (11)	102	5
Прикульская 4 (12)	75	5

Key:

- | | |
|----------------------------------|------------------------|
| 1. Name of varieties | 7. Volna |
| 2. Height of plants (cm) | 8. Veselopodolyanskaya |
| 3. Resistance to lodging (units) | 9. Monon |
| 4. Mironovskaya | 10. Butler |
| 5. Al'bidum | 11. Succula |
| 6. Triticale | 12. Priyekul'skaya |

to lodging. For example, Sfuloma variety had a stem length of 96 cm, diameter of second internode of 4.2 mm and resistance to lodging of 5 units; Mironovskaya 10 had figures of 38, 4.1 and 5, respectively; Triticale 201 had figures of 58, 4 and 5; Triticale 206 had figures of 56, 4.2 and 5, Bakka had figures of 71, 3.7 and 4; Sideten had figures of 74, 3.5 and 4 and Monon had figures of 82, 3.4 and 4.

It is noted that varieties resistant to lodging have well-developed root system, larger secondary radicles for each productive shoot and larger root diameter compared to non-resistant varieties. It is important to take all this into account when selecting initial material for derivation of varieties which do not lodge under rich soil conditions or on irrigated lands. [465-6521]

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HIGH QUALITY WINTER RYE SPECIMENS

Moscow SELEKTSIYA I SEMENOVODSTVO in Russian No 3, 1979 pp 24-25

[Article by V. D. Kobylyanskiy, doctor of biological sciences, Z. V. Chemleva, candidate of biological sciences, and A. N. Rakitina, candidate of agricultural sciences, All-Union Scientific Research Institute of Plant Growing]

[Text] The quality of rye grain should be considered primarily in two aspects: by the nutrient value and technological properties in which the baking properties play the main role.

The protein and essential amino acid content in the grain is the most important indicator of its nutritional value.

Study of a collection of rye carried out during the past few years in Leningradskaya Oblast showed a significant diversity of varieties, forms and species in protein and essential amino acid content. Initial material was determined for selection, characterized by high protein content (14 percent or more) during cultivation under different conditions.

Mestnaya K-9514 from Yugoslavia, containing 14.5 percent protein and 3.69 percent lysine, Balbo from the United States, containing 14.4 and 3.47 percent, respectively, Explorer from Canada, containing 14.4 and 3.45 percent, Tiszakozi Feher from Hungary, containing 14.4 and 3.55 percent, and Manychskaya from the USSR, containing 14.7 and 3.09 percent, are of special interest among them for selection.

Specimens which combine high grain quality with large size are of special significance among high-lysine varieties. The mass of 1,000 grains among the best of them comprises 35-41 grams, which has a positive effect on the increase of yield.

Some wild species are characterized by very high protein and lysine content in the grain. Thus, specimens of annual rye (*S. silvestre*) K-10054 contain 23.4 percent protein and 4.8 percent lysine, specimens of K-10362 contain

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High-Lysine Varieties of Rye

Сорт (1)	(2) Происхождение	Масса 1000 зерен (г) (3)	(4) Содержание белка % (№х5,7)	(5) Количество лизина	
				г/100 зерна (6)	% к белку (7)
Marlehofer	Австрия (8)	38,2	10,3	0,431	4,19
Wieselburger	То же (8)	41,4	10,2	0,427	4,20
Zungauer Tauern	» »	31,8	10,1	0,410	4,07
Fleischmanns	Венгрия (9)	31,0	10,9	0,464	4,27
Lovaszpatonal	То же	36,0	11,3	0,464	4,11
Kisvardai	» » (9)	41,0	10,8	0,461	4,28
Местная (10)	» »	35,7	10,6	0,437	4,13
Nagysenki	Италия (11)	24,9	11,2	0,462	4,12
Местная, K-5223	Италия (11)	18,8	10,0	0,434	4,34
Бурятская (12)	Бурятская АССР (13)	28,6	10,0	0,423	4,23
Фаленская (14)	Кировская область (15)	36,8	10,5	0,428	4,07
(16) Гибридная 2	Московская область	31,3	11,1	0,446	4,03
Волжанка (18)	Саратовская область (19)				

Key:

- | | |
|--|-------------------------|
| 1. Variety | 10. Mestnaya, K-5223 |
| 2. Origin | 11. Italy |
| 3. Mass of 100 grains (grams) | 12. Buryatskaya |
| 4. Protein content, percent
(No. X 5.7) | 13. Buryatskaya ASSR |
| 5. Amount of lysine | 14. Falenskaya |
| 6. Grams per 100 grams of grain | 15. Kirovskaya Oblast |
| 7. Percent of protein | 16. Hybrid 2 |
| 8. Austria | 17. Moskovskaya Oblast |
| 9. Hungary | 18. Volzhanka |
| | 19. Saratovskaya Oblast |

24 and 4.8 percent, respectively, and specimens of perennial rye (*S. montanum*) K-9669 contain 21.2 and 4.7 percent, those of K-10361 contain 24.4 and 4.1 percent and those of K-10038 contain 20.6 and 4.2 percent. However, *S. silvestre* plants are difficult to cross with cultivated rye, while the perennial wild species is rather easy to cultivate and enter up to 30 percent of hybrid seeds, yielding half viable fertile progeny.

One of the main features which characterize the high baking properties of grain is its resistance to shooting in the ear (in the root). This is especially important for varieties cultivated in the northern part of the Nonchernozem zone of the country, where rain frequently falls during ripening and harvesting.

The activity of its proteolytic and especially of aminolytic enzymes which break down protein and starch increases upon sprouting of the grain. The Swedish variety Otello, which our selection specialists use extensively, is unexcelled in this feature among the cultivated regionalized domestic and foreign varieties. However, it poorly tolerates unfavorable overwintering conditions -- it dies and perishes.

Technological analysis of an assortment from Siberia and Kazakhstan made it possible to determine a number of old varieties not presently cultivated which have high resistance to sprouting of the grain in the head and high

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baking properties, along with winter resistance: K-8181 (Yakutskaya ASSR) -- 250-430 eam, K-8018 (Altayskiy Kray) -- 260-400 eam, K-8029 -- 225-460 eam and K-8000 (Kazakh SSR) -- 250-350 eam.

Among the gene pool, the best in resistance to shooting was two varieties of local rye -- K-10409 (Yakutskaya ASSR) and K-8016 (Kazakh SSR), which exceed the world standard -- the Otello variety -- in this indicator. According to data of P. N. Shibayev and his colleagues (NIISKh [Scientific Research Institute of Agriculture] of the central regions of the Nonchernozem zone), YeM-1, a short-stalk donor developed at VIR, received high marks in resistance to shooting and baking properties. Upon cultivation in Moskovskaya Oblast in 1975, the height of the amylogram of YeM-1 comprised more than 1,000 eam, whereas that of Otello was only 640 eam. Thus, even in 1973, which was an unfavorable year according to weather conditions, only grain of variety YeM-1 yielded good quality flour. Thus, this variety serves as a donor not only of short stems, but also of the feature of sprouting of the grain in the ear. Moreover, the high technological qualities are well transferred upon hybridization. Evaluation of the first hybrids produced with participation of YeM-1 showed that the flour had viscosity by the amylograph 170-175 eam higher than that of parent varieties.

Besides cultivated rye varieties, genotypes resistant to shooting are found among wild species. The species *S. silvestre*, which is already used as initial material for selection for grain quality, may serve as a donor of resistance to this feature. According to data of V. K. Plarre (1974), the activity of the alpha-amylase of dead seeds of this species does not exceed 1.5 unit. It is known that this indicator is equal to 2.6 units in Otello variety.

It was established by investigations of some authors (A. Popov, 1941; Th. Roemer, 1939) that the feature of the grain resistance to sprouting in the ear is controlled by recessive genes. This makes it possible to select resistant forms from among hybrid populations after the second generation. The use of a provocation background considerably facilitates this task. [465-6521]

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VERNALIZATION OF WINTER CROPS IN LOW-TEMPERATURE CHAMBERS

Moscow SELEKTSIYA I SEMENOVODSTVO in Russian No 3, 1979 pp 11-12

[Article by V. N. Musich and A. K. Lyashok, candidates of biological sciences, and A. M. Chernozhybov, candidate of technical sciences, All-Union Institute of Selection and Genetics]

[Text] To accelerate the selection process, most scientific research institutions, primarily selection centers, are equipped with greenhouses, climate-control chambers and installations to accelerate cultivation of plants. Phytotron complexes are constructed in some large selection centers for winter crops.

Selection institutions having climate-control installations now produce a yield of winter wheat and barley within 60-80 days, which permits cultivation of 4-5 generations per year. However, a total of 2 and rarely 3 harvests can be obtained during the year during cultivation of winter wheat and barley, which require a rather long period of vernalization.

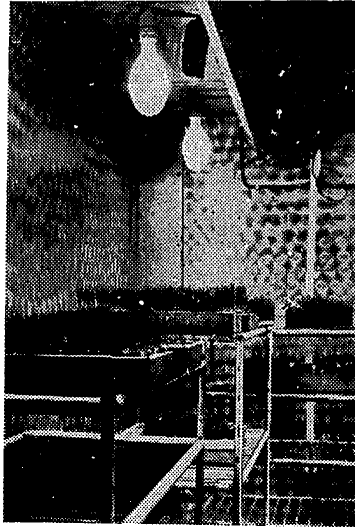
It was established that most varieties of winter wheat and barley successfully undergo vernalization processes (both in seed and in green plants) at temperatures from 1-4°C. Moreover, winter wheat plants have the capability of vernalization at temperatures of +15-20°C during short days.

The procedure of vernalization of winter seeds that have begun to shoot is the most widely used in selection practice. In some zones of our country, seeds are vernalized under natural conditions under a layer of snow, where the temperature is maintained at a level of 1-2°C.

When cultivating winter plants under artificial conditions, it is feasible to vernalize them in light during the appearance of green sprouts. This is related to the fact that vernalization processes proceed more slowly in seeds by 10-20 days and frequently by 25 days (depending on the variety). Moreover, the plants from vernalized seeds frequently head nonuniformly and rather long etiolated sprouts are produced upon vernalization of seeds that have sprouted, which makes it difficult to transplant them into the soil and frequently reduces the productivity of the plants.

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Overall View of KNT-1 Chilling Chamber, Equipped for
Vernalization of Winter Crop Plants

KNT-1 low temperature chambers designed to evaluate selection material for cold resistance are used for plant vernalization at the All-Union Selection and Genetics Institute. Serial production of chambers of this type has now been organized in our country. Equipping the chambers with 4-6 DRLF-400 lamps makes it possible to create illumination intensity of 2,500-4,500 lx at the plant level (see figure).

Seeds that have formed sprouts are sown in paper cups 1.5 cm in diameter and 5 cm high for vernalization. They are placed in boxes and are held at a temperature of 18-20°C until the appearance of the coleoptile. The boxes are then placed in the chamber alongside the walls on carriages or racks in 2 and even 3 tiers and are held at a temperature of 2-4°C.

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Effect of Length and Intensity of Illumination on Length of Vernalization of Odesskaya 16 Winter Wheat in KNT-1 Chamber

(1) Продолжительность яровизации	(2) Продолжительность освещения (ч)	(3) Интенсивность освещения (лк)	(4) Число дней от конца яровизации до выколашивания
Пять недель (5)	24	2500	75
	12	200	125
		2500	92
		200	через (8) 125 дней не выколослись
Шесть недель (6)	24	2500	75
	12	200	90
		2500	88
Семь недель (7)	24	200	115
	12	2500	83
		200	83
		2500	86
		200	88

Key:

- | | |
|--|----------------------------------|
| 1. Length of vernalization | 5. Five weeks |
| 2. Length of illumination (hr) | 6. Six weeks |
| 3. Lighting intensity (lx) | 7. Seven weeks |
| 4. Number of days from end of vernalization until shooting | 8. Did not shoot within 125 days |

It was established upon determination of the effect of the length of the photoperiod and the intensity of illumination on the length of the winter wheat vernalization process (see table) that it occurs most rapidly during 24-hr illumination at intensity of 2,500 lx.

Differences in the periods of shooting of plants are essentially smoothed out (83-88 days) in all variants when the period of vernalization is increased to 7 weeks.

It was established by investigations that winter wheat plants are most rapidly vernalized at 2-4°C and with 24-hour illumination of 2,500 lx when DRLF-400 lamps are used in chilling chambers (KNT-1).

However, the length of vernalization should be brought up to 7 weeks for more effective use of the chamber volume, which will provide simultaneous shooting of the plants located on the lower shelves of the carts or racks with lower light intensity.

The plants are usually in the phase of 2-3 leaves after completion of vernalization. To prevent yellowing, they must be dressed with Knop's solutions or ordinary mineral fertilizers weekly. The plants may be watered only with tap water during the first 2-3 weeks.

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They can be transplanted into vessels or directly into the soil by using a wooden marker whose diameter corresponds to the thickness of a pencil. This eliminates damage to the root system and provides good rooting.

It should also be noted that up to 50,000 plants can be placed in the KNT-1 chamber during vernalization of winter crops by the indicated method. An area of 500 m² is required when setting this amount in a soil greenhouse (20 X 5 cm) and an area of 250 m² is required when planting them in vegetation containers (10 plants each per container).
[465-6521]

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THE SPECIFIC COMBINATION CAPACITY OF WINTER WHEAT STRAINS

Moscow SELEKTSIYA I SEMENOVODSTVO in Russian No 3, 1979 p 8

[Article by I. M. Norik and A. I. Knysh, candidates of agricultural sciences]

[Text] The method of total diallel crossings permits one to obtain the most accurate information about general and specific combination capacity (OKS and SKS). However, it is very laborious.

During the past few years a number of authors (G. Khinkel'man, 1966; D. Fyffe and N. Gilbert, 1966; V. G. Vol'f, 1969 and others) has developed a method of incomplete diallel crossings which can be used when determining the SKS of parent forms. Its essence is in the fact that each checked line (variety) is crossed only with some varieties selected by the selection specialist according to a specific scheme, rather than with all lines and varieties. The effectiveness of incomplete diallel crossings compared to complete crossings comprises 80-90 percent with reduction of the volume of work by a factor of 3 or more (V. G. Vol'f, 1969).

The method which we proposed permits one to calculate the SKS constants of varieties and lines by comparing F_1 hybrids to the standard and by using zero evaluation instead of negative effects. This method is more dependable for determining the true extent of SKS by all the properties and features of interest to the selection specialist.

We studied the SKS by yield in 15 varieties. To do this, 30 ears were emasculated for each hybrid combination. Twenty blooms each were left in the ear. A total of 135 first-generation hybrids was produced. They were sown on plots with an area of 1 m² in twofold repetition. The length of the row was 1 m, the width between rows was 20 cm and 20 grains were sown in a row. The standard was Mironovskaya 808 variety, which was placed every 10 grains. The experimental data were processed mathematically on the Promin' 2 computer and the SKS constants were calculated. The years of conducting the experiments (1969-1971) were different by meteorological conditions. All this made it possible to differentiate varieties by the SKS effect and to distribute most of them into 3 groups: high, low and medium.

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In 1969 the Mironovskaya Yubileynaya and Zernogradskaya 5 varieties, the best hybrid of which exceeded the standard Mironovskaya 808 by 86.5 g/m², had high SKS in productivity. They also differed by high SKS in winter resistance. This, the best hybrids produced with their participation exceeded Mironovskaya 808 by 17-23 percent.

The Krupnokolosaya and Khar'kovskaya 159 varieties had medium SKS in yield. The best hybrid exceeded the standard by 10.5 g/m². An average evaluation of SKS in winter resistance was received by the Khar'kovskaya 159 variety. The best F₁ hybrids with its participation exceeded the standard by 5-6 percent.

Bezostaya 1, Ranyaya 12, Lyutestsens 145, Ivanovskaya 13, Veselopodolyanskaya 22, Dneprovskaya 521, Lyutestsens 29/114, Lyutestsens 25, Pervenka, Lyutestsens 918 and Belotserkovskaya 198 varieties yielded non-heterosis hybrids whose yield was lower (300-412 g/m²) or significantly lower (from 25-60 to 150-294 g/m²) than that of the standard. They were contained in a group with low SKS. In 1970 Krupnokolosaya, Bezostaya 1, Mironovskaya Yubileynaya, Lyutestsens 145, Zernogradskaya 5, Dneprovskaya 521, Lyutestsens 25 and Khar'kovskaya 159 varieties had high SKS. The best hybrid of Lyutestsens 145X Lyutestsens 25 in F₁ exceeded the standard by 96 g/m².

Ivanovskaya 13 and Belotserkovskaya 198 varieties had medium SKS. They exceeded Mironovskaya 808 by 56 and 52 g/m², respectively. Ranyaya 12, Veselopodolyanskaya 22, Lyutestsens 29/114, Pervenka and Lyutestsens 918 varieties yielded non-heterosis hybrids and low effects of SKS in yield during the same year with fluctuations from 339 to 419 g/m². Krupnokolosaya, Bezostaya 1, Mironovskaya Yubileynaya, Ivanovskaya 13, Zernogradskaya 5 and Khar'kovskaya 159 varieties had high SKS in yield in 1971.

