

APPROVED FOR RELEASE: 2007/02/08: CIA-RDP82-00850R000200030018-7

**11 DECEMBER 1979**

**(FOUO 7/79)**

**1 OF 1**

FOR OFFICIAL USE ONLY

JPRS L/8806

11 December 1979

# USSR Report

BIOMEDICAL AND BEHAVIORAL SCIENCES

(FOUO 7/79)

**FBIS**

FOREIGN BROADCAST INFORMATION SERVICE

FOR OFFICIAL USE ONLY

NOTE

JPRS publications contain information primarily from foreign newspapers, periodicals and books, but also from news agency transmissions and broadcasts. Materials from foreign-language sources are translated; those from English-language sources are transcribed or reprinted, with the original phrasing and other characteristics retained.

Headlines, editorial reports, and material enclosed in brackets [ ] are supplied by JPRS. Processing indicators such as [Text] or [Excerpt] in the first line of each item, or following the last line of a brief, indicate how the original information was processed. Where no processing indicator is given, the information was summarized or extracted.

Unfamiliar names rendered phonetically or transliterated are enclosed in parentheses. Words or names preceded by a question mark and enclosed in parentheses were not clear in the original but have been supplied as appropriate in context. Other unattributed parenthetical notes within the body of an item originate with the source. Times within items are as given by source.

The contents of this publication in no way represent the policies, views or attitudes of the U.S. Government.

For further information on report content call (703) 351-2938 (economic); 3468 (political, sociological, military); 2726 (life sciences); 2725 (physical sciences).

COPYRIGHT LAWS AND REGULATIONS GOVERNING OWNERSHIP OF MATERIALS REPRODUCED HEREIN REQUIRE THAT DISSEMINATION OF THIS PUBLICATION BE RESTRICTED FOR OFFICIAL USE ONLY.

FOR OFFICIAL USE ONLY

JPRS L/8806

11 December 1979

USSR REPORT  
BIOMEDICAL AND BEHAVIORAL SCIENCES  
(FOUO 7/79)

This serial publication contains articles, abstracts of articles and news items from USSR scientific and technical journals on the specific subjects reflected in the table of contents.

Photoduplications of foreign-language sources may be obtained from the Photoduplication Service, Library of Congress, Washington, D. C. 20540. Requests should provide adequate identification both as to the source and the individual article(s) desired.

CONTENTS	PAGE
ADVANCED BIOLOGY	
Theoretical Biology: A Specialty Whose Time Has Come (N. F. Kastrikin; VESTNIK AKADEMII NAUK SSSR, No 7, 1979) .....	1
AGROTECHNOLOGY	
The Morphophysiological Characteristics of Potential and Actual Productivity in Winter Wheat (L. V. Anan'yeva, D. A. Doglushin; DOKLADY VASKHNIL, No 7, 1979) .....	4
Stability and Performance in a Mounted Multi-Function Ditching Unit (T. P. Bukhnikashvili; DOKLADY VASKHNIL, No 7, 1979)	9
Effect of Mineral Fertilizers on Accumulation of Strontium 90 in Winter Crop and Potato Harvest (Ye. V. Yuditseva, et al.; DOKLADY VASKHNIL, No 5, 1979) .....	13
Experience in Visual and Instrumental Interpretation of Aerial Photographs of Cultivated Lands (V. L. Andronikov; DOKLADY VASKHNIL, No 4, 1979) ...	17

- a -

[III - USSR - 21A S&T FOUO]