The best hybrid Krupnokolosaya X Khar'kovskaya 159 in F₁ exceeded the standard by 155 g/m², the hybrid Mironovskaya Yubileynaya X Khar'kovskaya 159 exceeded it by 94 g/m², while the hybrid Ivanovskaya 13 X Khar'kovskaya 159 exceeded the standard by 89 g/m². Dneprovskaya 521 X Bezostaya 1 hybrid, which exceeded the standard by 50 g/m² in F₁, had medium SKS in yield.

Ranyaya 12, Lyutestsens 145, Veselopodolyanskaya 22, Lyutestsens 29/114, Lyutestsens 25, Pervenka, Lyutestsens 918 and Belotserkovskaya 198 varieties had low SKS. The derived data permit one to conclude that the seasons of the year significantly affect the SKS effect. Thus, a number of varieties received different evaluation by the value of SKS effects during the years of the investigations: it was low for Ivanovskaya 13 varieties in 1969, medium in 1970 and high in 1971; it was low, high and medium, respectively, for Dneprovskaya 521 varieties. Krupnokolosaya, Khar'kovskaya 159, Mironovskaya Yubileynaya, Bezostaya 1 and Zernogradskaya 5 had high SKS in yield.

[465-6521]

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ACCELERATED INTRODUCTION OF NEW VARIETIES CALLED FOR

Moscow SELEKTSIYA I SEMENOVODSTVO in Russian No 3, 1979 pp 4-6

[Report of chairman of the State Committee on Strain Testing M. A. Fedin to a meeting of the State Committee on Strain Testing of Agricultural Crops]

[Text] A meeting of the State Committee on Strain Testing of Agricultural Crops was held at the beginning of April at which the tasks of state strain testing in light of the decisions of the July and November (1978) Plenary Sessions of the CPSU Central Committee, the results of strain testing during 1978 and proposals on variations in strain regionalization for 1980 and for improving the method of strain testing to accelerate evaluation of varieties and hybrids were discussed. The chairman of the State Committee on Strain Testing M. A. Fedin gave a speech at the meeting. His report is published below in condensed form.

In his report at the 25th CPSU Congress, said M. A. Fedin, Comrade Leonid Il'ich Brezhnev, talking about the urgent problems of increasing the effectiveness of agriculture, emphasized that "one of them is development of selection and seed growing. According to the evaluation of specialists, it is good in the modern sense that organized seed growing can increase the yield by at least 20 percent. And these are additional tens of millions of tons of grain and other agricultural products."

It is good in the modern sense that organized seed growing assumes accelerated introduction of new, more valuable varieties into production, obtained by the strain testing network from the selection of experimental institutions. The process of introducing them largely depends on us strain testers, on the number of years we have expended on evaluation and selection of the best of them and also on the amount of produced seeds of promising and scarce varieties.

The inspectors of the State Committee and the strain testing stations of Moskovskaya Oblast (inspector V. V. Kaminskiy), Gor'kovskaya (K. I. Beresneva), Donetskaya (Ye. G. Kulikova), Ivano-Frankovskaya (V. I. Presich) Khmel'nitskaya (L. P. Bagach) and Karagandinskaya (V. P. Kligis) oblasts, Primorskiy (Yu. I. Fedorov) and Khabarovskiy (M. S. Zadubinnaya) krays, the Azerbaijan

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SSR (L. Karayev) and the Tadzhik SSR (Kh. M. Mirakilov) are coping with these problems well. They prepared the proposals on regionalization for 1980 from 2 or 3 years of data, which contributes to more timely introduction of new intensive type varieties into production. And the inspectors of the State Committee and the variety stations of Kirovskaya, Orenburgskaya, Dnepropetrovskaya, Kievskaya, Semipalatinskaya and Taldy-Kurganskaya oblasts, the Kalmytskaya ASSR, the Buryatskaya ASSR, Krasnoyarskiy Kray, the Armenian SSR and the Uzbek SSR expended 4-5 or more years on study of some varieties proposed for regionalization. One can say the same thing about accelerating their introduction into production! True, the fraction of these proposals on regionalization comprises approximately 12 percent, but one must try to see that they are not absent at all so that evaluation of the variety continued for more than 3 years.

An important condition for introducing new varieties onto the fields of kolkhozes and sovkhoses is production of the required amounts of seeds. This is one of the most important tasks in the activity of strain testing stations and inspecting stations of the State Committee. During the reporting year, the strain testers reproduced and transferred to the farms 1,119,800 quintals of high-quality seeds of grain and oil crops and grasses, which is 12,000 quintals more than in 1977. Unfortunately, the fraction of seeds of scarce promising varieties comprised only 34 percent in the gathered harvest. And in this regard the inspection stations of the State Committee operated differently. The fraction of scarce varieties comprised 50-80 percent at the strain testing stations of the Bashkirskaya ASSR, Tatarskaya ASSR, Gor'kovskaya, Omskaya, Sverdlovskaya, Tul'skaya, Chitinskaya, Nikolaevskaya, Cherkasskaya and Kirovogradskaya oblasts, Altayskiy kray and the Tadzhik SSR, which cultivated 10,000-30,000 quintals of seeds each, while the fraction was no more than 20 percent at the strain testing stations of Leningradskaya, Novosibirskaya, Orenburgskaya, Tyumenskaya, Rovenskaya, Khersonskaya, Kokshetavskaya, Severo-Kazakhstanskaya and Taldy-Kurganskaya oblasts, the Uzbek SSR and the Turkmen SSR.

The managers of the inspection stations and also the heads of the strain testing stations should understand that extensive popularization of new varieties in newspapers, journals and on radio and television must be reinforced by actions -- by increasing the production of first-class seeds. This is one of the main conditions for extensive introduction of the achievements of selection onto the fields of kolkhozes and sovkhoses. In this regard the initiative of the inspection station of the State Committee for Chitinskaya Oblast (inspector P. K. Lukin), which consolidated additional plots for strain testing stations for reproduction of seeds of scarce and promising varieties, which permitted a significant increase of their production, deserves extensive approval. A socialist competition must be widely organized in 1979 to increase the production of seeds of scarce and promising varieties.

The importance of accelerating the introduction of new varieties into production becomes especially understandable when one becomes familiar with their advantages.

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A number of varieties of grain crops having increased resistance to lodging and which are suitable for cultivation on rich soil and on irrigated land has passed state trials during the past few years and has been recommended for production. Thus, the variety of Chulpan rye (and as is known, this crop has more of a tendency toward lodging) did not lodge even during the extremely unfavorable weather conditions of 1978 due to a short stalk (24-52 cm shorter than that of the previously regionalized Vyatka 2 and Chishminskaya 2). Short-stalk varieties of Polukarlikovaya 49 winter wheat (stalk height of 80 cm, which is 30 cm shorter than that of Bezostaya 1) and Khersonskaya 153 winter wheat were specially regionalized for cultivation under irrigation conditions. They essentially do not lodge with formation of a yield of 75-80 qt/ha. Eritrospermum 80, Odessa semi-dwarf and other varieties of winter wheat have similar properties.

The reporter related in detail about the new varieties regionalized for 1980. According to the results of state testing during 1978 and previous years, 170 new varieties and hybrids of grain, commercial, vegetable, fodder and fruit-berry crops were proposed for the first time for different zones of our country from the suggestions of oblast, kray and republic agricultural meetings and republic committees on variety regionalization. Of them, 63 are the highest yielding and valuable grain crops by the quality of the strain and hybrid, including 11 winter wheat, 4 winter rye, 10 spring wheat, 11 spring and winter barley, 4 oats, 2 rice, 3 pea and 13 corn varieties. A total of 12 varieties is being regionalized for commercial and oil crops, 28 for potatoes and vegetable crops, 27 for fruit and berry crops and 39 for fodder crops.

The scientific research institutions have reared very valuable short-stalk winter-resistant, lodging-resistant varieties of winter wheat with potential yield of 80-90 qt/ha; Odessa semi-dwarf -- the All-Union Selection-Genetic Institute, Zaporozhskaya ostistaya -- the Zaporozha Agricultural Experimental Station, Mironovskaya 25 -- the Mironovka Scientific Research Institute of Wheat Selection and Seed Growing, Dneprovskaya 846 -- the All-Union Scientific Research Institute of Corn and others; Belorusskaya 23 winter rye with yield of 50-60 qt/ha -- selection stations of the Belorussian Scientific Research Institute of Agriculture; Donetskii 8 spring barley -- the Donetsk Agricultural Experimental Station, Zernogradskiy 73 -- the Zernograd Selection Station, resistant to lodging with increased protein content and potential yield of 60-70 qt/ha; Mironovskaya yarovaya spring wheat -- the Mironovka Scientific Research Institute of Wheat Selection and Seed Growing, Bezenchukskaya 139 -- the Kuybyshev NIISKH [Scientific Research Institute of Agriculture], Sredneural'skaya -- the Krasnoufimsk State Selection Station, Tselinnaya 21 -- the All-Union Scientific Research Institute of Grain Farming and other drought- and lodging-resistant varieties with potential yield of 40-60 qt/ha; Spal'chik rice, which has a potential yield of more than 100 qt/ha; Krasnodarskiy 362 TV, Krasnodarskiy 229, Dneprovskiy 430 T, Vizit TV and other corn hybrids capable of yielding more than 120 qt/ha on irrigated lands and 80-90 qt/ha without irrigation; Kolokol'chik tomato varieties -- the Moldavian Scientific Research Institute of Irrigated

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Agriculture and Vegetable Growing, Raketa -- the Crimean Experimental Station of VIR; turnip-like Moldavskiy onions -- the Moldavian Scientific Research Institute of Irrigated Agriculture and Vegetable Growing; Vyatka potatoes, early maturing, high yielding and relatively resistant to phytophthora -- selections of the Falenki Selection Station; medium-late nematode-resistant Kristall variety -- the Kaluga Oblast Agricultural Station, Adretta (from the German Democratic Republic) -- high yielding (up to 500 qt/ha) with increased starch content (up to 17 percent), suitable for mechanized cultivation; white Krupnokochannaya cabbage and red Sochinskaya cabbage and many others.

Strain testers, developing cooperation with colleagues of CEMA member countries, recommend high-yielding intensive type foreign varieties, including Partizanka winter wheat (Yugoslavia) and Nadya and Trumpf brewing barley (German Democratic Republic), for production. The following example indicates their capabilities: the yield of grain of the Nadya variety comprised 69.9 qt/ha from a plot of 5 ha in 1978 on Lelyay kolkhoz of Kel'messkiy Rayon of the Lithuanian SSR.

The General Secretary of the CPSU Central Committee Comrade L. I. Brezhnev, speaking on the importance of solving the fodder problem at the July (1978) Plenary Session of the CPSU Central Committee, emphasized that "there is enormous overconsumption of feed due to a protein shortage. It is planned to expand sowings during the next few years on the kolkhozes and sovkhoses and to increase harvesting of grain-legume and oil crops, alfalfa, clover and rape."

The State Committee on Strain Testing is devoting a great deal of attention to grain-legume and legume fodder crops. Three varieties of winter and spring vetch, 3 of fodder peas, 5 of fodder soybeans, 2 of fodder lupin, 2 of alfalfa, 3 of sainfoin and so on are being regionalized for 1980.

One of the main methods in solving the problem of increasing sunflower seeds is heterosis selection -- development of first-generation hybrids. The first domestic hybrid Rassvet, of the All-Union Selection-Genetic Institute, has been recognized as promising for Odesskaya Oblast. During an average of 2 years of testing, it provided an increase in oil yield by 200 kg/ha compared to the standard in Poltabskaya Oblast, by 106 kg/ha in Kirovogradskaya Oblast, by 104 kg/ha in Vinitzkaya Oblast and by 359 kg/ha in Cherkasskaya Oblast. By 1981 the hybrid should apparently be regionalized and to do this, the originator should organize production of hybrid seeds.

Rearing and regionalization of new varieties of agricultural crops made it possible to remove 92 obsolete varieties everywhere with regionalization.

The strain testers are actively introducing investigations on accelerated evaluation of varieties by setting up experiments with an expanded set of varieties of the leading grain crops and potatoes. In 1977, expanded sets of grain crops were tested at 132 strain testing stations, the number was

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increased to 208 in 1978 and moreover, 50 expanded sets of potatoes were selected for testing.

The first results were hopeful. This procedure will provide accelerated evaluation of varieties and will permit determination of the area of distribution of the best of them within a short time. The data of testing expanded sets are now being prepared for special processing by the selection index method. This method makes it possible to express productivity, the quality of the produced product, lodging-resistance, the length of the vegetation period, susceptibility to specific diseases and a number of other important indicators which reflect the economic-biological value of the variety, in unified analysis. One strain testing station for the expanded set of a specific crop or group of them was allocated to approve the new method in each administrative region (oblast or kray).

The number of experiments with expanded sets to determine the degree of their disease resistance from the first year of testing on a severe infection background is being increased annually to accelerate evaluation of new varieties. At the same time, the number of studied pathogenic agents is being expanded with regard to their prevalence in different regions of the country (powdery mildew, septoria leaf spot, downy mildew of sunflowers, stem rot of corn and others) is being expanded.

Based on the results of strain testing of the past few years with regard to some achievements in selection for immunity, we are forced to state that as a whole the number of varieties resistant to diseases and even more so to pests is extremely inadequate throughout the country.

Unfortunately, methods of sampling on an infectious background, purposeful rearing of multiline varieties with different alleles which determine the non-susceptibility to the leading races of parasites, have still not achieved the proper development in the work of most selection specialists.

Selection and seed-growing science is more and more becoming a productive force of society. Selection relies on the achievements of genetics, general and molecular biology, cybernetics, biochemistry and a number of other sciences at the modern stage. The arsenal of methods of developing new varieties and hybrids was expanded, more accelerated exchange of them is occurring and new varieties for fields with elevated fertility background, specially for irrigation, and also varieties of vegetable, fruit-berry and commercial crops suitable for mechanized cultivation and harvesting are being developed. The length of the selection process is being reduced and the number of varieties presented for state testing is being increased due to consolidation of the material-technical base and improvement of the work of selection centers.

In this regard and according to the decree of the CPSU Central Committee and the USSR Council of Ministers "On measures for further improvement of selection and seed growing of grain and oil crops and grasses" (1976), the

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State Committee jointly with the branch central boards of the Ministry of Agriculture of the USSR, Department of Plant Breeding and Selection and Plant Protection of VASKhNIL [All-Union Academy of Agricultural Sciences imeni V. I. Lenin] prepared the "Main requirements on new varieties and hybrids turned over for state testing," which was confirmed by the minister of agriculture of the USSR. They are being introduced in 1980. New "Instructions on the procedure for compilation and submitting applications for a new reared variety turned over for state testing" have also been worked out. Both these documents are directed toward increasing the requirements on new varieties.

The draft of "Regulations on state strain testing" has been prepared in which organization of a network of strain testing stations in the union republics, krays and oblasts is provided. This will make it possible to expand testing, more intensively study new varieties and more rapidly introduce them into production.

[465-6521]

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ACHIEVEMENTS AND PROSPECTS FOR DEVELOPMENT OF THEORETICAL RESEARCH

Moscow SELEKTSIYA I SEMENOVODSTVO in Russian No 3, 1979 pp 1-3

[Editorial: "Achievements and Prospects for Development of Theoretical Research"]

[Text] Important tasks on further increasing the level and effectiveness of scientific research, universal development of theoretical work, accelerated development and introduction of new highly productive varieties and hybrids into production which meet the requirements of modern agriculture were posed in the decisions of the 25th Party Congress, the July (1978) Plenary Session of the CPSU Central Committee and in the decree of the CPSU Central Committee and the USSR Council of Ministers "On measures for further increasing the effectiveness of agricultural science and of strengthening its contact with industry" (1976).

The scientists of the scientific research institutes and selection centers of the country have now concentrated their efforts on development of more than 100 of the most important scientific and technical problems, tasks and topics of state and sector themes in the field of plant breeding and selection. The leading head institutes have accomplished a number of important developments during the past few years on the genetic bases of selection, methods of intraspecies and remote hybridization, the genetic and physiological-biochemical bases of heterosis, cold and winter resistance, drought resistance, grain quality, the immunity of agricultural crops, introduction and a number of other important trends. Thus, the All-Union Selection-Genetic Institute as the head institution on the theoretical basis of selection, is conducting intensive investigations to develop a more improved technology of the selection process based on modern achievements of genetics, biochemistry, immunology, physiology, mathematics and other fundamental sciences. One of the world's largest phytotrons, artificial climate chambers and other cultivation structures with regulated temperature, soil humidity, air and lighting parameters are being used extensively for this. Investigations to develop complex-resistant varieties of wheat, barley, corn hybrids and sunflowers to a number of the most dangerous diseases have been expanded significantly on the basis of the phytotron and scientific-methodical

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developments on optimization of the cultivation conditions and selection of forms distinguished by high productivity and a complex of other valuable features and resistance to the effects of low temperatures (for winter crops) are also being accomplished on a broad front.

Special attention is being devoted in this case to working out methods of accelerated development of varieties (within 5-6 years instead of 10-12 years by the old scheme). This work is being conducted at the Krasnodar NIISKh [Scientific Research Institute of Agriculture], the Mironovka Scientific Research Institute of Wheat Selection and Seed Growing. Development of methods of accelerated multiplication of selection material, which make it possible to produce 5-6 harvests of peas, common vetch, beans, lentils and buckwheat and 3-4 harvests of lupin, fodder, beans and peas with high coefficient of seed reproduction, has been completed by using climatic chambers at the All-Union Scientific Research Institute of Grain-Legume and Groats Crops. Methods which permit production of three generations of selection material for spring wheat and other grain crops during the fall-winter period have been developed by using improved UVR [Expansion unknown] at the All-Union Scientific Research Institute of Grain Management.

The results of investigations to study the individual genetics of the quantitative features of barley and spring wheat plants have been generalized at the Ukrainian Scientific Research Institute of Plant Breeding, Selection and Genetics imeni V. Ya. Yur'yev and methods of evaluating varieties in the selection nursery and the principle of developing genetically based models of intensive type varieties have been proposed.

Investigations on remote hybridization which make it possible to develop the richest selection material, new species and forms of plants are of important practical interest. Academician N. V. Tsitsin was awarded the Lenin Prize and a second Gold Medal of Hero of Socialist Labor in 1978 for working out the theoretical bases of remote hybridization and rearing of new valuable varieties of agricultural crops.

A number of important developments of the genetic and physiological-biochemical nature of heterosis is being accomplished at the All-Union Scientific Research Institute of Plant Breeding, VSGI [All-Union Institute of Selection and Genetics], the All-Union Scientific Research Institute of Corn, VNIIMK [All-Union Scientific Research Institute of Oil-Bearing Crops], VNIS [All-Union Scientific Research Institute of Sugar Beets] and other scientific research institutions. The possibility of using DNA and the level of endopolyploidy of corn as a test to determine the complementarity of genomes of parental forms and selection of the best hybrid combinations was revealed. Scientists of VIR [All-Union Scientific Research Institute of Plant Growing] have developed methods of selecting low-stalk hybrids of rye on a sterile basis with high potential yield (80-90 qt/ha). New fixing agents of sterility in sugar beets were determined and methods of improving polyploidal single-seed varieties in productivity and fertility were worked out.

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Investigation of the physiological-genetic bases of wheat and other crop productivity has been developed. The structure and functions of the photosynthetic apparatus of modern varieties of intensive type wheat have been studied. The positive response of intensive type varieties to exposure to red light has been established at VSGI.

A number of important theoretical developments was accomplished at the All-Union Scientific Research Institute of Applied Molecular Biology and Genetics. Special attention is being devoted here to developing methods of cultivating the protoplasts of plant cells and tissues to produce somatic hybrids. As is known, this method may be of considerable assistance to selection specialists in developing intergeneric and interspecific hybrids, of producing homozygote selection material, of accelerating the selection process and reproduction of genetically unique economically-valuable forms of plants and opens up prospects for the use of parasexual hybridization of cellular selection.

The most promising trend of investigations in practical selection is now production of haploid plants from a crop of isolated anthers which utilize haploids for diploidization. The experience of the All-Union Scientific Research Institute of Rice, where rice haploids and dihaploids have been produced for the first time from the anthers of hybrid combinations, deserves a positive evaluation in this regard. Interesting forms of haploid and diploid triticale have been produced at the All-Union Selection-Genetic Institute.

A system of healing potato varieties of viral diseases, which permits one within a comparatively short time to produce virusless initial material in the necessary volume, has been developed by using the method of cell and tissue culture.

Investigations to study the characteristics of genetic control of the features of the grain quality of wheat, barley, rye and other grain crops and development of the principles of selecting pairs for hybridization and effective methods of sampling during selection have achieved extensive development. Scientists of VIR, as a result of complex biochemical, technological and molecular-genetic study of grain crops, have determined the main features of the genetic and morphogenetic structure of a number of complex features of grain quality -- protein content and composition, gluten properties and baking qualities.

The leading institutes have accomplished a number of developments on problems of cold and winter resistance. Winter crops which combine the short-stalk feature (70-90 cm) with high cold resistance, which opens up the opportunity to a known extent to overcome the negative correlation between winter-resistance and short stalk feature, have been produced from spring forms by the photothermal effect at the Mironovka Scientific Research Institute of Wheat Selection and Seed Growing. An express method of determining the cold resistance by the electrical resistance of tissues has been developed and introduced at VSGI. The biophysical characteristics of the cold resistance

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of winter wheat and the drought resistance of spring barley have been studied at the Ukrainian Scientific Research Institute of Plant Breeding, Selection and Genetics imeni V. Ya. Yur'yev. Laboratory-field methods of evaluating varieties for drought and heat resistance during different phases of plant development have been worked out.

Investigations to study the genetic bases of the disease resistance of grain and other crops have been developed during the past few years. The genetic nature of resistance has been studied in a number of wheat varieties-donors at the All-Union Selection-Genetic Institute, which made it possible to compile a hybridization program to produce varieties with a polygenic basis and complex resistance to diseases. The genes of the race-specific resistance of wheat and barley to rust, powdery mildew and head diseases have been studied for this same purpose. More than 700 variety specimens for selection for resistance have been determined as a result of many years of investigations at VIR, and approximately 150 of them are resistant to a complex of diseases. The numerical composition of the genes which control resistance to regional populations of rust and loose smut has been determined. The principle of the territorial disposition of resistance donors has been developed for individual zones on the basis of this material. Systems for evaluating the resistance of grain-legume and fodder crops to fungal and bacterial diseases have been developed. The genetic nature of the resistance of wheat to rust, of grain-legume crops to leaf blight and of tomatoes to scab was studied. Differentiation of the pathogenic agent of crown rust of oats was begun on a genetic level. Development and improvement of methods of creating infectious and provocation backgrounds were completed at the All-Union Scientific Research Institute of Grain-Legume and Groats crops. Interspecific hybrids of sunflowers resistant to the European race of downy mildew, were produced at VNIIMK. The possibility of monitoring resistance by a single dominant gene was determined. The principles of wild species of this crop inheriting resistance to complex pathogens, which can be utilized as initial forms for producing interspecific hybrids with group immunity, were established. Important investigations were conducted at the All-Union Scientific Research Institute of Cotton Selection and Seed Growing on selection of wilt-resistant varieties. Forms which combine wilt resistance with high productivity and good quality of raw cotton, which have already been widely recruited to selection development, were determined in this case.

However, the volumes and scales of selection investigations still lag behind the required level for many crops.

It is noted in the decree of the CPSU Central Committee "On the 50th anniversary of the First Five-Year Plan for development of the national economy of the USSR" that, based on a complex approach to solution of economic, scientific-technical and social problems, "the drafts of plans for the 11th Five-Year Plan and prospects up to 1990, called upon to become an important benchmark on the path of creating a communist society are now being prepared. The task now includes raising all our planning work and the content of planning itself to a qualitatively new level and of thinking out more deeply

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economic problems which give birth to life and to carry out a creative search for optimum methods of solving them with complete responsibility and initiative." These propositions must be totally utilized even when improving the planning of selection work for the future. More attention must be devoted to developing the theoretical bases of selection and optimization of the selection process, including that based on using artificial climate systems. Develop adequate mathematical models which reflect the relationship between variety productivity and the morphobiological properties and features of plants to design ideatypes in the future for the main crops. Simulation of plant selection and of the desired type of populations is planned to improve the effectiveness of selection. It is planned to study more extensively the problems related to justification and development of procedures of rational selection of parent pairs for crossing, especially of remote ecological-geographic forms, to improve the yield of positive transgressions and practically valuable recombinants.

The long-term program provides for study of the genetic and cytogenetic principles of remote hybridization to synthesize new highly productive forms and species of plants. Problems of the genetic nature and physiological-biochemical prerequisites of the heterosis effect in plants to develop methods of purposeful synthesis of highly heterosis hybrids based on TsMS [Expansion unknown], especially of sunflowers, sugar beets and vegetable crops, will achieve further development. Effective methods of selecting highly productive forms with regard to their physiological-biochemical indicators may be determined on the basis of universal study of the productivity of photosynthesis, mechanisms of respiration and formation of selection-significant features and properties during ontogenesis.

It is planned to expand investigations on the study of the physiological-genetic bases of plant resistance to a complex of unfavorable environmental factors (low temperatures, reduced humidity, high concentrations of some chemical elements and compounds) at the leading scientific research institutes. It is planned to devote special attention to development of the genetic bases for improving the resistance of the created varieties to the main diseases and pests and to intensify and expand selection programs directed toward creating highly immune varieties and hybrids of agricultural crops to the most harmful diseases and pests. It is planned to study the genetic and physiological-biochemical nature of the most important features of grain quality, which will make it possible to develop essentially new methods of creating high-yield varieties capable of forming grain with high nutrient, fodder and production advantages under conditions of intensive agriculture.

There is no doubt that the scientists of the selection centers, All-Union and branch scientific research institutes will apply all their knowledge and experience for successful development of theoretical research in the field of biology, genetics, selection and seed growing of agricultural crops and to increase the level and effectiveness of scientific research and will thus make a worthy contribution to implementation of the decisions of the 25th

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CPSU Congress and the July and November (1978) Plenary Sessions of the
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[465-6521]

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BEHAVIORAL SCIENCES

UDC: 15.07

INTERNATIONAL CONGRESS ON APPLIED PSYCHOLOGY

Moscow VESTNIK AKADEMII NAUK SSSR in Russian No 6, 1979 pp 115-116

[Excerpt from article by N. V. Tarabrina, candidate of psychological sciences]

[Excerpt] With reference to the nature of work processes, the congress participants observed that human labor cannot be reduced merely to a system of motions and operations; it has always been and remains as active and controllable behavior, which has a substantial influence of man's vital functions. Of special significance is man's system of value orientations, his ability to anticipate the nature of occurrence of processes in time.

There was also discussion of problems related to psychological aspects of increasing the reliability of "man-machine" systems under conditions of increasing automation of industry. F. Kliks and K. Timpe (GDR) delivered a paper entitled "Psychological Problems of Increasing the Reliability of a 'Man-Machine' System."

A large place was devoted at the congress to problems of industrial psychology related to the role of motivation and personality distinctions of people in the course of work activity. There was extensive discussion of the problem of manner of [style] management under different socioeconomic regimes, as well as questions of screening, rating and training managers, problems of leadership.

The members of the Soviet delegation participated actively in the work of the congress. Soviet scientists delivered 12 papers at different symposiums. For example, at the symposium dealing with "Physiological Psychology," much attention was aroused by the paper of the head of this symposium, E. Yu. Pung (USSR), entitled "Psychophysiological States of Man Under Different Working Conditions." Ye. D. Khomskaya, in a paper entitled "Psychophysiological Analysis of Interhemispheric Asymmetry in Cognitive Activity," reported the results of an experimental study of bioelectrical activity of symmetrical regions of the cerebral hemispheres in both healthy and sick (with local brain lesions) individuals, which is related to different types of cognitive activity. The paper of V. V. Suvorova dealt with analysis of psychophysiological mechanisms of peripheral binocular vision. She observed a difference between functions of the basal regions of the retina

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from the contralateral projection in the cerebral hemispheres and temporal zones that have a direct projection into the hemispheres.

Much interest was displayed in the evening lecture delivered by Yu. M. Zabrodin, head of the Soviet delegation, which dealt with the question of receiving and processing information by an operator and planning his activities. On the basis of analysis of extensive factual data, he arrived at some conclusions of importance to planning of operator activity. Yu. M. Zabrodin observed that development of a strong descriptive language, consistent with psychological reality and compatible with the language for description of the technical part of the "man-machine" system, is required to solve this problem. Such a general description could be constructed in terms of complex dynamic systems with variable structure. To plan operator activity, one must also solve the problem of measuring human capabilities and analyzing basic questions of mental regulation of activity. This includes the search and construction of ideal objects of theory and adequate ways and means of investigation, data processing and interpretation, use of data processing methods that are more complex than linear ones. One must investigate the range of distribution of interindividual and intraindividual variations, including those in time and space of the mental functions studied, rather than averaged data. It is only within the framework of defining the operator's capabilities and occupational requirements made of him that one can find the optimum range of the "man-machine" system and define the the performance range of the system as a whole and each operator individually.

During the work of the congress, Soviet scientists kept in close contact with their colleagues from socialist countries and progressive psychologists of capitalist nations. These contacts aided in further improvement of mutual understanding and development of collaboration, as well as fruitful exchange of scientific information.

The international congress on applied psychology became a significant event in the scientific life of psychologists in different countries. It has made a ponderable contribution to the further development of applied psychology. [546-10,657]

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CONFERENCES

DELEGATION OF SOVIET MEDICAL CORPS GENERALS VISITS FRANCE

Paris supplement to MEDECINE ET ARMEES in French Vol 7 No 6, Jun-Jul 79 p 1

[Article by M.B.J.]

[Text] Medical Lt Gen Urov, deputy director of the Soviet Health Department, paid an official visit to France from 7 to 12 May 1979, at the invitation of Medical Inspector Ronflet. Medical Gen Urov was accompanied by Medical Maj Gen V. Moguilny, deputy Health Department chief; Medical Lt Gen E. Gembizky, chief of the treatment service; Medical Maj Gen M. Litkine, professor-in-chief of the Academy of Medicine; Medical Col V. Turine, division chief of the Health Department; Mr A. Migatcheve, interpreter.

The program, which was set up according to their wishes, included visits to three teaching hospitals (Val-de-Grace in Paris, St. Anne in Toulon and Desgenettes in Lyon), a training school (ESSA [expansion unknown], Lyon), a school for practical application (ESSAT [expansion unknown], Paris), two research centers (CRSSA [expansion unknown], Lyon and CRMA [expansion unknown], Paris) and the Main Center for Medical Evaluation of Flight Personnel in Paris.

It also included a visit to the medical section of Selection Center No 8 in Lyon and the medical section of the Undersea Intervention Group in Toulon.

An especially heavy program, since our visitors were staying just five days in France, during which they had not only to travel from Paris to Toulon and Lyon, but also to squeeze in some "touristic interludes."

Throughout the many questions asked, it was very apparent that our two departments of health share a number of points in common and that their chiefs are concerned with the same problems--the universality of medical growth, budgetary restrictions and technical sophistication!

It is both amazing and reassuring to discover that our Soviet confreres are just as much concerned with reducing the cost of daily fees and duration of hospital stays as our own country's civilian and military leaders are.

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The introduction of data processing into the hospital is also a subject of joint concern. Organizing functional exploration services (called clinical physiology in the Soviet Union) and the place of such a service in the hospital's general economy are a topical subject. Our visitors seem to hesitate between creating a single service in which all investigations would be accomplished for the benefit of the other hospital services, and having everyone specialize in his own field.

Concerning what is properly called medical technology, the Soviet physicians were especially attentive to problems raised by the treatment of badly burned patients and to the latest techniques in radiology.

The visit to the Selection Center showed an aspect which is quite peculiar to French military medicine. No similar establishment seems to exist in the Soviet Union, where the first meeting of young people with the army occurs at an earlier age and under very different circumstances.

Throughout the stay, numerous informal conversations presented opportunities for fruitful exchanges. A climate of confidence and candor was very quickly established, making it possible to surmount linguistic difficulties and cultural differences.

The welcome given the delegation at the time of its trip in the Southeast, in Toulon (Medical Gen Forissier) as well as in Lyon (Medical Inspector Vittori and Medical Gen Thalabard) was especially appreciated by our guests, who returned to Moscow happy at having visited Paris, the Gien Peninsula and--Beaujolais.

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ECOLOGY

UDC: 577.4/578.088.91/577.391

THE PROBLEM OF RADIOACTIVE CONTAMINATION OF BENTHIC SEDIMENT AND PREVENTION THEREOF

Sverdlovsk EKOLOGIYA in Russian No 3, 1979 pp 85-88

[Article by O. M. Aleksanyan and Yu. Ya. Katsenl'xon, Azov Scientific Research Institute of the Fish Industry, Rostov-na-Donu, first submitted 15 Jul 77 and submitted in final version 17 Nov 78]

[Text] When radioactive substances penetrate into a body of water under the influence of natural factors, a number of conversions occur (dilution and scatter, shift and deposition of radionuclides). The main objective of investigations of radionuclide behavior in sediments and water is to identify the mechanism of its action, with determination of the factors and conditions that determine the course of the process.

This work was based on experimental studies of the role of different types of benthic sediment in the radioecology of inland bodies of water (on the example of the Sea of Azov). Moreover, we investigated the possibility of preventing radioactive contamination of benthic sediments with the use of glauconite, a mineral of sedimentary diagenetic origin that is widespread in the central regions of the RSFSR, the Volga region, in the Ukraine, Rostovskaya Oblast and other territories. It is known that glauconites actively absorb certain toxic substances and radionuclides (Spitsyn, Gromov, 1959; Voropayeva et al., 1976; Katsnel'son, 1976; Kohler, 1976).