FOR OFFICIAL USE ONLY

FOR OFFICIAL USE ONLY

CONTENTS (Continued)	Page
Analysis of the Electrophoretic Mobility of the Structural Proteins of Classical Swine Fever Virus (N. V. Likhachev, et al.; DOKLADY VASKHNIL, No 4, 1979) .....	21
INSTRUMENTS AND EQUIPMENT	
New Filming Apparatus for Studying the Swimming Kinematics of Aquatic Animals (V. A. Gogolev, et al.; GIDROBIOLOGICHESKIY ZHURNAL, No 4, 1979) .....	27
Collection of Cybernetic Techniques in Biomedical Research (KIBERNETICHESKIY PODKHOD K BIOLOGICHESKIM SISTEMAM, 1976) .....	35
Experience in the Operation of a Consultative-Diagnostic Point of a Computer Diagnostic System for Acute Cranial-Brain Trauma (Natal'ya Ivanovna Moiseyeva, Grigoriy Danilovich Luchko; OPYT RABOTY KONSUL'TATIVNO-DIAGNOSTICHESKOGO PUNKTA VYCHISLITEL'NOY DIAGNOSTIKI OSTROY CHEREPNO-MOZGOVOY TRAVMY, 1977) .....	39
LIMNOLOGY	
Development of Limnology in the USSR (O. A. Alekin; VESTNIK AKADEMII NAUK SSSR, No 7, 1979) .....	41
PUBLICATIONS	
Cyclic Nucleotides and Adaptation of the Body (G. I. Dorofeyev, et al.; TSIKLICHESKIYE NUKLEOTIDY I ADAPTATSIYA ORGANIZMA, 1978) .....	49
New Book on Science's Role in Improving the Environment (PROBLEMY OPTIMIZATSII V EKOLOGII, 1978) .....	53
Military Medical Training Described in New Book (VOYENNO-MEDITSINSKAYA PODGOTOVKA, 1978) .....	57

- b -

FOR OFFICIAL USE ONLY

FOR OFFICIAL USE ONLY

CONTENTS (Continued)	Page
RADIOBIOLOGY	
Problems of the Radioecology of Water-Cooled Nuclear Power Stations (R. M. Aleksakhin, V. A. Yegorova; EKOLOGIYA, No 4, 1979) .....	67
VETERINARY MEDICINE	
The Metabolism of Co <sup>60</sup> , Zn <sup>65</sup> , Fe <sup>59</sup> and H <sup>3</sup> in Poultry (A. N. Sirotkin, et al.; DOKLADY VASKHNIL, No 6, 1979) .....	70
Determining the Relative Molecular Mass of RNA From the Classic Swine Fever Virus in Polyacrylamide Gel (I. P. Nikolayeva, N. V. Likhachev; DOKLADY VASKHNIL, No 7, 1979) .....	75
Submicroscopic Organization of Anaerobic Bacteria Pathogenic for Animals (A. V. Kulikovskiy, A. A. Polyakov; DOKLADY VASKHNIL, No 7, 1979) .....	78
Generating Atoxigenic Clones From Clostridium Botulinum Type C Exposed to Physical and Chemical Factors (A. A. Shakhbanov, V. P. Onufriyev; DOKLADY VASKHNIL, No 7, 1979) .....	82

- c -

FOR OFFICIAL USE ONLY

FOR OFFICIAL USE ONLY

ADVANCED BIOLOGY

THEORETICAL BIOLOGY: A SPECIALTY WHOSE TIME HAS COME

Moscow VESTNIK AKADEMII NAUK SSSR in Russian No 7, 1979 pp 67-68

[Article by Cand Biol Sci N. F. Kastrikin]

[Text] During the swift development of modern biology certain biological disciplines accumulated a tremendous amount of experimental material pertaining to certain problems; it is difficult and often even impossible to evaluate and understand this material without integrating data from different disciplines. This is the unavoidable result of scientific specialization. It leads to a unique sort of theoretical "indigestion" of experimental data, or their excessive accumulation, apparently in anticipation of the time when another Darwin will appear, capable of generalizing the mountains of boundless and scattered experimental material.

But we would need not just one Darwin but 10 for this gigantic project. And were they to engage in this theoretical work nonprofessionally, in breaks between experiments (as modern theoretical biologists must do), they would hardly be up to the job. The author of "The Origin of Species," who systematically labored over his problem for 20 years, was in fact the first professional theoretical biologist, and the secret of his success apparently lies not only in his genius (which Darwin himself modestly denied) but also in his professional approach to theoretical biology.

Today's nonprofessional theoretical biology, which is studied part-time by some experimenters at their own expense and risk, is obviously unable to complete the complex tasks facing it for the simple reason that the modern experimenter does not have the time needed for serious theoretical analysis; this is not to mention the fact that as the history of science shows, the capabilities for experimentation and for theoretical work are rarely found together in the same individual.