An experimental study was made of the degree of sorption and desorption of ^{90}Sr and ^{137}Cs by four of the most typical forms of sediments in the Sea of Azov (argillaceous and fine aleurite silt, shell sand ["peschanaya rakusha"] and shell rock ["rakusha"]). We also studied accretion and elimination of these radionuclides from argillaceous silt with addition of glauconite concentrate in the form of sand with about 20 mg·eq/100 g substance alkaline cation exchange resin.

Experiments were conducted in 10 variants, each repeated 3 times. The initial concentration of nuclides in the water constituted 10^{-7} Ci/l. Dynamic methods were used in the laboratory tests; experiments were conducted in 10-liter glass vegetation jars, with 60-day exposure (radionuclide

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sorption was studied for 30 days and desorption, for 30 days). The sediment was 10 cm in thickness and the water layer was 15 cm high. We used water from the same parts of the sea where benthic sediment samples were taken as desorbent. The layer of glauconite concentrate did not exceed 2 mm. The samples were collected with a tube (a miniaturized version of GOIN-1.5 pipe) in layers at intervals of 0-1, 2-3, 4-5 and 6-7 cm every 5 days. Samples weighing 50-100 mg were submitted to radiometry on units of the UMF-1500 type with reading efficiency of 30%.

The coefficients of accumulation [accretion], CA, were calculated as the ratio of nuclide concentration in the sediment (Ci/kg) to its concentration in water (Ci/l), while the coefficients of elimination, CE, were calculated as the ratio of residual concentration of the radionuclide in the sediment after washing in clean sea water to its concentration in water (Polikarpov, 1964; Barinov, 1965); CA and CE were calculated in wet sediment.

It is known that the degree of dispersion of marine sediments affects the extent of radionuclide adsorption, and the sorptive capacity of sediment increases with decrease in particle size. As was to be expected, argillaceous silt was found to be the best nuclide sorbent. The CA of ^{90}Sr and ^{137}Cs for the top centimeter layer of different types of benthic sediment were as follows: 7.5 and 120 for argillaceous silt; 3.6 and 87.8 for fine aleurite silt; 5.2 and 73.3 for shell sand; 6.4 and 82.3 for shell rock. Consequently, the benthic sediment of the Sea of Azov can be put in the following order, according to degree of absorption of ^{137}Cs : argillaceous silt > fine aleurite silt > shell rock > shell sand; for ^{90}Sr the order is: argillaceous silt > shell rock > shell sand > fine aleurite silt.

The sorptive capacity of argillaceous silt is about twice as high as that of fine aleurite silt, other conditions being equal. The absorptive capacity of silt is determined by the large amount of organic matter present in a highly dispersed colloid state. In addition, the magnitude of nuclide adsorption depends on the duration of contact of the sediment with contaminated water. The cumulative rate is significant for ^{90}Sr and ^{137}Cs in benthic deposits for the first days of the experiment, then this process slows down somewhat.

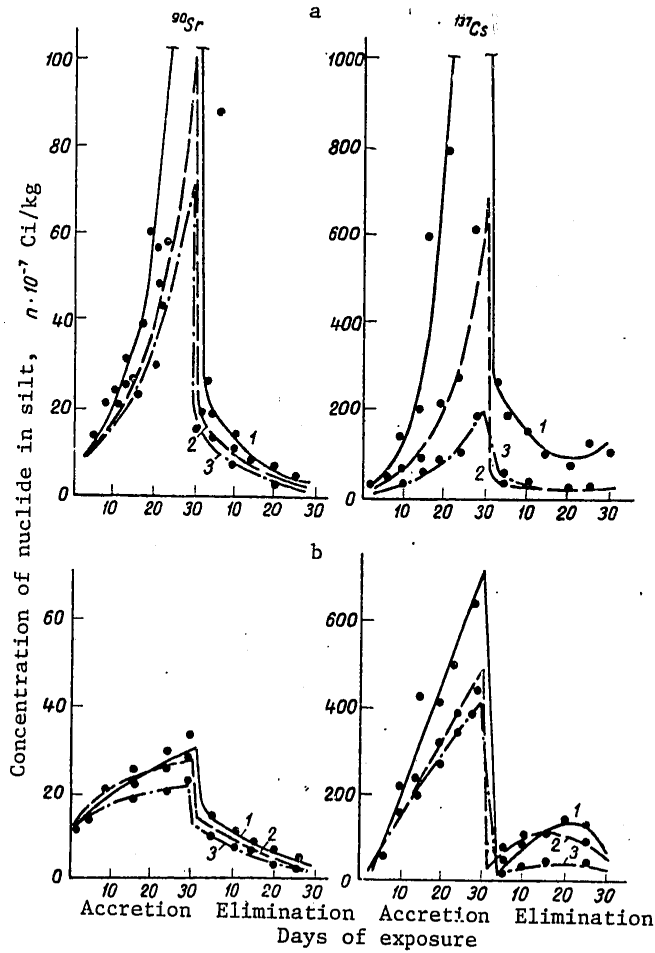
Our investigations revealed that, in an artificial benthic sediment-water system, ^{90}Sr is distributed relatively uniformly, while ^{137}Cs accumulates in the sediment. The coefficients of accumulation of nuclides in different sediments are rather low: 2.2 to 6.3 for ^{90}Sr and 28.3 to 51.3 for ^{137}Cs .

Radionuclides are capable of penetrating relatively deeply into benthic sediment and fixing stably in them. According to the data in the literature (Spitsyn, Gromov, 1959; Aleksakhin, 1963; Yudintseva, Gulyakin, 1968; Gromov, Spitsyn, 1975), the nature of accumulation and vertical distribution of radionuclides is determined by the aggregate effect of many factors (their physicochemical properties, geochemical mobility, condition of environment [medium], mineralogical and chemical composition of benthic sediment and

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other parameters). We demonstrated a consistent decline of ^{137}Cs and ^{90}Sr concentration with increase in depth; it was shown that most of the elements (about 60%) is concentrated in the top centimeter layer. The correlation between change in concentration of radionuclides in benthic sediment and depth (Sepetliyev, 1968) is exponential for ^{137}Cs and linear for ^{90}Sr .



Change in concentration of radionuclides as a function of time in argillaceous silt without glauconite (a) and in the presence thereof (b); sediment depth, cm: — 0-1; - - - 2-3; - · - · - 4-5.

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The dynamics of absorption and desorption of radionuclides in a water-benthic sediment (argillaceous silt) system with and without glauconite differ, not only in the quantitative aspect of the process, but description by curves of different shapes (see Figure). The mean concentration of nuclides in silt in the presence of glauconite concentrate decreases by 71% for ^{90}Sr and 25% for ^{137}Cs . In the top centimeter layer, only 30% ^{90}Sr and about 40% ^{137}Cs is concentrated in the presence of glauconite. This may be attributed to the fact that glauconite absorbs these radionuclides relatively well, forming stable compounds with them. The decrease in adsorption of ^{90}Sr and ^{137}Cs by argillaceous silt because of the glauconite concentrate can be used to accelerate decontamination of the water.

Our study of desorption of fission products from benthic sediment of the Sea of Azov enabled us to establish that sea water does not completely desorb radionuclides. Thus, the mean CE in argillaceous silt constituted 6.3 for ^{90}Sr and 80.1 for ^{137}Cs . Cesium 137, which is relatively more readily absorbed, is washed out of benthic sediment much more slowly. This is probably attributable to the fact that it penetrates into the interlayer intervals of micaceous minerals of benthic sediments and, becoming partially hydrated, they are fixed within the sorbent (Gromov, Spitsyn, 1975). The desorbent, in the form of sea water, eliminated about 50% of the nuclides from fine aleurite silt and about 90% ^{90}Sr and 40% ^{137}Cs from argillaceous silt in 30 days. Among the types of benthic sediment studied, argillaceous silt is in first place, according to degree of absorption and retention of radionuclides.

Thus, the types of benthic sediment of the Sea of Azov that we studied absorb ^{137}Cs with a higher CA than ^{90}Sr . Argillaceous silt absorbs both radionuclides the most. Addition of glauconite lowers absorption of both radionuclides by argillaceous silt, and ^{137}Cs is captured more actively by glauconite than ^{90}Sr . In pond fisheries, of which there are many in the basin of the Sea of Azov and other regions, addition of glauconite to the water could accelerate removal of radioactive strontium and cesium from the water, or prevent probable contamination by these nuclides.

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INSTRUMENTS AND EQUIPMENT

UDC 578

THE APPARATUS BASE OF THE PHYSIOLOGICAL EXPERIMENT

Moscow VESTNIK AKADEMII NAUK SSSR in Russian No 8, 1979 pp 40-43

Article by B. Ya. Pyatigorskiy, Candidate of Biological Sciences

Text Modern physiological experiments are conducted at different levels-- from the molecular to the behavioral--using different methods. The complexity and diversity of the methods of investigation require a large fleet of modern apparatuses and devices of computer technology for their realization. Thus, in order to conduct electrophysiological experiments multichannel amplifiers with high sensitivity and a low level of intrinsic noise, stimulators, a set of devices for fixing the animal and controls over its condition, reception, recording, data processing, etc. are necessary. Research in the field of membrane biophysics, morphology, biochemistry, etc. is no less saturated by the amount and complexity of apparatus used. For this reason it is clear that it is difficult for scientific institutions of the physiological specialties to supply the different trends of research fully with current apparatus. Consequently it is advisable to concentrate basic resources and efforts on the development of one of the most urgent research trends and one which corresponds to the resources of the given institution.

At the same time the physiological experiment cannot, as a rule, be unique, inasmuch as the complexity of the subjects under investigation requires preliminary investigations of its individual systems, and the great number of parameters which determine the behavior of these systems dictates the necessity of a great number of repeat experiments. It appears to be justified if several groups using similar methods work in parallel fashion on the solution of some problem or a number of related problems. How can each of these groups be supplied with the complex and costly apparatus which they need in order to conduct the experiments? Apparently the basic way is to create a centralized service. The experience of the Institute of Physiology imeni A. A. Bogomol'tsa of the AN USSR UkSSR Academy of Sciences has shown that the creation of photometric, electronmicroscopic and other specialized subdivisions is completely justified.

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The creation of such mutual-use subdivisions is advantageous in many respects: first, it makes it possible to save resources inasmuch as the necessity of buying several apparatuses of the same type declines; second, the efficiency of the use of equipment increases, making it possible to exhaust its technical resources practically completely before it becomes obsolete; and, finally, it becomes possible to service this equipment in a more skilled manner.

As applied to computer technology, however, the advisability of such a policy is not always apparent. In fact when it is a question of batch processing of data by computers (i.e., the data is first accumulated, prepared and then transmitted for processing), the advisability of installing a centralized EVM [electronic computer] joint use does not give rise to any particular doubts. Direct communications systems and systems operating in real time, however, are more progressive. A system operating in real time makes it possible to obtain the results of data processing during the experiment, which unquestionably opens new possibilities for the experimenter. Such a system may be realized most simply by using individual small EVM's. But the specific nature of physiological experiments in most cases requires analysis of large banks of data and in some cases comparison of data obtained in different experiments. In order to do this the operative memory of small EVM's should be significantly expanded; in conjunction with the necessity of acquiring other apparatus (displays, graphics terminals, devices for communication with the subject) this sharply increases the overall cost of the equipment.

Naturally in this manner it is possible to solve the problem of automation of experiments only for the group or laboratory which is conducting intensive investigations in a given field and not for all the departments of the institute. For example, in the Institute of Physiology of the AN UKSSR it proved to be efficient to create a subsystem for a group of colleagues engaged in study of ion channels of biological membranes. On the whole, however, many departments of the institute use the centralized system based on an average capacity EVM which serves them both in batch processing and, if necessary, real time operation.

It should be noted that the creation of a centralized real-time processing system significantly complicates the tasks of the specialists exploiting it. This system also requires highly skilled service on all levels from electronics to provision of software. But economically it is more efficient, and use of an average capacity EVM with a developed mathematical library and a large volume memory makes it possible to create data banks and to solve such serious problems as image identification. In addition, with an average capacity EVM it is possible to accomplish imitation and mathematical modelling of complex subjects through data processing, and this is a most promising trend in the further development of physiological research.

The creation of a centralized institute equipment fleet, for example attached to the metrology department, may apparently also prove to be promising in increasing the effectiveness of the use of the individual

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apparatuses. Many experimenters, however, have still not gotten over a definite prejudice against centralization of equipment, preferring to have "their own" equipment. This is an obstacle to creation, and even more so to the normal exploitation, of the fleet. Of course, with a large series of similar experiments an apparatus is assigned long-term to the group or laboratory which is conducting these experiments, thus limiting the possibilities of other groups or laboratories' using the apparatus. For this reason it is advisable to have in the centralized equipment fleet additional standard elements (from stimulators and interchangeable blocks to transducers, oscillographs, etc.), with which inoperative elements might be temporarily replaced or that or another installation augmented. In the staff of such a centralized there should obviously be a group of two three persons for routine repairs and preventative operations.

It has already been said*that uniqueness is not characteristic of the physiological experiment, and when it is a question of creating specialized apparatus manufacture of at least a small series of it is implied. High-grade development of specialized physiological apparatus and subsequent production of it in small series is probably possible only when there is an experimental design plant administratively under the authority of the management of the top-level scientific research organization of the given specialty. Such a plant makes it possible to supply the apparatus necessary for physiological experiments not only to this scientific research organization but also to many others of similar specialties.

An experimental design plant has been operating successfully for many years at the Institute of Physiology of the AN UkSSR. Such equipment manufactured by them as the SEZh-3 stereotaxic device for neurophysiological investigations on laboratory animals, the FOR-2 photorecorder oscillogram, the UPT-2 device for working with microelectrodes and a number of others have received recognition not only in the scientific research institutions of the biological and medical specialties but also in the technical organizations of our country. At the present time development has been completed and serial production of UIDZh-1 artificial respiration apparatus has begun. A new model of the RM-4-3 four-channel magnetogram for recording physiological processes, a new photorecorder, a device for pulse transference of IPM-2 microelectrodes and several other instruments are being developed.

The existing structure of the experimental plant, where the subdivisions developing the instruments and manufacturing them in small series are virtually united, cannot be considered satisfactory, however. While having certain positive features (particularly, close contact of the designers with the plant), at the same time such a structure limits both the volume and the technical complexity of the developments produced and the quantity of instruments manufactured. More promising is the complex: scientific research institute-special design office-experimental plant by analogy with the scientific-manufacturing associations which have become widespread in the AN UkSSR system. An experimental plant with a staff of 500-600 people would make it possible to supply the necessary physiological equipment to the majority of institutions of our country and even other

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socialist countries. Our experimental design plant with a staff of 150 persons is able to satisfy only 30 percent of the requests received from other organizations. For this reason the AN UkSSR Presidium found it necessary to provide for an increase in the capacity of this plant and passed a resolution concerning the construction of a new building for it.

The development of scientific instrument making on the basis of the experimental design plants of the institutes is limited by a number of difficulties. For example, the tendency of the specialists developing the equipment to use modern progressive elements and designs in it is natural. When instruments are manufactured in small series, however, it is impossible to implement this, since the academies of science receive practically no funds for such products. The problem of supplying the scientific instrument-making organizations with products which complete units of machinery has been raised more than once in print, but at present it remains unresolved.

And finally, a last item--removal of obsolete equipment. It should be said at the outset that this should be thought about before resolving the problem of the advisability of acquiring some equipment or other. The process of obsolescence is not identical for instruments with different functions. Thus in the past 10-15 years no fundamental changes occurred in the design of oscillographs (the switch to semiconducting elements essentially only increased the reliability of the operation of these devices). There is reason to assume that there will also be no radical changes in these instruments in the next 5-7 years. Consequently in correctly selecting the type of oscillograph one can count on completely exhausting its resources without replacing it with another. It also may be a question only of transferring these instruments within the institute as exploitation of some is completed by it and when others are planned.

Microscopes, photorecorders, sterotaxic devices, etc. may be grouped with instruments of this type. It is quite another matter with many measuring and computing devices, the models of which change frequently and often become obsolete before one has managed to create conditions for utilizing all their resources. For example, several biological institutes were recently equipped with M-400 EVM's; however, the external equipment for these EVM's was not supplied. For this reason the machines were used only in limited modes, but the users who needed them did not lose hope of receiving the necessary external devices. Imagine their disappointment when it became known that the M-400 EVM had already been taken out of production and replaced with new machines, also lacking external equipment! Obviously the time has come to forbid the production of such "semi-finished products". This applies not only to EVM but also to many other complex devices.

What should be done with obsolete equipment or with excess equipment which has cropped up at the institute (something which also happens frequently)? If the equipment is in good technical condition as a rule other organizations, most frequently of the academic sector, may be interested in them. Information on the presence of unused equipment may be transmitted to the

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"Salon-Pribor" stores, which have existed for many years and through which they are also sold.

In order to detect surpluses of equipment (as for resolving the question of the advisability of acquiring new equipment) it is necessary to have available a carefully compiled catalog of instruments and equipment at the organization with an indication of their characteristics and technical condition. The metrology departments of the institutes should play an important role in the timely detection and sale of unused equipment.