The impression is created that the main obstacle to further development of modern biology is the absence of professional theoretical processing of the wealth of various experimental data that have been accumulated. Physics, the most developed of the natural sciences, a science which has created, through the efforts of professional theoreticians, a theoretical foundation

FOR OFFICIAL USE ONLY

FOR OFFICIAL USE ONLY

that is extremely rich with major achievements, points the way of further development for modern biology. However, despite the fact that the number of works published annually in, for example, biochemistry exceeds the present number of publications on the physics of elementary particles--the most swiftly developing area of modern physics, professional theoretical biology does not yet exist. The domestic theoretical journal *USPEKHI SOVREMENNOY BIOLOGII* has been published for a long time, but there is no such thing as a specialty of theoretical biology, and people having the capability for and interest in theoretical biology are forced to engage in it only as a sideline.

These circumstances urge us to create a laboratory (and later an institute) of theoretical biology in which biologists having facility with theory and the appropriate qualifications could raise today's in many ways dilettente theoretical biology to a higher professional level. It would obviously be best to begin this new effort within the USSR Academy of Sciences, relying upon specialists possessing a sufficiently broad biological outlook. Not requiring considerable material outlays (the theoretical biologist requires only a writing table and quiet) in the very next 2 years professional theoretical biology would be able to open up unexpected aspects to many practically important biomedical problems, and this will impart a more thoughtful and purposeful nature to experimental planning. The possibility is not excluded, for example, that even solution of fundamental biomedical problems such as aging depends not so much on further accumulation of experimental data in individual disciplines as on theoretical integration of the diverse material that has already been collected. Perhaps some of the biological problems that still remain unsolved have already been solved experimentally: Enough experimental material has been accumulated to permit theoretical conceptualization, and arrival at concrete conclusions.

The routine work of the laboratory of theoretical biology could include preparation of integrated reviews out of the mosaic of diverse data. Experimenters have an especially acute need in this era of information explosion: They will afford researchers the possibility for peering over the "fence" of their narrow specialty. The most qualified colleagues of the theoretical laboratory should make it their job to compare, logically analyze, and integrate the mass of experimental results obtained in the integrated reviews. Finally theoretical biologists could organize theoretical colloquia and seminars that would bring together experimenters in different specialties.

Figuratively speaking, modern biology is "pregnant" with professional theoretical biology. The "labor pains" will produce no less important and perhaps more important results than did the birth of professional theoretical physics. The first steps have already been taken in the West: The University of Chicago has had a department of biophysics and theoretical biology for more than a year; a research group in theoretical biophysics has been created in the department of theoretical physics of the Royal Institute of

FOR OFFICIAL USE ONLY



FOR OFFICIAL USE ONLY

Technology in Stockholm, and a laboratory of theoretical biochemistry has been organized at the Paris Institute of Physicochemical Biology.

Time marches on, and the more quickly we create our first domestic laboratory of theoretical biology, the sooner our theoretical biologists will be able to begin their complex but absolutely necessary work of generalizing and conceptualizing the tremendous amount of experimental material that has been accumulated in the laboratories of our country and the entire world.

[638-11004]

COPYRIGHT: Izdatel'stvo "Nauka", "Vestnik Akademii nauk SSSR", 1979

11504  
CSO: 1840

3  
FOR OFFICIAL USE ONLY

FOR OFFICIAL USE ONLY

AGROTECHNOLOGY

UDC 633.11"324":631.559

THE MORPHOPHYSIOLOGICAL CHARACTERISTICS OF POTENTIAL AND ACTUAL PRODUCTIVITY  
IN WINTER WHEAT

Moscow DOKLADY VASKHNIL in Russian No 7, 1979 pp 42-44

[Article by L.V. Anan'yeva, presented by VASKHNIL Academician D.A. Doglushin,  
submitted to the editors 16 January 1979]

[Text] Morphophysiological analysis of the potential and actual productivity of the wheat varieties Odesskaya 51, Bezostaya 1 and Odesskaya 16 conducted over a period of four years (1975-1978) shows through which elements of productivity, the yield of Odesskaya 51 was greater than the yield from parent forms during all these years in conditions of optimum planting time.

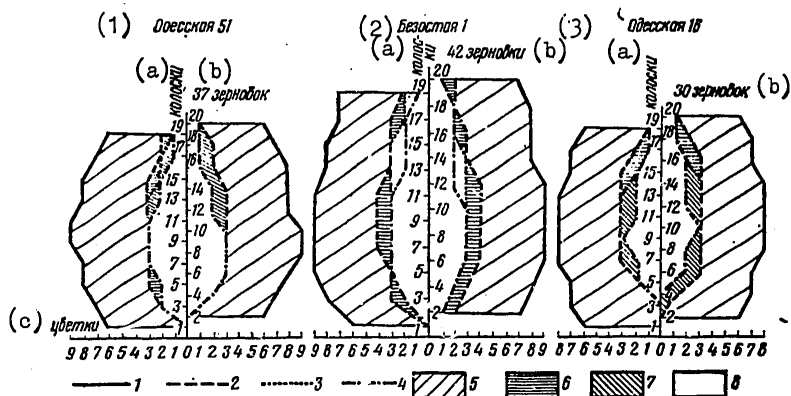
In terms of the coefficient of productive tillering, the Odesskaya 51 variety is close to Odesskaya 16 and, even though it lags somewhat behind it, it does surpass the coefficient for productive tillering for Bezostaya 1.

From the model diagrams (see illustration) for the potential and actual productivity of an ear from the first shoots, it is apparent that the number of spikelets formed during the 4th stage of organogenesis fluctuates slightly over the years for these varieties and averages from 19 to 21. The number of productive spikelets is somewhat greater for the Bezostaya 1 than for Odesskaya 51 and averages three times more than for Odesskaya 16 (15-16). As may be seen from Table 1, the number of spikelets in the second shoot forming during the 4th stage of organogenesis averaged over 4 years was somewhat lower than for the first shoot. The number of productive spikelets in the second shoot as well as in the first was greater for Bezostaya 1 than for Odesskaya 51 and Odesskaya 16 (16-18, 15 and 13-15 spikelets, respectively).

The number of blossoms forming during the 5th stage of organogenesis was subject to greater fluctuation over the years in comparison to the spikelets. Bezostaya 1 and Odesskaya 51 are characterized by a considerable number of blossoms forming during the 5th stage averaged over the four years while Odesskaya 16 is characterized by few. In all three varieties, a lesser number of blossoms formed on the second shoot during the 5th stage of organogenesis.

FOR OFFICIAL USE ONLY

FOR OFFICIAL USE ONLY



Model diagrams of the nature of potential and actual productivity of an ear from the first shoots of wheat during the 5-7th stages of organogenesis. Number of blossoms per spikelet and ear:

1-during the 5th stage, 2-during the 7th stage, 3-during the 8-10th stages; 4-number of grains during the 11-12th stages; reduction in blossoms during the periods: 5-from the 5th to the 6th stage; 6-from the 7th to the 8th stage; 7-from the 9th to the 10th stage; 8-number of spikelet grains during the 11th-12th stages (actual productivity).

Key:

- |                 |                |                 |
|-----------------|----------------|-----------------|
| 1. Odesskaya 51 | 2. Bezostaya 1 | 3. Odesskaya 16 |
| a. spikelets    | a. spikelets   | a. spikelets    |
| b. 37 caryopses | b. caryopses   | b. 30 caryopses |
| c. blossoms     |                |                 |

FOR OFFICIAL USE ONLY

Table 1  
Morphophysiological indicators of potential and actual productivity in winter wheat varieties during the years 1975-1978