In conclusion it would be desirable for information on instruments manufactured in this country and necessary for research in the field of physiology were improved. We are not talking about colorful brochures but at least short notices on the pages of widely known physiology periodicals. Incidentally with a good supply of information on the manufacture of new instruments scientists will part more readily with unused equipment which they are trying to keep for themselves "just in case".

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INTERNATIONAL COOPERATION

INTERNATIONAL COOPERATION IN DEVELOPMENT AND PRODUCTION OF MEDICAL EQUIPMENT
(ON THE 30TH ANNIVERSARY OF CEMA)

Moscow MEDITSINSKAYA TEKHNIKA in Russian No 3, 1979 pp 4-9

[Article by V.A. Dvoryakovskiy, deputy minister of medical industry]

[Text] Thirty years have passed since the creation of the Council of Economic Mutual Aid (CEMA)--the first in the world economic organization of socialist countries based on the principles of proletarian internationalism, full equality of members, mutual respect of national interests, independence and sovereignty, mutual gain and comradely mutual aid. The formation of the CEMA was an outstanding event in the development of the world socialist system that has no precedent in international economic relations.

The decision on creating the CEMA was adopted in January 1949 at a conference held in Moscow of representatives of Bulgaria, Hungary, Poland, Romania, the USSR and Czechoslovakia. The GDR joined the CEMA in a year's time; in 1962, Mongolia became a member of the CEMA, in 1972--Cuba. In 1978 socialist Vietnam became a member of the organization at the 32nd session of the CEMA.

In the past 30 years, the CEMA has traveled a long way in development; its activities have been constantly expanding, deepening, improving and being enriched with new forms and methods characteristic of each stage of the historical development of the countries comprising the CEMA.

In the first years of this organization's existence, CEMA member-countries were restricted in their interrelations basically to the giving of mutual economic aid and barter. As the national economy of each socialist country strengthened and developed, economic cooperation among us began to expand and assume increasingly complex forms. Initially it was expressed in production planning of individual products for the needs of this or that country, in exchanges of complete sets of technical documentation and in the fulfillment of special orders. Subsequently, it was found necessary to coordinate developmental plans of sectors of industry and then to coordinate national-economic plans as a whole. Major attention was paid by the 24th CPSU Congress to questions of economic cooperation of the socialist countries and to

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the thorough use of the tremendous possibilities inherent in it. Its decisions were aimed at the further expansion and improvement of economic and scientific-technical ties in the direction of steadfast strengthening of cooperation and consistent development of the socialist economic integration of CEMA member-countries.

In 1971 cooperation of CEMA member-countries was raised to a new level with the adoption of the Complex Program for Further Deepening and Improvement of Cooperation and Development of Socialist Economic Integration designed for a step by step realization over the course of 15-20 years. The Complex Program was the expression of the firm decision of the fraternal parties to make the fullest possible use of the advantages of the socialist system of management for the strengthening of the economic power of each country individually and of the entire socialist community as a whole.

"The work on fulfillment of the Complex Program," L.I. Brezhnev emphasized at the 25th CPSU Congress, "has been responsible for the fact that even as of now our economic interaction has become deeper, while reciprocal supplementation to the economies of our countries has increased to the considerable benefit of each one of them."

The socialist community of CEMA member-countries is the most dynamically developing economic organization in the world. It is developing at a rate that is significantly greater than the rate of economic development of capitalist countries. After 1950, the national income of the countries of the socialist community grew as a whole more than sevenfold, while it increased approximately threefold among the developed capitalist states. The difference is still greater in the growth of industrial production: elevenfold and slightly more than threefold, respectively.

The present level of cooperation of CEMA member-countries is characterized by the development of specialization and industrial cooperation. This provides the possibility of concentrating to a greater degree production in one place, concentrating capital and forces on improvement of technology, increasing series production and obtaining as a result products of higher quality at less expense.

A special role is played by scientific-technical cooperation of socialist countries, inasmuch as the successful fulfillment of the Complex Program is possible only on the basis of effective utilization of the achievements of science and technology.

The medical equipment industry in CEMA member-countries, which is guided by general principles and directives, has also assumed the path of integration and international cooperation.

Items of medical equipment are produced in practically all of the countries of the socialist community. In the USSR alone more than 5,000 descriptions of products are produced, the same number is put out by the enterprises of

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the GDR, Czechoslovakia and Hungary. The product mix of medical equipment is extremely diverse as to technical content and is constantly growing. Providing medical institutions with equipment requires significant material expenditures. The development and production of new products is connected to the need for introducing new technological methods, new organization of production and broad specialization and cooperation. Ensuring of the further development of medical sciences is also closely connected to the necessity for development and production of special instruments and apparatus for research. The steady rapid growth of the product mix of medical equipment requires the constant expansion of the group of highly qualified workers of different specialties brought together for its development, and for its production--increases of production capacities. In this connection, utilization of the advantages of socialist economic integration in the field of development and production of medical equipment and development of scientific-technical cooperation in this field and solution of the problems of specialization of CEMA member-countries relating to the development and production of different kinds of products constitutes the best founded and economically validated way of solving the problem of providing modern equipment to health-care and medical-institutions of the countries of the socialist community. But in each country specific demands are made on medical science; they are both medical and technical, including demands for test methods, and each country uses its own terminology. Therefore at the first stage of scientific-technical cooperation it was necessary to prepare a normative basis for specialization and cooperation in production of items of medical equipment and also for joint work on the creation of new kinds of it.

For the solution of these questions, there began to be developed in 1957 within the framework of the Temporary Working Group contacts between the All-Union Scientific-Research Institute of Medical Instrument Making (VNIIMP) and the Hirona Association of People's Enterprises (CSSR); by 1971 the VNIIMP implemented bilateral scientific-technical cooperation with 9 organizations engaged in the development and production of medical equipment in Czechoslovakia, Hungary, Bulgaria and the GDR. In this connection, on the part of the USSR the Leningrad affiliate of the VNIIMP and the Mekhanizatsiya Central Design Technological Bureau joined in the scientific-technical cooperation. Mutual aid was provided in the creation and stocking of patent funds for items of medical equipment. Joint technical testing of new models of products reciprocally enriched the cooperating countries and contributed to a better understanding of the tasks facing the organizations.

In 1971, seven countries--Bulgaria, Hungary, the GDR, Poland Romania, the USSR and Czechoslovakia signed an agreement on the creation of a Coordination Center for the Problem "Creation of Biomedical Instruments and Apparatus for Scientific Research and Clinical Medicine," whose mission includes according to the agreement the organization of development of analyses and forecasts on the problem, the organization of cooperation on research, the holding of scientific conferences, symposiums, conferences, scientific-technical information and the like. The Coordination Center has done work on the classification of medical equipment and systematization of scientific-research work

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along several directions of its development and a number of other works aimed at the coordination of scientific-research work in participating countries of the agreement.

The agenda includes work on the solution of problems of standardization of medical and technical requirements for medical equipment, methods for technical and clinical testing of new products, analysis of the status and prospects of development of health-care requirements for separate chief groups of diagnostic and medicinal products, determination of prospective need for medical equipment for new and developing methods.

The realization of this work would assist the operation of industrial organizations with respect to the specialization and development of the production of medical equipment conducted both within the framework of the CEMA Permanent Commission for Cooperation in the Field of Machine Building and on a bilateral basis.

The tasks set by the Complex Program of Socialist-Economic Integration of CEMA Member-Countries and the constantly growing development of scientific-technical cooperation in the field of medical equipment demanded a significant increase in work both as to volume and to breadth of the examined questions. In this connection a regular session of the CEMA Permanent Commission for Machine Building (PKM) adopted a decision on the transformation as of 1 January 1979 of the permanent working group on medical equipment into Section No 11--Medical Equipment of the CEMA Permanent Commission for Machine Building.

The following primary tasks were assigned by this decision to the section as the working organ of the Commission:

--conducting work on problems of economic and scientific-technical cooperation coordinated on a multilateral basis in the field of medical equipment during 1981-1985, keeping in mind satisfaction of the requirements of the countries for modern medical equipment;

--conducting consultations on questions of development of the medical industry at sessions of the section in conformity to the provisions of the Complex Program and the decisions of the 30th meeting of the CEMA session.

For the purpose of resolving these tasks, the section must carry out its work in the following directions:

--coordination of plans of development of the medical industry of CEMA member-countries, expansion and intensification of specialization and cooperation of production of items of medical equipment;

--organization of immediate multilateral scientific-technical cooperation in the field of medical equipment for the purpose of effective solution by the countries of questions relating to efficient utilization of capacities, development and use of new equipment and technology, improvement of quality and the like;

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--monitoring of the course of cooperation within the framework of appropriate multilateral agreements concluded on recommendations of the Commission;

--development of CEMA standards in the field of medical equipment, first of all for products that are the objects of specialization and cooperation of production in accordance with multilateral agreements.

In 1976, an Agreement on Multilateral International Specialization and Cooperation of Production of Items of Medical Equipment was concluded by the following CEMA member-countries: Bulgaria, Hungary, Poland, the USSR and Czechoslovakia. It encompassed the following divisions of medical equipment:

--instruments for the measurement and registration of biopotentials and other physiological values, including sensors and transformers;

--endoscopes;

--ultrasonic instruments for diagnosis;

--electromedical therapeutic apparatus, including electrosurgical;

--equipment for sterilization and disinfection of medical implements;

--ophthalmological apparatus;

--stimulators, including implanted stimulators, bioprotheses.

In 1977, the GDR joined the aforesaid agreement. Further development of the agreement involved the adoption of addenda to the agreement on the following sections:

--anesthesia and respiratory apparatus;

--stomatological devices and equipment.

At the present time the existing agreement on multilateral international specialization and cooperation of production of items of medical equipment takes in 308 item designations. In this connection, important significance is to be attached to the overcoming of the still existing gap between scientific-technical and economic cooperation through a transition to its comprehensive forms, taking in scientific-technical and production elements by a single regulation.

At the present time, bilateral scientific-technical cooperation is being implemented with respect to 86 themes, with the following organizations of CEMA member-countries taking part:

--from Czechoslovakia--the Hirana concern, the Spofa Association of National Enterprises;

--from Bulgaria--the Institute of Medical Equipment;

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--from the GDR--the Combine of Medical and Laboratory Equipment, the Karl Zeiss Jena People's Enterprises, the TUR People's Enterprise;

--from Hungary--the Medikor Association of Plants, MOM, Granvizus, Labor-MIM, the Gamma Combine, the State Institute of Medical Instruments (ORMI);

--from Poland--the OMEL Association of Optical and Medical Industry.

From the USSR, 9 organizations, solely from the all-union industrial associations of Soyuzmedpribor and Soyuzmedinstrument, participate in cooperation with CEMA member-countries.

This cooperation has already borne certain fruit in the form of joint development and production of medical equipment on the basis of specialization or cooperation. Thus, together with Czechoslovakia (Hirana) there has been designed a 6-channel electrocardiograph, series production of which is being done on the basis of cooperation of USSR and Czechoslovak enterprises. Within the framework of the agreement work is continuing among four ministries of the USSR and the GDR on the creation of a complex of standardized endoscopic instruments involving the use of the latest achievements of optics and instrument making on the basis of specialization of development and production and also of a 4-channel biochemical analyzer with a discrete principle of operation. Proposals have been developed for specialization of production and mutual delivery of units and components of the analyzers, which are turned over to foreign-trade organizations for the preparation of appropriate agreements.

In cooperation with the MOM Association of Plants (Hungary) a number of optical fiber elements for endoscopic instruments were developed, which made it possible to initiate the development and series production of these instruments in the USSR with the cooperation of Hungary. Delivery to the USSR of optical fiber elements produced by MOM is secured by a pertinent agreement on specialization of production.

In the USSR, Hungary and the GDR there is in operation a standardized system of connecting elements of glass fiber bunched conductors [zhguty] both to the source of light and directly to the endoscopic instruments. Joint work has been completed with Hungary (Medikor Association of Plants) on the creation of the Pneumotachograph-2 instrument designed for study of the mechanics of spontaneous and artificial respiration; the organization of its production was assigned on the basis of specialization to Hungary. In the joint creation of the Pneumotachograph-2 instrument, Soviet and Hungarian specialists acquired rich experience, which undoubtedly will be useful in the creation of a number of other instruments.

Joint work with Bulgaria has been completed on the development of the Tonus-2, a portable apparatus for treatment with diadynamic currents. Production of the instrument has been set up in Bulgaria, and at the present time deliveries of it are being made to the USSR. Development of a number of other electronic medical instruments has been started. Scientific-technical cooperation with Bulgaria continues to develop successfully.

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CEMA member-countries have worked out the main directions of scientific-technical cooperation on the most important aspects of medical equipment to 1990 for provision of the Agreement on Specialization and Cooperation of Production of Items of Medical Equipment.

Under the conditions of the scientific-technical revolution and growing international socialist division of labor, cooperation in the field of standardization is of major importance. International standardization is an important instrument, eliminating technical barriers in foreign trade and scientific-technical cooperation. Standardization was highly recognized in the Concluding Act of the Conference on Security and Cooperation in Europe, which pointed out the importance of agreement of standards in the development of economic and scientific-technical ties between countries.

In accordance with the Long-Term Directions and Complex Themes in the Field of Standardization of CEMA Organs and International Organizations of CEMA Member-Countries for 1976-1980, the development of standards for the CEMA was started in the current five-year plan for the first time in the history of the CEMA. They are to be obligatory both in foreign-trade relations among CEMA member-countries and within the countries as national standards.

The cardinal changes in the principles of organization and the scale of work on international standardization that are taking place in the world require intensification and expansion of work on international standardization in the field of production of medical equipment for the purpose of ensuring its competitiveness on the world market. This work has been going on since 1971.

At the present time, the USSR is actively engaged in scientific-technical cooperation with CEMA member-countries for the development of CEMA standards and other normative-technical documentation for provision of standardization of long-term goal programs of cooperation. Each year about 30 standards are developed at the same time; they include standards for different items of medical equipment included in the agreement on specialization and cooperation of production of items of medical equipment of the CEMA member-countries and also standards of general technical designation. Moreover, work is going on on standardization of standards and other normative-technical documentation within the framework of bilateral cooperation on the basis of intergovernment agreements. Considerable experience exists in this field of cooperation with the GDR, and work has begun on standardization of standards with Hungary.

The systematic and purposeful realization of international socialist division of labor and the establishment of stable economic ties, as well as the significant development of international specialization and cooperation of production have brought about an essentially new approach to work on standardization and have made it possible to practically undertake wide-scale development of CEMA standards (with their direct use in the national economy of the USSR and other CEMA member-countries) and to implement the Long-Range Directions and Complex Themes in the Field of Standardization of CEMA Organs and International Organizations of CEMA Member-Countries for 1976-1980.

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In the field of medical equipment; the transition to program goal planning is continuing in accordance with the general setting of the task of a complex approach to problems of standardization. Its purpose--the creation of an interlinked complex of CEMA standards required for the timely and full normative-technical provision of concrete measures on economic and scientific cooperation of CEMA-member countries in the field of medical equipment.

Thus an orderly and scientifically substantiated system of international CEMA standards is being created to be directly used in national production operations, making it possible to upgrade the quality of production and the level of production in each of the CEMA member-countries, to provide compatibility and interchangeability of products produced, to improve conditions of barter and to reduce the time for putting new products in production.

The further development of economic and scientific-technical cooperation of CEMA member-countries in the field of medical equipment, deepening and expansion of the process of specialization and cooperation will create still more favorable conditions for the further development of medical science and the supplying of health-care institutions with instruments, equipment and apparatus meeting modern requirements.

The achieved successes provide every basis for thinking that economic and scientific-technical cooperation of CEMA member-countries in the field of design and production of medical equipment will steadily develop and actively contribute to the improvement of people's health care in the countries of the socialist community.

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PUBLICATIONS

RADIOACTIVE CARBON IN THE BIOSPHERE

Moscow RADIOAKTIVNYY UGLEROD V BIOSFERE in Russian 1979 signed to press
27 Nov 78 pp 2, 3-5, 149-150

[Description, introduction and table of contents from the book "Radioaktivnyy uglerod v biosfere" by V. P. Rublevskiy, G. P. Golenetskiy, and G. S. Kiridin, Atomizdat, 1570 copies, 152 pages]

[Text] Together with the authors' own investigations, this book correlates and analyzes materials of Soviet and foreign scientists on the problem of ^{14}C --an isotope of carbon, one of the most important biogenic elements. The causes of the formation of artificial ^{14}C and its behavior in the environment, its distribution and accumulation in different substances of the biosphere, including the human organism, are examined. Different mechanisms of the biochemical effect of this nuclide on living organisms are discussed. The problem of setting standards for discharge of ^{14}C from individual sources and for accumulation of it in the environment are considered. Current methods for measuring samples with low activity and possible methods for controlling the discharge of ^{14}C by local sources and its content in substances of the environment are described in detail.