(1) Год	(2) Одесская 51					(3) Безостая 1					(4) Одесская 16				
	(a) Урожай (t/ha)	(b) число колосков в колосе (IV stage)	(c) число цветков в колосе (V stage)	(d) число зерновок в колосе (XI-XII stages)	(e) число 3-зерных колосков в колосе	(a) Урожай (t/ha)	(b) число колосков в колосе (IV stage)	(c) число цветков в колосе (V stage)	(d) число зерновок в колосе (XI-XII stages)	(e) число 3-зерных колосков в колосе	(a) Урожай (t/ha)	(b) число колосков в колосе (IV stage)	(c) число цветков в колосе (V stage)	(d) число зерновок в колосе (XI-XII stages)	(e) число 3-зерных колосков в колосе
1975	36,6	19	140	31	3	32,1	19	150	38	7	29,7	19	132	26	0
1976	57,5	19	146	36	6	49,8	19	165	39	7	44,2	20	136	27	1
1977	56,8	20	158	34	3	46,3	20	164	49	10	44,5	20	147	30	1
1978	58,1	22	165	47	10	53,0	21	169	41	6	46,6	21	153	41	7
Среднее	52,3	20	152	37	6	45,3	20	162	42	8	41,3	20	142	31	2
(5) Первый побег															
1975	36,6	18	132	27	0	32,1	18	131	35	6	29,7	19	122	22	0
1976	57,5	18	134	32	4	49,8	18	137	30	2	44,2	19	130	25	0
1977	56,8	19	140	28	2	46,3	20	157	42	8	44,5	20	146	25	0
1978	58,1	22	160	40	5	53,0	20	160	35	4	46,6	20	140	33	4
Среднее	52,3	19	142	32	3	45,3	19	146	36	5	41,3	19	135	26	1
(6) Второй побег															
1975	36,6	18	131	24	0	32,1	18	131	35	6	29,7	16	120	20	0
1976	57,5	18	134	30	4	49,8	18	137	30	2	44,2	18	123	22	0
1977	56,8	18	134	27	1	46,3	19	159	42	8	44,5	19	129	22	0
1978	58,1	21	159	35	4	53,0	20	160	35	4	46,6	20	130	28	0
Среднее	52,3	19	140	29	2	45,3	19	146	36	5	41,3	18	126	23	0
(7) Третий побег															
1975	36,6	18	131	24	0	32,1	18	131	35	6	29,7	16	120	20	0
1976	57,5	18	134	30	4	49,8	18	137	30	2	44,2	18	123	22	0
1977	56,8	18	134	27	1	46,3	19	159	42	8	44,5	19	129	22	0
1978	58,1	21	159	35	4	53,0	20	160	35	4	46,6	20	130	28	0
Среднее	52,3	19	140	29	2	45,3	19	146	36	5	41,3	18	126	23	0

FOR OFFICIAL USE ONLY

- Key:
1. Year
  2. Odesskaya 51
  - a. yield (centners/hectare)
  - b. number of spikelets per ear (4th stage)
  - c. number of blossoms per ear (5th stage)
  - d. number of grains per ear (11-12th stages)
  - e. number of three-grain spikelets per ear
  3. Bezostaya 1
  4. Odesskaya 16
  5. First shoot
  6. Second shoot
  7. Third shoot
  8. Average

(8)

FOR OFFICIAL USE ONLY

FOR OFFICIAL USE ONLY

Table 2  
Grain production of second and third shoots in percentages  
of the first, given optimum planting date

(1) Год	(3) Одесская 51			(4) Безостая 1			(6) Одесская 16		
	1	2	3	1	2	3	1	2	3
1975	100	87	77	100	92	—	100	85	77
1976	100	89	83	100	77	—	100	93	81
1977	100	82	79	100	86	—	100	83	73
1978	100	85	74	100	85	—	100	80	68
(2) Среднее	100	86	78	100	85	—	100	85	75

## Key:

- |                 |                 |
|-----------------|-----------------|
| 1. Year         | 4. Bezostaya 1  |
| 2. Average      | 5. shoot        |
| 3. Odesskaya 51 | 6. Odesskaya 16 |

Varieties of the intensive type are distinguished by a larger number of simultaneously developing blossoms on the spikelets during the 7th-8th stages of organogenesis which determines the grain production of each spikelet and the ear as a whole. This situation is maintained up until the 9th stage. For Bezostaya 1, the first shoot retains an average of 47 blossoms, the Odesskaya 51 has 43 and the Odesskaya 16 has 38. An analogous situation is noted in the second and third shoots as well.

In terms of the grain content for an ear from the first shoot during the 11-12th stages of organogenesis, the Odesskaya 51 variety differs little from the Bezostaya 1 and significantly exceeds the Odesskaya 16.

According to one of the basic indicators for actual productivity--the grain content of an ear--the second shoot in all three varieties is distinguished by much lower indicators averaging 5-6 grains less in all varieties than the first shoot. By the same token, the excellence of Odesskaya 51 and Bezostaya 1 intensive type varieties over Odesskaya 16 is upheld. For a second shoot, the number of three-grain spikelets is also greater in Bezostaya 1 and Odesskaya 51 while the Odesskaya 16 formed only four such spikelets in 1978.

Third shoots stand out as the major varietal differences in terms of actual and potential productivity. It should be noted that a third shoot is essentially lacking for Bezostaya 1. In the Odesskaya 16 variety, based on the number of blossoms formed during the fifth stage of organogenesis as well as the number of caryopses during the 7-8th stages, the third shoot yields significantly to Odesskaya 51 in that it rarely forms three-grain spikelets in the ear.