The book may be useful for specialists studying questions of environmental protection and the mechanisms of the influence of incorporated radioactive nuclides on living organisms and engaged in setting standards for radioactive substances, etc.

Thirty-eight figures, 38 tables, 251 references.

Introduction

Carbon is one of the most important biogenic elements. It plays an important role in all forms of life and participates in most biological, biochemical and biogeochemical processes occurring on earth; it is the structural basis of all organic material. Because of this the radioactive isotopes of carbon which enter the environment and above all the long-lived radioactive isotope, carbon-14 (^{14}C) may have a definite effect on the vital activities of all living organisms, including man.

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Carbon-14 is formed naturally in nature as the result of interaction of neutrons of cosmic origin with the terrestrial atmosphere. All living organisms contain some quantity of this "natural" ^{14}C . Only in the fifth decade of our century has the content and behavior of ^{14}C in nature become the subject of detailed investigation.

This interest in ^{14}C stems from the fact that a new artificial source of formation of this isotope has appeared--nuclear explosions set off in the atmosphere. Nuclear tests have resulted in the ^{14}C content in living matter having doubled. The substantial increase in the amount of ^{14}C in living organisms has raised for investigators the question of the possible dangerous consequences of such an increase, including the remote after-effects influencing many generations of people.

The fact is that ^{14}C entering the composition of genetic structures of organisms may as the result of radioactive decay provoke undesirable changes in the genetic codes both as the result of beta-radiation and nuclear transformation of ^{14}C to ^{14}N . Model experiments have shown that there is a certain genetic effect associated with the entry of ^{14}C into the genetic apparatus of living organisms. This question, however, has still not been sufficiently studied.

The treaty banning nuclear tests in the atmosphere, in outer space and underwater signed in Moscow in 1963 has resulted in a sharp reduction in the entry of artificial "bomb" ^{14}C into the atmosphere. As a result of this its content in the substances of the biosphere should gradually approach that equilibrium level which existed on earth at the beginning of the 20th century. The rate of this decrease is determined by the natural processes of cycling substances and the half-life of ^{14}C .

Explosions of nuclear devices is not the only source of artificial ^{14}C . Since the beginning of the mastery of nuclear energy by mankind yet another source for the entry of artificial ^{14}C into the biosphere has appeared: research, industrial, energy and transport nuclear reactors.

The decrease in oil and gas resources, which are now increasingly viewed not only as fuel but as material for the chemical industry, the necessity of long-distance transportation of mineral materials from the place of extraction to the consumer nations, pollution of the environment by the wastes of thermal power stations, the political aspects associated with the fuel problem and, as a result, the acute energy crisis in the developed capitalist countries which has emerged recently--all of this makes it necessary to search for new sources of energy. Most promising in this direction are atomic power stations (AES). The development in this branch of energy has now reached such a level that the cost of electric energy generated at AES is no higher (and at large AES even lower) than at thermal power stations operating on mineral fuel. The largest capitalist countries--the USA, the FRG, Great Britain, Japan, Canada and others--are carrying out wide programs of AES construction. It is also planned to put a large number of new AES into operation in the Soviet Union and the other socialist countries.

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AES have a number of advantages in comparison with traditional sources of electric energy; therefore their construction in certain regions of the USSR is economically justified. Moreover it should be noted that at present the reliability of atomic technology is such that AES are essentially the "cleanest" energy source in terms of pollution of the environment with harmful substances.

In the past two decades the total quantity of ¹⁴C discharged from all nuclear reactors was small in comparison with the quantity of bomb ¹⁴C. For this reason the contribution of "reactor" ¹⁴C is not taken into account in examining the global radiocarbon problem. The vigorous development of nuclear energy, however, is changing this situation.

The uninterrupted growth of the capacities of operating AES will result in a significant increase in the quantity of ¹⁴C discharged into the atmosphere and surface waters or accumulated in the nuclear reactors of the AES. The effective recovery and burial of ¹⁴C, which has a long half-life (the period of half-decay equals 5760 years) is a very difficult action.

Thus, as new AES are put into operation the global level of ¹⁴C in biological substances will increase. The appearance of local regions near large AES with increased concentrations of this isotope in the environment is possible.

The chief objective of this book is to trace the behavior of ¹⁴C in the environment. The book examines methods of formation of ¹⁴C, its distribution and accumulation in substances of the biosphere, including the human organism. Possible mechanisms of the biochemical radiation effect of ¹⁴C on living organisms is considered. The problems of setting standards discharge of ¹⁴C from individual sources is examined. In this connection methods of control of discharge of ¹⁴C at AES and current methods for measuring samples with low specific activity are examined in detail.

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PUBLIC HEALTH

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STUDY SHOWS PESTICIDES A POTENTIAL GENETIC HAZARD

Kiev TSITOLOGIYA I GENETIKA in Russian No 3, 1979 pp 228-231

[Article by M. A. Pilinskaya and T. S. L'vova: "Results of a Cytogenetic Study of Population Groups in the Presence of Intensive and Limited Pesticide Use"]

[Text] Introduction. To evaluate the degree of genetic danger to the public from pesticides, which are recognized as one of the leading mutagenic chemical factors of the biosphere, one must have objective base information about the intensity of spontaneous mutagenesis among the population under the concretely existing conditions of environmental contamination.

Such information can be obtained on the basis of cytogenetic monitoring of human sub-populations for whom pesticides represent a predominant anthropogenic factor. To determine the relative contribution of pesticides to the mutagenic process and to preclude the influence of other environmental factors it is expedient to conduct comparative cytogenetic studies in various agricultural regions having substantial differences in the intensity of pesticide use with other conditions being equal.

One of the most practicable stages in a program of cytogenetic monitoring is control over the frequency of chromosome mutations in the somatic cells of representative groups of a population (1) living in zones of intensive and limited pesticide use.

We conducted such a cytogenetic study on the territory of two republics (screenings 1 and 2) in agricultural regions chosen by a group of specialists at the All-Union Scientific Research Institute of Hygiene and Toxicology of Pesticides, Polymers, and Plastics as a model for a study of pesticide effect on the population's health. Two zones were selected in each republic -- experimental and provisional-control zones which had similar natural, climatic, and socio-hygienic conditions, but which differed in intensity of pesticide use by a factor of three (first screening) or more (second screening). The results of the cytogenetic study obtained from the first screening have been published (2). This current work cites data on the

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frequency of chromosome aberrations in peripheral blood lymphocytes of persons living in zones of the second screening.

Material and Methods. The cytogenetic study was conducted in two centers of population located at a distance of 75 kilometers from each other and specializing in different agricultural products; as a result, there was a substantial difference both in the intensity of pesticide consumption and in the level of environmental contamination. About 20 pesticide preparations were used in the test zone: among them stable chlorocarbon compounds constituted the highest proportion by volume, frequency, and duration of application. The main method of chemical application was aerial; in a number of cases this promoted contamination of environmental objects, especially during and immediately after pesticide application. In the control zone the centralized use of pesticides was limited in nature, however, their use on private plots was not precluded.

The selection of a representative group for the cytogenetic study was governed by a number of factors. On the one hand, such a study, especially under field conditions, can be conducted more conveniently among organized contingents among whom the possible effect of probable mutagens (including-production contact with the pesticides) is reduced to the minimum. Children's contingents meet this condition best. On the other hand, the need to obtain reliable data through questionnaires, as well as a sufficient amount of blood for cytogenetic analysis increases demands on the age of the persons to be studied. With consideration for all these conditions we chose groups of essentially healthy teenagers of both sexes ages 15 to 17 who had lived in the specific locality since birth and who denied any conscious contact with any mutagenic agents. The number of persons studied in each of the groups met the essential requirements and constituted a representative selection (23 persons) (3). According to the sampling, the group of teenagers who live in the test zone were periodically involved in temporary agricultural work, however, contact with pesticides was not demonstrated here.

The level of chromosome aberrations was established in peripheral blood lymphocytes.

Blood samples were taken simultaneously in all groups of persons studied in 6 months after pesticide application ended before the beginning of the new season for pesticide use. The generally accepted method of blood culturing and preparation of chromosome specimens was somewhat modified by us for the simultaneous seeding and fixing of a large number of cultures. The principle of calculating chromosome aberrations was identical to that described previously (2).

The cytogenetic analysis was made on the encoded preparations. In one subject we analyzed 100 metaphases which meet the necessary requirements (3). In all, 4,600 metaphases were analyzed. The data obtained were processed statistically.

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Results and Discussion of the Research. As may be seen in Table 1, we obtained from the chromosome analysis the following basic cytogenetic indicators which differ positively ($\chi^2=17.02$; $R<0.01$): the average frequency of metaphases with aberrations was 7.35 and 4.48; the number of aberrations per cell studied was 0.088 and 0.061; the number of individuals containing over 2 percent aberrant metaphases was 91.3 and 78.3 percent (for test and control zones, respectively).

Table 1

Basic Quantitative Cytogenetic Indicators in Test and Control Zones in the Second Screening

1. Зона	4. Среднее значение частоты aberrантных метафаз, проц.	5. Размах индивидуальных колебаний в группе, проц.	6. Число aberrаций на одну метафазу		9. Количество индивидов, содержащих 2% метафаз с aberrациями, проц.
			7. исследованную	8. aberrантную	
2. Опытная	7,35±0,54	1÷14	0,090	1,19	91,30
3. Контрольная	4,48±0,43	1÷9	0,061	1,37	78,27

- | | |
|---|--|
| 1. Zone | 6. No. of aberrations per metaphase |
| 2. Test | 7. Tested |
| 3. Control | 8. Aberrant |
| 4. Average value of frequency of aberrant metaphases, % | 9. No. of individuals containing 2% metaphases with aberrations, % |
| 5. Scope of individual ranges in the group, % | |

A statistical analysis of the distribution of individuals by frequency of cells with aberrations has not made it possible to clearly determine its nature.

It may be seen from the data in Table 2 that the majority of aberrations in both zones was represented by solitary and paired acentric fragments which were encountered with great frequency in the zone of intensive pesticide use (7.69 and 5.74 per 100 metaphases studied for the test and control zones, respectively). The frequency of chromatid and chromosome interchanges and their ratio to all aberrations were also certainly higher in the test zone. Predominant among the interchange aberrations were chromatid translocations and dicentric chromosomes, the overall frequency of which was 1.09 and 0.39 per 100 cells studied (for the zones with intensive and limited pesticide use, respectively).

The distribution of breaks identified by chromosome groups in both zones was random in nature. There was definite interest in one of the cultures in the test zone in which there was observed an intensification of secondary

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constriction in homologues of group C (9th or 11th pair) and group E (17th pair) chromosomes and an instability of those very chromosomes in which six of the eight recorded breaks were located. Probably, this case can be related to an individually caused tendency toward breaks of a number of autosomes at a specific point (6).

Table 2

Frequency and Percentage of Basic Types of Chromosome Aberrations in Test and Control Zones of the Second Screening

1. Типы aberrаций	10. Количество aberrаций			
	на 100 исследованных метафаз 11.		проц. от общего числа aberrаций 14.	
	12. Опытная зона	13. Контрольная зона	12. Опытная зона	13. Контрольная зона
2. Хроматидные				
3. Одночные фрагменты	5,34	3,39	60,89	55,32
4. Хроматидные обмены	0,39	0,09	4,45	1,42
5. Всего	5,73	3,48	65,34	56,74
6. Хромосомные				
7. Парные фрагменты	2,35	2,35	26,73	38,30
8. Хромосомные обмены	0,69	0,30	7,92	4,96
5. Всего	3,04	2,65	34,65	43,26
9. Всего aberrаций	8,78	6,13	100,00	100,00

- | | |
|---------------------------|-----------------------------------|
| 1. Types of Aberrations | 8. Chromosome interchange |
| 2. Chromatid | 9. Total aberrations |
| 3. Single fragments | 10. No. of aberrations |
| 4. Chromatid interchanges | 11. per 100 metaphases studied |
| 5. Total | 12. Test zone |
| 6. Chromosome | 13. Control zone |
| 7. Paired fragments | 14. % of total no. of aberrations |

In the evaluation of the results obtained, attention is drawn to the fact that in the control zone the overall frequency of certain types of chromosome damage substantially exceeds the average population level (3), while the percentage ratio of various types of aberrations on the whole does not differ from average population indicators.

Several proposals, not one of which can as yet be taken as conclusive, can be set forth to explain the data obtained. In particular, it was not precluded that pesticides used on private plots or pesticides which entered the body on food products which are in part imported from other regions of the republic could have had a specific effect in the control zone.

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Nonetheless, the presence of a certain difference among cytogenetic indicators obtained in both zones indicates the more pronounced effect of the mutagenic factor (or group of factors) in the test zone.

It can be assumed with a great degree of probability that the increase in the level of spontaneous chromosome mutations in the teenagers studied in the test zone is the result of intensive pesticide use in the region of the specific center of population.

This established cytogenetic effect should be viewed as an unfavorable sign indicating the possibility of an increase in the frequency of pathology having a genetic component in the zones studied.

The data obtained confirm the need to conduct cytogenetic studies of groups in contact with pesticides, inasmuch as the results of such studies present the possibility of coming closer to a real evaluation of the degree of genetic danger to man from pesticides and to the possibility of predicting it: this, as you know, is a necessary prerequisite for carrying out prophylactic measures.

Conclusions. We made a cytogenetic study of two groups of teenagers of both sexes who lived in zones with intensive and limited pesticide use. As the result of chromosome analysis we detected a statistically significant difference between basic quantitative cytogenetic indicators obtained in the test and control zones. The established cytogenetic effect indicates the pronounced effect of the mutagenic factor and must be viewed as an unfavorable sign from the viewpoint of the possible origin of genetically based pathology.

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SCIENTISTS AND SCIENTIFIC ORGANIZATIONS

UDC 576.343

TIMELY PROBLEMS OF THE BIOCHEMISTRY OF PEPTIDE-PROTEIN HORMONES

Moscow BIOKHIMIYA in Russian No 6, 1979 pp 1145-1147

[Article by A. A. Bulatov]

[Text] The symposium "Biosynthesis, Structure, Function and Mechanisms of Action of Peptide-Protein Hormones," organized by the Institute of Experimental Endocrinology and Chemistry of Hormones of the USSR Academy of Medical Sciences, was held in Moscow in November 1978. Approximately 180 specialists from different scientific centers of the USSR and also 16 scientists from the socialist countries participated in the work of the symposium. A total of 27 reports was heard at 5 sessions and 11 test units on the most timely problems of the biochemistry of peptide-protein hormones were presented.

In his introductory speech, the chairman of the organizing committee of the symposium Academician of the USSR Academy of Medical Sciences N. A. Yudayev emphasized the basic nature of hormone research for understanding the biomechanical mechanisms of regulation of the main functions of the organism from the moment of its birth until old age. Evaluating the development of the biochemistry of hormones in the historical aspect, he pointed out that accumulation of knowledge in this field did not occur uniformly. Approximately 40 steroid compounds were separated from different endocrine glands during the 1930's-1940's and their chemical structure was established. These compounds were then synthesized chemically and very rapidly found extensive application in clinical practice. Significant success has been achieved during the past few years in the study of the molecular mechanisms of the effect of steroid hormones. Specifically, proof of the capability of steroid hormones acting on the genes is undoubtedly one of the important discoveries in the biology of our time. Study of the more complexly structured peptide-protein hormones proceeded much more slowly. However, these investigations began to develop vigorously during the past 10-15 years. The hormones of the hypothalamus, hypophysis and other endocrine glands were isolated in pure form and the chemical structure of most of these hormones was deciphered within a short time interval. Some of them were produced by chemical synthesis. Essentially new data were obtained on the biochemical mechanisms of the action of peptide-protein hormones, including their reception in the target cells and the role of cyclic nucleotides as

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intracellular mediators of the hormonal effect. Synthesis of somatostatin on synthetic DNA, introduced into a bacterial cell as a plasmid, is found in a number of the most important advances of modern biological science. Peptide compounds which repeat the structure of known hormones or are fragments of them are found in brain tissue and apparently play an important role in brain activity. At the same time, N. A. Yudayev turned attention to the fact that, despite the great step forward in the study of peptide-protein hormones, primarily their chemical structure, we know little about the biochemical relationships of these hormones to the numerous processes in the living organism. We are also still far from understanding the molecular bases of the pathogenesis of many severe diseases related to disruptions of biosynthesis or the mechanism of action of these hormones. These diseases, specifically, include sugar diabetes, distribution of which has acquired social significance.

The Vice-President of the USSR Academy of Medical Sciences, Academician of the USSR Academy of Medical Sciences A. M. Chernukh, who emphasized the important significance of fundamental and theoretical research for development of medicine, pointed out the primary importance of the problems discussed at the symposium in his greeting to the participants of the symposium.

According to modern concepts, the mechanism of action of protein hormones includes a chain of reactions in which the receptor, adenylate cyclase, sAMR and proteinkinase participate during the initial stage. Three reports presented from the laboratory headed by N. A. Yudayev (Moscow) were devoted to study of the initial stages of the biochemical mechanism of the action of corticotropin (AKTG) and the luteinizing hormone (LG). The mechanisms of the participation of sAMR and sAMR-dependent proteinkinase in the steroidogenic and trophic action of ACTH on the adrenal glands were considered in one of them (N. A. Yudayev and S. A. Afinogenova et al). The basal and ACTH-stimulated activity of adenylate cyclase and also the sAMR and sGMR in the tumorous tissue of the adrenal glands and hyperplased glands were studied. The derived data indicate that the hyperfunction of the adrenal glands and disruption of gland regulation may be related to a change in the state of adenylate cyclase. Disruption of hormonal regulation of the adenylate cyclase system is also shown in tumors. N. A. Yudayev and M. A. Krekhova studied the effect of ACTH and of dexamethasone on formation of sAMR and corticosterone in the adrenal glands of normal and hypophysectomized rats. A hypothesis is advanced about the presence of a mechanism in the adrenal cortex which regulates the activity of the adenylate cyclase system by endogenous corticosteroids and which acts by the principle of short negative feedback. The results of investigating the relationships between tropic hormones (ACTH and LG), steroid genesis and sAMR and biosynthesis of prostaglandins were reported in the third report (M. K. Chekhranova et al). The participation of prostaglandins in the mechanism of action of tropic hormones was found and it was shown that the opposite nature of the action of some prostaglandins on the corpus lutea of rat ovaries is determined by their effect on sAMR formation.

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L. Makho and M. Fitskova (CSSR) established in experiments on rats that the reaction of fatty tissue to ACTH and insulin is reduced with age and that the cause of reduced lipolysis in old animals is reduction in stimulation of sAMR synthesis in the fatty cells.

The amino acid sequences of corticotropin, β -lipotropin and prolactin of different species of animals, studied at the Institute of Experimental Endocrinology and Chemistry of Hormones of the USSR Academy of Medical Sciences were considered in the report of Yu. A. Pankov (Moscow) and the main features of the structural and functional organization of protein hormone molecules were formulated on their example. A report was given on the method of quantitative analysis, developed at the institute, of local affinity in amino acid sequences of related proteins by using a computer which made it possible to determine sections which perform a different function in their mechanism of action in the peptide chains of hormones. Several other communications on the study of the primary structure and the structural and functional relationships of protein hormones were presented from the laboratory headed by Yu. A. Pankov. Thus, A. A. Bulatov et al presented data on the structural and functional organization of the growth hormone. They established a 90 percent amino acid sequence of the growth hormone of the sei whale, constructed of 190 amino acid residues, and they studied the functional significance of individual sections of its molecule. Yu. M. Keda et al, as a result of universal investigation of the biological action of tetradecapeptide synthesized at the institute, which corresponds to the sequence of 31-44 human growth hormones, concluded that this section of the molecule may be an effective beginning in manifestation of the fat-mobilizing effect of the growth hormone. The prospects for using mathematical methods of comparing the primary structure of protein hormones were demonstrated in the report of V. I. Pozdnyakov and Yu. A. Pankov (Moscow).

G. Kokhman, K. Kokhman and Ye. Domanski (Polish Peoples Republic) talked about the drop of biological activity and variation of antigen properties of prolactin after modification of tryptophan residues.

Reports concerning different aspects of the problem of releasing factors were heard at one of the symposium sessions. N. A. Yudayev, Z. F. Utesheva and T. Ye. Novikova (Moscow) summarized some results of investigations on isolation, purification and study of the properties of compounds of the hypothalamus which regulate the secretion of the growth hormone and prolactin. They isolated highly purified preparations of the stimulator of growth hormone secretion and the inhibitor of the release of prolactin from bull hypothalami and established their difference from other hypothalamic regulators by physicochemical and biological properties. The different aspects of the biological action of somatostatin were reported in the report of Oscar Mateo de Acosta (Republic of Cuba) and V. P. Fedotov (Moscow). It is shown that an inhibiting effect on secretion of the thyrotropic hormone, the growth hormone and insulin, stimulated by different factors, is inherent to this hormone and that the blocking effect of somatostatin is at least partially related to action on sAMR. K. Kokhman, G. Kokhman and Ye. Domanski (Polish

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Peoples Republic) investigated the biosynthesis of luliberin in the hypothalamus of rats in vivo and concluded that the ribosomes participate in the process of hormone biosynthesis. A group of investigators from the Hungarian Peoples Republic (M. Fekete et al) reported interesting data on the effect of the thyrotropin-releasing factor and its analogs on the level of the neurotransmitters of the brain and of the hypophyseal-adrenal gland function.

Sh. T. Milcu (Hungary) reported on producing a peptide with antisteroid effect from the epiphysis and O. N. Zryakov (Kiev) reported on the inhibiting and stimulating factors of the epiphysis of a peptide nature and which regulate the biosynthesis and secretion of prolactin.

G. Telegdi and G. Kovach (Hungarian Peoples Republic) reported on the effect of ACTH, vasopressin and oxytocin on the behavior of rats and the metabolism of mediators in the brain.

A significant part of the reports was devoted to insulin. Ye. Ye. Makarovskaya (Moscow) presented a paper of a group of investigators headed by N. A. Yudayev on production of matrix RNA translated in a noncellular system from wheat embryos into insulin-like peptides, from the pancreas of rabbits and human insulin. H. Zulke et al (German Democratic Republic) in a report "The Biosynthesis of Insulin -- the Current State of the Art and Prospects," talked about the results of their own investigations which indicate that disruption of insulin biosynthesis in sugar diabetes may occur at both the level of transcription and translation. The different forms of insulin and of "insulin-like activity" circulating in the blood, their origin and properties were analyzed in a report of L. K. Starosel'tseva (Moscow). A. V. Natarov, B. V. Aleshin et al (Khar'kov) devoted their report to some aspects of the effect of insulin on the mechanisms of regulating the neurosecretory function of the hypothalamus.

A great deal of attention was devoted at the symposium to the biochemical bases for the occurrence and development of some severe endocrine diseases. Ya. Kh. Turakulov et al (Tashkent) studied polyribosomes which synthesize thyroglobulin in the cells of the thyroid gland and the scope of population under normal conditions and during thyroid pathology. According to their data, changes in the content of thyroglobulin with different forms of thyroid pathology are determined primarily by changes in the amount of mRNA for thyroglobulin and by changes in the number of thyroglobulin polyribosomes. A. S. Yefimov et al (Kiev) established a decrease in binding of insulin by specific receptors of the plasmatic membranes of fatty cells in humans with hypercarticism. The subject of the report of H. Wibergeil et al (German Democratic Republic) was regulation of glucagon secretion by the pancreas under conditions of prolonged glucose infusion during latent and explicit diabetes. New data which merit attention were reported by investigators from the Peoples Republic of Bulgaria on lactorrhea and prolactin secretion during acromegaly (E. Bozadzhiev et al) and on secretion of renin during diabetes insipidus (G. Kirillov and V. Ankov). B. Schultz et al (German

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Democratic Republic), studying the secretion of insulin and the sensitivity of substratutilizing tissues to insulin in persons of normal weight with nonsymptomatic sugar diabetes, established that not only the affliction of β -cells, but also disruption of peripheral sensitivity to insulin are of significance in development of disruptions of tolerance to carbohydrates.

On the whole, the symposium enriched the participants with new information and contributed to development of optimum paths for further investigations on the biochemistry of peptide-protein hormones.

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GALINA VASIL'YEVNA PUSTOVOYT

Moscow SELEKTSIYA I SEMENOVODSTVO in Russian No 3, 1979 p 7

[Article commemorating the 70th birthday of G. V. Pustovoyt]

[Text] Galina Vasil'yevna Pustovoyt -- the leading selection specialist of the country on sunflowers, doctor of agricultural sciences, head of the selection laboratory and first sunflower seed grower of the All-Union Order of Lenin and Order of the Red Banner of Labor Scientific Research Institute of Oil Crops imeni V. S. Pustovoyt -- celebrated her 70th birthday in March and 48 years of scientific and production activity.

By education the selection specialist and seed grower is a phytopathologist, but Galina Vasil'yevna has subsequently combined these two specialties very successfully in practical work (during the first 20 years of labor activity). Working with sunflowers, she began in the position of junior scientific worker and first assistant to her father -- the prominent scientist Vasilii Stepanovich Pustovoyt. A new dangerous disease of sunflowers -- downy mildew -- appeared during those years in the Kuban'. It infected all varieties of this important oil crop. Conducting a phytopathological analysis of more than 40 wild species of sunflowers and having established the genotypic immunity to the main pathogenic agents of sunflowers in the hexaploid group of species, Galina Vasil'yevna selected a difficult but the only correct path -- to use them as donors of resistance to downy mildew and other diseases.

Examples of overcoming the failure to cross and infertility of Topinambur sunflower hybrids and the method and scheme of selecting them were developed within a short time. And as a result initial material was developed for the first time in selection practice which has complex immunity to 9 pathogenic agents: downy mildew, broomrape, rust, verticilliose, powdery mildew rot, phomosis, alternaria spot, leaf-curling plum aphid and sunflower moth. A population of interspecific hybrids which combines complex immunity, high oil content (close to the biological maximum) (57-60 percent) and yield of seeds (up to 30-35 qt/ha) was also produced.

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The first interspecific hybrid Progress has been regionalized since 1978 (one of the first authors of which is G. V. Pustovoyt) with total resistance to downy mildew, downy mildew rot, verticilliose wilt, sunflower moth and broomrape. Two new varieties -- Oktyabr' and Yubileyny 60, resistant not only to downy mildew, but also to new races of broomrape, were turned over the same year for state strain testing.

G. V. Pustovoyt also heads the work on selection and primary seed growing of population varieties of VNIIMK. She is the co-author of many regional varieties. Among them are improved Peredovik, improved Smena, improved VNIIMK 8931, improved VNIIMK 8883, improved VNIIMK 6540, Salyut and the interspecific hybrid Progress. The area occupied by these varieties comprises more than 2.5 million ha.

Galina Vasil'yevna participates most actively in social life, in training postgraduate specialists in sunflower selection and seed growing and in measures to introduce the achievements of selection into production. She was awarded the orders of the Red Banner of Labor and "Badge of Honor" and the medal "For valorious labor. In honor of the 100th anniversary of V. I. Lenin's birth" and one of the higher orders of the Socialist Republic of Rumania for achievements in the field of sunflower selection and seed growing.

Galina Vasil'yevna was the first to be awarded the Gold Medal imeni Academician Vasilii Stepanovich Pustovoyt for developing methods of interspecific hybridization of sunflowers and development of valuable initial material and high-yielding varieties having immunity to the most dangerous diseases and pests.

Galina Vasil'yevna Pustovoyt was awarded the Order of Lenin for her important services in the field of sunflower selection and seed growing and with regard to her 70th birthday.
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SECOND ALL-UNION CONFERENCE ON PROBLEMS OF BIOMECHANICS

Riga MEKHANIKA KOMPOZITNYKH MATERIALOV in Russian No 3, 1979 pp 560-563

[Article by I. V. Knets]

[Text] The Second All-Union Conference on Problems of Biomechanics was convened in Riga, from 18 to 20 April 1979, at the initiative of the scientific council for problems of biomechanics of the USSR Academy of Sciences, Latvian Academy of Sciences and Latvian Ministry of Health.

A total of 367 papers by Soviet scientists and 19 by foreign ones was selected by the organizing committee for presentation at the conference. All of the papers were referable to 54 different topics, on each of which a survey paper was delivered. In making its selections, the organizing committee gave preference to papers dealing with basic or applied problems, of practical importance, in biomechanics.

Four review papers were delivered at the first plenary session. The paper of V. K. Kalnberz discussed pressing problems of medical biomechanics related to the use of compression-distraction equipment for treatment of bone deformities, osteosynthesis and restoration of articular functions. In his paper, V. I. Shumakov offered a comprehensive analysis of the current status of development of an artificial heart, different methods of supplying it with nutrients and of control, as well as evaluation of biomechanical properties of the circulatory system for the purpose of refining the design of the artificial heart. The paper of G. A. Lyubimov dealt with a new and rapidly developing branch of biomechanics, mechanics of respiration. Studies were made of the main problems related to development of an effective mathematical model of respiration, and the influence of mechanical properties of respiratory organs on biomechanics of the respiration process was evaluated. The paper of A. P. Gromov presented the main aspects of biomechanics of trauma to the head, an evaluation of the influence of both mechanical and morphogeometric properties of the skull on the nature of injuries it sustains.

Six survey papers were delivered on basic problems of biomechanics of compact bone tissue. In the paper of I. V. Knets, deformation and destruction

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of compact bone were discussed from the standpoint of mechanics of a deformable solid, with evaluation of the degree of anisotropism and physical nonlinearity thereof; it also dealt with questions of viscoelastic behavior of bone tissue and analysis of the role of the piezoelectric effect in bone. The paper of Ye. P. Podrushnyak dealt with general aspects of aging of bone tissue and related process of morphological and biomechanical changes in bone. In his paper, G. P. Pfafrod evaluated the influence of various factors, including diminished circulation, weightlessness and irradiation, on mechanical properties of human and animal bone tissue. The paper of S. S. Tkachenko dealt with pressing problems of formation of regenerated bone in fusion of fractures and evaluation of the influence of electrical polarization and local mechanical vibration on this process; he also analyzed the degree of change in acoustical and mechanical properties of bone with regeneration. The paper of A. K. Muyzhulis dealt with complex problems of biomechanics in the treatment of fractures by internal osteosynthesis, evaluation of allogenic and xenogenic bone posts and steel immobilization devices. I. K. Vilki discussed comprehensively in his paper the biomechanical problems that arise during the rehabilitation period. They are related to teaching correct walking, compensation for a motor defect and optimization of control of movements.

Six survey papers were delivered on biomechanics of endoprostheses. The paper of Kh. A. Yanson discussed general biomechanical aspects related to endoprosthetics, with analysis of the possibility of using crystal dielectrics as biological construction material for endoprostheses. The paper of Ya. M. Shersher evaluated the durability and strength of endoprostheses of various articulations. The paper of Ya. B. Kuzenok dealt with evaluation of the location, shape and orientation of different bone elements in an articulation by means of roentgenography. V. S. Shargorodskiy analyzed, in his paper, the main biomechanical principles involved in treating articular pathology of the lower limb. Such pressing problems were discussed as determination of biomechanical criteria of restoration of knee joint functions as related to method of plastic surgery on ligaments and hip joint following arthroplastic surgery. The paper of T. A. Revenko dealt with various statodynamic parameters in the presence of orthopedic pathology and trauma to the lower extremity. B. S. Rozenshteyn submitted the general biomechanical criteria of standing and walking after providing endoprostheses for the knee or hip joint, and he evaluated the electrical activity of femoral muscles after fitting an endoprosthesis for the knee joint according to Sivash.

Three survey papers were delivered on biomechanics of the spine. V. Ye. Raykhinshteyn surveyed the data on deformation and destruction of spinal elements, vertebrae, intervertebral disks and spinal cord meninges. Analysis was made of statics and dynamics of intervertebral disks when submitted to different loads, with evaluation of the bearing capacity of the human spine and vertebrae. The paper of Ya. L. Tsiv'yan submitted the results of biomechanical assessment of mechanogenesis of the spine and discussed problems of treatment of posttraumatic and degenerative deformities thereof. Biomechanical criteria were proposed for the choice of optimum variant of osteoplasty of the spine. The paper of V. Ye. Belen'kiy dealt with questions

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of biomechanics of mechanogenesis and problems of treatment of scoliosis, including biomechanical substantiation of operations on intervertebral disks and vertebrae in the presence of scoliosis.

Two survey papers discussed new models of biological systems and investigative methods in biomechanics. A. S. Vitenzon described the principles of physical modeling of elements of a pathological gait; he submitted a model of electrical resistance of bone tissue; he made an evaluation, from the standpoint of biomechanics, of spinal lesions and discussed the functions of the foot. The paper of R. A. Gurevich discussed questions of examining biomechanical properties of human lower extremities by methods of vibration tests and ultrasonic probing, measurement of pressure between bone fragments, increasing the informativeness of statographic studies and use of quantitative electromyography.

One survey paper was concerned with general biomechanical problems in zoology. The speaker, S. F. Manziy, made a comprehensive analysis of the distinctions of deformity and destruction of bone tissue, ligaments and muscles of animals; he called attention to the statolocomotion distinctions of the locomotor system of terrestrial vertebrates, and he evaluated the patterns of ontogenetic changes in structure of animal bone tissue.