FOR OFFICIAL USE ONLY

## FOR OFFICIAL USE ONLY

Given the relatively close indicators for potential and actual productivity for an ear on the main shoot which is characteristic for varieties of the intensive type (Odesskaya 51 and Bezostaya 1), the coefficient for productive tillering and the number of second and third shoots in percentages of the first takes on a special meaning in the conditions of the southern steppes of the Ukraine for predicting yield. Due to the much higher coefficient of productive tillering (by almost a factor of 2) as well as the better winter hardiness found on Odesskaya 16, the average yield over the four years was considerably higher for Odesskaya 51 in comparison with Bezostaya 1 (assuming optimum planting times of 10-20 September in this zone) according to data from the All-Union Selective Genetics Institute. Similar findings have been obtained in a number of strain testing stations and the majority of farms in the south of the Ukraine, in Moldavia, in the Stavropolskiy kray Rostovskaya oblast.

## BIBLIOGRAPHY

1. Dolgushin, D.A. et al.; VESTNIK S-KH. NAUKI [Journal of Agricultural Science], 1973, No 9.
2. Kirichenko, F.G.; In: "Metody i rezultaty seliktsionno semenovodcheskoy raboty" [Methods and Results in Selective Seed-Growing Work], Moscow, 1956.
3. Kuperman, F.M.; Murashev, V.V.; DOKLADY VASKHNIL, 1976, No 1.
4. Luk'yanenko, P.P.; SELEKTSIYA I SEMENOVODSTVO [Selection and Seed Production], 1961, No 3.
5. Remeslo, V.N. et al.; VESTNIK S-KH NAUKI, 1976, No 7.

COPYRIGHT: Izdatel'stvo "Kolos", "Doklady VASKHNIL", 1979  
[643-9003]

9003  
CSO: 1840

FOR OFFICIAL USE ONLY

AGROTECHNOLOGY

UDC 626.861:631.3.072

STABILITY AND PERFORMANCE IN A MOUNTED MULTI-FUNCTION DITCHING UNIT

Moscow DOKLADY VASKHNIL in Russian No 7, 1979 pp 40-41

[Article by T.P. Bukhnikashvili, presented by VASKHNIL Academician T.S. Mirtskhylava, submitted to the editors 9 March 1978]

[Text] Studies of the technological process for the installation of temporary drainage collectors with a multi-function ditcher have shown that the contour of the collector being cut is smooth and stable with an absence of embankments along the brow [1].

The new machine consists of a ditching plough and disc with side rollers mounted on a carriage drawn by a tractor.

A large turning radius and sway in the path of the carriage in the working position is a shortcoming in the design of the above-noted vehicle.

To eliminate the deficiencies noted, a mounted unit for a swamp tractor has been suggested in lieu of the trailer where  $G_{dop}$  is the safe force of gravity for mounted equipment on the rear suspension of a caterpillar tractor as defined by R.L. Turetskiy's formula [3].

It was determined earlier [1] that in mineral soils with a moisture content of  $W = 45 \pm 5\%$  and given a trench dug previously by a ditching plow (0.3 meters deep), a roller disc requires a gravity force of  $G_{tr}(1.3 \pm 1.4) G_{dop}$  to deepen the trench to the depth of a temporary collector (0.6 meters).

Consequently, the structure of the mount for a multi-function ditching unit on a tractor must be designed so that the disc has a gravity force of  $G_{tr}$  in the working position but, in the transport position when the mounted equipment is raised, the force of gravity must not exceed  $G_{dop}$ .

This problem is completely resolved by a new design [2] where, in the vehicle's working position, the additional load  $\underline{3}$ , which has a gravity force of  $G_{pr}$  is placed on the rear platform  $\underline{1}$  above the disc. In this instance,  $G_{tr}$  can be represented as follows:

$$G_{tr} = G_d + G_{pr}$$

where  $G_d$  is the disc's force of gravity ( $G_d < G_{dop}$ ).

FOR OFFICIAL USE ONLY

FOR OFFICIAL USE ONLY

In the vehicle's transport position, the additional load 3 is placed on the front platform 4 of the tractor as a counterweight. Shifting the additional load from the platform 1 to the platform 4 and back again is accomplished by means of lateral hydraulic cylinders 5 and a channel frame 6.

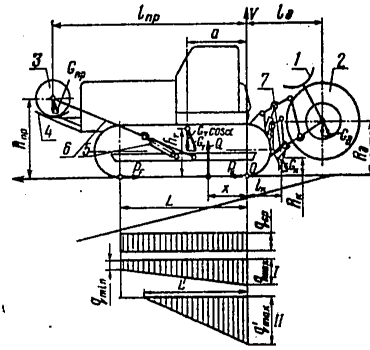


Diagram of forces acting on a tractor-mounted ditcher during steady movement.

With steady motion of the vehicle, its sliding during an ascent is the critical tipping position. At any given moment, in addition to the above-noted forces  $G_d$  and  $G_{pr}$ , the following forces are also acting on the tractor:  $G_t$  - the tractor's force of gravity,  $G_k$  - the force of the ditching plow 7,  $Q$  - the normal ground response,  $R_k$  - the tangential force of the tractor's thrust,  $R_f$  - the force of resistance to the tractor's motion.

In order to determine coordinates for the shift in the center of pressure  $x$ , we can set up an equation to project the forces onto the Y axis and the moments of force relative to the point 0:

$$\sum Y = (G_t + G_d + G_{pr} + G_k) \cdot \cos\alpha - Q = 0, \quad (1)$$

$$\begin{aligned} \sum M_0 = & (G_{pr} \cdot l_{pr} + G_t \cdot a - G_k \cdot l_k - \\ & - G_d \cdot l_d) \cdot \cos\alpha - (G_{pr} \cdot h_{pr} + G_t \cdot h_t + \\ & + G_k \cdot h_k + G_d \cdot h_d) \cdot \sin\alpha - Q \cdot x = 0, \quad (2) \end{aligned}$$

where  $l_{pr}$  and  $h_{pr}$ ,  $a$  and  $h_t$ ,  $l_k$  and  $h_k$ ,  $l_d$  and  $h_d$  are coordinates for the point of application for the respective forces of gravity,  $\alpha$  is the angle of ascent (incline) for a sector of the travel route.

The unknown  $x$  can be found through equations (1) and (2).

From theory we know that the longitudinal stability of a tractor moving on an incline with a piece of mounted equipment is certain when  $x < 0$ .

FOR OFFICIAL USE ONLY



## FOR OFFICIAL USE ONLY

The equation for determining the maximum angle of incline that can be overcome by a mounted multi-function ditching unit has the form:

$$\alpha_{\max} = \frac{G_{pr} \cdot l_{pr} + G_t \cdot a - G_k \cdot l_k - G_d \cdot l_d}{G_{pr} \cdot h_{pr} + G_t \cdot h_t + G_k \cdot h_k + G_d \cdot h_d} \quad (3)$$

The distribution of thrust reactions along the propulsive mechanism has a great effect on the performance of earth-working machinery.

To evaluate the change in pressure over the support surface of the treads, the coefficient  $\nu$  [4] for an increase in pressure is used:

$$\nu = q_{\max} / q_{sr}$$

where  $q_{sr}$  and  $q_{\max}$  are the average and maximum specific pressures for the treads on the ground defined by the theory of static design for a tractor.

For an increase in performance on loose soils,  $\nu = 1.35 + 1.45$  [4] is recommended.

From the calculations shown it is determined that when a tractor-mounted multi-function ditcher is moving steadily, the theoretical maximum angle of incline that the machine can overcome is 0.74 radians and the maximum angle of descent is 0.79 radians.

In the vehicle's working position, the average specific pressure is significantly reduced since the force of gravity  $G_{tr} = G_d + G_{pr}$  is transferred directly to the ground.

The use of a hinged counterweight simultaneously insures the stability and work performance of a tractor-mounted multi-function ditching unit as well as a deeper insertion of the disc.

The structural properties of a multi-function ditcher in comparison with existing machinery makes it possible to use it in conditions of heavy mineral soils with an increased moisture content with considerably greater efficiency. It has been estimated that the economic effect from the introduction of a single vehicle will amount to 6,100 rubles per year.