Ten papers were delivered on mechanics of soft biological tissues and substitutes thereof. In his interesting survey of mechanics of skeletal muscles, L. V. Nikitin discussed various mathematical models of muscles; he analyzed muscular deformity as related to activation thereof, and he evaluated its viscoelasticity. There was separate discussion of artificial muscles. The paper of V. I. Vorob'yev dealt with biomechanical problems related to the structure and mechanical properties of one of the main components of biological tissues, collagen; in particular, an assessment was made of the influence of its structural organization on the mechanical behavior of a collagen fiber. The paper of Yu. Zh. Saulgozis dealt with the distinctions of deformity of the skin, sclera and other types of soft tissues, as well as analysis of the effects of different mechanical conditions on regeneration of soft biological tissues. R. P. Kikut discussed biomechanics of arteries and tissues of the brain, paying special attention to thrombus formation in arteries of the brain. V. V. Dzenis not only made a comprehensive analysis in his paper of the distinctions of passage of ultrasound through soft biological tissues, but submitted some interesting data on the use of ultrasound to define the characteristics of coxarthrosis and fractures of the long bones of the lower extremities. V. A. Kas'yanov described in detail the distinctions of mechanical behavior of large blood vessels. He submitted some rather general mathematical models of these vessels, which describe deformity thereof in the presence of diverse mechanical factors, and he submitted extensive experimental material. The paper of V. Ya. Izakov offered an analysis of general problems of myocardial mechanics; in particular, he described mathematical modeling of myocardial contractions, viscoelastic behavior of the myocardium and mechanical properties of the ventricular walls. The interesting paper of N. B. Dobrova dealt with

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problems of practical importance referable to investigation of distinctions of mechanical behavior of cardiac valves and development of prostheses thereof; an integral evaluation was made of hydrodynamic indices of valves, and the dynamics of their function were analyzed. The paper of B. A. Purini dealt with the choice of blood vessel substitutes; she discussed the possibility of using autologous tissue, xenotransplants and synthetic prostheses to replace damaged vessels. The paper of I. A. Movshovich and N. S. Gavryushenko assessed the role of an aggressive biological environment on mechanical properties of various polymer implants; these authors submitted a mathematical model of implant destruction in the bioenvironment, and they assessed the strength and antifriction properties of biologically neutral [inert] thermoplasts for articular endoprostheses.

Five papers were delivered on the subject of mechanical properties of biological fluids and problems of biological mass exchange. V. A. LevtoV analyzed comprehensively the distinctions of aggregation and orientation of erythrocytes; he compared the viscosity of blood of healthy and sick individuals; he assessed the influence of additives on dynamic indices of circulation and discussed the flow of synovium through a capillary at different rates. The paper of V. M. Zaiko was concerned with hydrodynamics of circulation. A comprehensive scrutiny was made of digital modeling of movement of blood through cavities with irregular geometry and in a tube with deformable walls; experimental data were submitted on flow in the venous system. Problems of biomechanics of microcirculation were discussed in the paper of S. A. Regirer; he made a comprehensive survey of the current status of this question and analyzed a number of questions, such as mathematical modeling of a myogen-active blood vessel, investigation of isometric contractions of smooth muscles and modeling of vascular tonus. The paper of M. A. Khanin dealt with modeling of the vascular system and evaluation of peripheral vascular resistance. V. N. Akimov analyzed problems related to extracorporeal biological mass exchange, mainly with extracorporeal circulation.

A total of 12 papers was delivered on biomechanics of movement of man and animals. V. V. Beletskiy described new principles of modeling walking on two legs; he discussed control of the inertial leg at the phase of transfer and parametric optimization of biped walking. The paper of Ye. A. Devyanin dealt with modeling of walking on six legs; he also evaluated the distribution of efforts in the legs of the locomotion system and analyzed the use of a range finder to control a walking robot moving in a complicated area; he also described a mock-up of an integral walking machine. The paper of M. V. Kudryavtsev described the results of experimental studies of human and animal locomotion; he evaluated the dynamics of movement by means of a special measuring and computing complex, and he discussed the distribution of bearing reactions in a system of the exoskeleton type. The paper of A. Ye. Kobrinskiy was devoted to the biomechanics of work movements, questions of maximum endurance of loads on the body of a person using a safety belt, mobility of human hands, refinement of precision movements of adolescents through training. V. M. Zatsiorskiy considered problems of biomechanical analysis of human locomotion, and he evaluated the radioisotope method of defining the biomechanical characteristics of segments of the human body.

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V. K. Bal'sevich evaluated exogenous and endogenous determination of parameters of development of locomotor systems in ontogenesis of man, as well as the characteristics of integral criteria for evaluation of level of goal achievement in athletic movements. The paper of A. N. Laputin dealt with development of technical means of forming movements, including automated control in instruction on motor conditioning of athletes. I. M. Kozlov discussed the distinctions of muscular activity in different sports-related movements. I. P. Ratov offered a distinct formulation of principles involved in control of athletes' movements; he discussed spectral analysis of movements and modeling of processes of controlling movements referable to human biomechanical elements. The paper of V. T. Nazarov dealt with synthesis of sports movements and vibrostimulation of muscles in training athletes. F. K. Agashin discussed wave biomechanics and evaluated training on biomechanical stands. The paper of the Polish scientist, E. Marynyak, dealt with general questions of mathematical modeling in biomechanics of movement; in particular, he submitted the results of estimating the dynamic properties of a man jumping with a closed parachute.

Five papers were concerned with biomechanics of prosthetics. Yu. V. Kurochkin described the biomechanical aspects of standing and walking under normal conditions and in the presence of various pathological deviations; he submitted biomechanical criteria of effectiveness of surgical management of children with congenital dislocation of the hip; he analyzed the distinctions of statics and kinematics of patients with compression fractures of the spine. The paper of V. I. Filatov dealt with kinematics of both the upper extremity and a prosthesis thereof; he describe the theoretical prerequisites for developing systems for controlling multifunctional prostheses of the hands, and he evaluated the use of a kineplastic tunnel in such control systems. The paper of I. A. Mendelevich discussed biomechanical aspects of designing prostheses and measuring devices, including means of normalizing functional properties of the knee joint of a femoral prosthesis and rolling articulating surfaces as a means of strengthening the joint. V. A. Berdnikov dealt with prosthetics following amputation of the lower extremities and analysis of biomechanical schemes of prosthesis construction. I. Sh. Moreynis discussed statics and kinematics in man after fitting a prosthesis; he evaluated the stability of man's orthograde position under normal conditions and with a prosthesis; he examined the influence of normalizing the position of the OTsM [center of mass] on the results of fitting a prosthesis.

At the end of the conference, there were meetings of all five sections of the scientific council for biomechanical problems of the USSR Academy of Sciences, which discussed the results of the conference and offered suggestions for improving the work of the conference in the future.

At the concluding plenary session, a brief opinion about the papers delivered in the fields of their sections was offered by the following: V. S. Gurfinkel', doctor of medical sciences, chairman of the section of biomechanics of processes of control and regulation of biological systems; I. V.

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Knets, doctor of engineering sciences, chairman of the section of biomechanics of biological materials and systems; V. K. Kalnberz, corresponding member of the USSR Academy of Medical Sciences, chairman of the section of medical biomechanics; V. I. Filatov, doctor of medical sciences, chairman of the section of biomechanics of substitutes of biological tissues, organs and systems; and V. T. Nazarov, doctor of pedagogic sciences, chairman of the section of athletic biomechanics. A decision was adopted for broader deployment of research in the main directions of biomechanics.

Decision Adopted by the 2d All-Union Conference on Problems of Biomechanics

A total of 398 specialists, including 113 doctors and 176 candidates of sciences, participated in the work of the 2d All-Union Conference on Problems of Biomechanics. There were considerably more individuals who wanted to participate in the work of the conference. The survey papers delivered by the most prominent specialists of our country reflected the main achievements in various branches of biomechanics, both in the world in general and in our country in particular.

Substantial advances were made in the interval between the 1st and 2d All-Union conferences on problems of biomechanics (October 1975 to April 1979), with regard to investigation of the mechanical behavior of biological tissues, systems and fluids, research on processes of regulation of biomechanical systems, biomechanics of artificial tissues, organs and systems, medical biomechanics, analysis of control of movements in work and sports. There was an increase in number of dissertations and publications dealing with the main problems of biomechanics, as well as increase in practical importance of the proposed scientific projects.

With regard to the organizational aspect, the most important event was the foundation of the scientific council for problems of biomechanics under the USSR Academy of Sciences, which worked on defining the main directions of development of biomechanics, coordination of theoretical and experimental research. At the present time, research dealing with biomechanics is being conducted in more than 30 institutes of the USSR Academy of Sciences, USSR Academy of Medical Sciences and academies of sciences of Union republics, including those of the Ukraine, Latvia, Georgia and Armenia, 50 VUZ's of our country, 40 scientific research institutes of ministries of health of the USSR and Union republics, and others.

At the same time, the decision adopted by the First All-Union Conference on Biomechanics concerning inclusion of the specialty of "biomechanics" in the nomenclature of specialties of scientists has not yet been implemented; there is still no publication on biomechanics, and not enough specialists are still being trained in biomechanics at VUZ's of our country.

With the foregoing in mind, the conference recommends the following:

- 1) To deploy on an even broader scale research in the main directions of biomechanics, devoting attention mainly on complex [in collaboration] solutions

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to the most pressing theoretical problems and practical tasks; 2) to ask the state committee for science and technology under the USSR Council of Ministers to add the specialty of "biomechanics" to the nomenclature of specialties of scientific workers, which would aid in training highly qualified scientific personnel and thereby provide for a better quality of scientific projects they work on; 3) in view of the acute need for a publication on biomechanics, the office of the scientific council for problems of biomechanics, USSR Academy of Sciences, should be asked to consider the matter of possibility of publishing a specialized collection on biomechanics and to submit a request to management bodies for creating such a collection; 4) to ask the ministries of higher and specialized secondary education and ministries of health of the USSR and Union republics to support the initiative of our country's VUZ's with regard to training specialists in the main directions of biomechanics. [550-10,657]

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SCIENTISTS AND SCIENTIFIC ORGANIZATIONS

UDC: 611-018(092 Portugalov)

VIKTOR VALENTINOVICH PORTUGALOV

Leningrad ARKHIV ANATOMII, GISTOLOGII I EMBRIOLOGII in Russian No 5, 1979
pp 121-122

[Text] The 16th of February 1979 marked the 70th birthday and 50th year of scientific and pedagogic activities of Viktor Valentinovich Portugalov.

V. V. Portugalov began his morphological research on the chair of histology of Moscow State University, where he remained after graduating from the biological faculty in 1934. There he worked on problems of cytophysiology, studied the effects of hormones on growth and differentiation of tissular cells. For the first time in the world, he demonstrated amitotic division of the polyploid cell nucleus by the microcinematographic method. He participated in organizing the laboratory of scientific cinematography at the Scientific Research Institute of Zoology, Moscow State University. He designed and constructed a set of equipment for high-speed macro- and micro-cinematography. He made 15 scientific films, including those on development of ascarida, embryogenesis of mollusks, about cells and tissues, etc., which have been approved as educational aids in higher and secondary educational institutions.

From 1938 to 21 June 1941, V. V. Portugalov worked in the department of morphology of the All-Union Institute of Experimental Medicine (VIEM), under the supervision of the outstanding Soviet neurohistologist, B. I. Lavrent'yev; he was concerned with development of general problems of neurobiology: cytophysiology of the neuron, nerve fiber and vital microscopy. The annual VIEM prize was bestowed upon him in 1940 for his research and the scientific film, "The Living Nerve Cell." V. V. Portugalov conducted a number of investigations dealing with the structure of unmyelinated fibers of peripheral nerves, the findings of which were included in histology textbooks.

During the Great Patriotic War, V. V. Portugalov worked on problems of toxicology, physiology of military labor and aviation medicine. The data he obtained were used extensively in the practice of the artillery service, while his work in toxicology made it possible to give a new formulation of the question of effects of some neurotropic toxic agents. V. V. Portugalov

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is a pioneer in the field of investigation of the effects of accelerations on animals and man. The experimental research he pursued in the 1940's was confirmed ["approved"] in the course of development of aviation and cosmonautics. In 1951, the USSR State Prize was bestowed upon V. V. Portugalov for his participation in development of some problems of aviation medicine.



From 1947 to 1955, V. V. Portugalov worked at the Institute of Biophysics, USSR Academy of Medical Sciences [AMS], on problems of medical radiology. He demonstrated the patterns that made it possible to refute the conception of radioresistance of nerve tissue; he established that the structures of the sympathetic nervous system and some parts of the brain are damaged by penetrating radiation. This research had a substantial influence on development of theoretical and clinical radiation medicine.

V. V. Portugalov was among the first in the Soviet Union to use cytochemical and histochemical research methods. V. V. Portugalov accomplished much in this new branch of modern science, not only with respect to development and refinement of techniques, but broad introduction thereof into the practice of laboratories of Soviet research institutions and

chairs of VUZ's; he was the editor of the main translated textbooks on theoretical and clinical histochemistry. The work done by V. V. Portugalov in the 1940's and early 1950's is equally important to morphologists, biochemists and physiologists concerned with physiology of nerve endings, and it is well-known in our country and abroad. The results of his research during this period are summarized in the monograph, "Essays on Histophysiology of Nerve Endings," which was published in 1955. On the example of mechanoreceptors, it was demonstrated in this monograph for the first time that reception is based on chemical conversions of biologically active substances localized in the terminal parts of sensory nerve endings and adjacent ancillary neuroglial cells.

In 1955, V. V. Portugalov tackled a new and difficult problem pertaining to structural and chemical organization of the brain's analyzer systems, in the ontogenetic and physiological aspects, at the laboratory of biohistochemistry that he organized (Brain Institute, USSR AMS), which soon became the leading research and methodological center in our country in the field of cytochemistry and histochemistry. Scientists from different cities and republics of the

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Soviet Union and other socialist countries undergo training and specialization in this laboratory.

Election of V. V. Portugalov as corresponding member of the USSR AMS in the specialty of histochemistry, as well as chairman of the National Committee for Histochemistry under the Presidium of the USSR AMS and member of the International Organization for Brain Research, was an expression of the wide recognition of his contribution to development of Soviet cytochemistry and histochemistry.

From the time the Institute of Biomedical Problems, USSR Ministry of Health, was founded in 1964, V. V. Portugalov accomplished much work to organize morphological research at this institute. A team was formed under his supervision, which is successfully working on pressing theoretical and practical problems of space biology and medicine. The main direction of work at that period of endeavors of V. V. Portugalov was investigation of the effects of space flight factors on mammals. In subsequent years, he and his coworkers obtained some unique data that made it possible to assess the effects of weightlessness and other space factors on higher vertebrates. The obtained facts and generalizations made were commented on and gained broad recognition among Soviet and foreign specialists. V. V. Portugalov participated actively in organizing the programs and conducting experiments aboard the Cosmos series of artificial earth satellites.

At the present time, V. V. Portugalov is working at the Scientific Research Institute of Normal Physiology imeni P. K. Anokhin, USSR AMS, where he heads the department of histomolecular physiology of functional systems and laboratory of neurohistology imeni B. I. Lavrent'yev. Determination of cytochemical mechanisms of onset and development of emotional stress is the main direction of his research.

V. V. Portugalov has authored more than 160 scientific works. He devotes much attention to the education and training of young cadres, handing over to them his rich knowhow and extensive knowledge. A total of 23 candidatorial dissertations were prepared under his guidance. The following prepared and defended their doctoral dissertations with the counsel of V. V. Portugalov: L. K. Sharashidze (Tbilisi, 1960), M. G. Shubich (Krasnodar, 1967), Ya. G. Erenpreys (Riga, 1967), N. N. Metlitskiy (Simferopol', 1968), E. G. Bykov (Voronezh, 1969), Yu. K. Yeletskiy (Moscow, 1970), E. G. Ulumbekov (Kazan', 1971), T. S. Bruyevich (Moscow, 1974), A. S. Kaplanskiy (Moscow, 1974) and V. K. Podymov (Moscow, 1975). The disciples of V. V. Portugalov are working in administrative positions, they head chairs and laboratories at medical institutes and scientific research institutions of the USSR AMS and USSR Ministry of Health.

At the early stage of his career, V. V. Portugalov performed pedagogic work for several years at the All-Union State Institute of Cinematography, where he gave a course on microcinematography and high-speed photography on the chair of motion picture engineering, and on the chair of histology at Moscow State University.

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V. V. Portugalov has been a worthy representative of Soviet science abroad, having been the head of several Soviet delegations and participant of many international congresses and symposiums.

V. V. Portugalov performs much scientific public work. He is a member of the office of the Department of Biomedical Sciences, USSR AMS, member of the boards of the All-Union and Moscow scientific societies of anatomists, histologists and embryologists; he is on the editorial board of the journals ARKHIV ANATOMII, GISTOLOGII I EMBRIOLOGII [Archives of Anatomy, Histology and Embryology] and CELLULAR AND MOLECULAR BIOLOGY, as well as of the Pergamon Press Publishing House.

V. V. Portugalov, who was a participant in the Great Patriotic War, was awarded the Order of the Red Banner of Labor and several medals, including the one "For Valiant Labor," and the "Outstanding Public Health Worker" insignia. Appreciation has been expressed to him many times by the USSR Ministry of Health and Presidium of the USSR AMS.

The editorial board of ARKHIV ANATOMII, GISTOLOGII AND EMBRIOLOGII sincerely congratulates its spirited comrade, whose high standards and bold impersonal criticism were largely instrumental in upgrading the scientific level of articles published in this journal. At the same time, all of the morphologists of our country wish him long years of health, new scientific achievements and creative rewards!
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