## BIBLIOGRAPHY

1. Bukhikashvili, T.P.; In: "Voprosy gidromelioratsii v Gruzii" [Questions of Hydrologic Management in Georgia], Tbilisi, GruzNIIGiM, 1977, No. 4.
2. Bukhnikashvili, T.P.; Samkharadze, V.I.; "Kanavokopatel'. Avtorskoye svid. No 609846, Byull. [Ditching machine, Certificate of Copyright No 609846, Bulletin], 1978.

FOR OFFICIAL USE ONLY

3. Turetskii, L.R.; "Avtoref. dokt. dis." [Author's abstract, Doctoral Dissertation], Minsk, 1963.
4. Khayzerk, Ye. M., "Kabeukladchik" [Cable-laying Machine], Moscow, Mashinostroyeniye", 1974.

COPYRIGHT: Izdatel'stvo "Kolos", "Doklady VASKHNIL", 1979  
[643-9003]

9003  
CSO: 1840

FOR OFFICIAL USE ONLY

FOR OFFICIAL USE ONLY

AGROTECHNOLOGY

UDC: 631.89:546.42

EFFECT OF MINERAL FERTILIZERS ON ACCUMULATION OF STRONTIUM 90 IN WINTER CROP AND POTATO HARVEST

Moscow DOKLADY VASKHNIL in Russian No 5, 1979 pp 10-12

[Article by Ye. V. Yudinseva, doctor of biological sciences; T. L. Zhigareva, candidate of agricultural sciences; and Ye. D. Sidorova (presented by N. A. Korneyev, academician of the All-Union Academy of Agricultural Sciences imeni Lenin), All-Union Scientific Research Institute of Agricultural Radiology, submitted 3 Oct 77]

[Text] Lime treatment of acid soil and use of organic and mineral fertilizers should be considered the most feasible means of lowering passage of strontium 90 from soil into plants in the agricultural industry.

The scientific information concerning the effects of fertilizers, particularly mineral ones, on reducing access of radionuclides into plants is inadequate and rather contradictory [1, 4, 5, 8-10].

Several authors [2, 3, 6, 7] have demonstrated that there is less migration of strontium 90 from soil into plants under the influence of high doses of potassium and sodium phosphates, as well as monocalcium phosphate.

The results of these studies are of basic significance to solving the problem of using phosphorus fertilizers. It is known that more phosphorus is applied with fertilizers than removed with the harvest. Moreover, in the case of superphosphate, a large amount of calcium is applied, which could have a substantial effect on accessibility of strontium 90 to plants. For this reason, regular application of phosphorus fertilizers to augment the harvest could be one of the procedures to lower the level of contamination of plant production and feed.

We investigate the effects and aftereffects of phosphorus and potassium fertilizers after pretreatment of soil with lime on migration of strontium 90 into agricultural plants.

These studies were conducted on soddy podzolic sandy loam, into which 10 tons/ha [hectare] dolomite had been introduced in the fall.

FOR OFFICIAL USE ONLY

FOR OFFICIAL USE ONLY

Table 1. Strontium 90 content of winter crop and potato harvest (nCi/g dry substance)

Variant of experiment	Rye		Wheat		Potatoes	
	straw	grain	straw	grain	haulm	tubers
Soil without fertilizer						
Soil with addition of:	2.4	0.17	1.9	0.21	21.5	1.10
N <sub>200</sub> P <sub>200</sub> K <sub>200</sub>	1.9	0.08	1.2	0.14	16.5	0.62
N <sub>200</sub> P <sub>200</sub> K <sub>150</sub>	1.4	0.09	1.3	0.15	15.0	0.52
N <sub>200</sub> P <sub>200</sub> K <sub>100</sub>	2.0	0.11	—	—	14.8	0.44
N <sub>200</sub> P <sub>150</sub> K <sub>200</sub>	1.8	0.11	1.0	0.13	16.1	0.50
N <sub>200</sub> P <sub>100</sub> K <sub>200</sub>	1.5	0.10	0.9	0.12	14.0	0.50
N <sub>200</sub> P <sub>150</sub> K <sub>150</sub>	1.6	0.13	0.7	0.09	14.9	0.50
HCP <sub>0,95</sub>	0.4	0.05	0.4	0.05	3.8	0.1

Table 2. Calcium and strontium 90 content of winter crop and potato harvest

Variant of experiment	Rye		Wheat		Potatoes	
	straw	grain	straw	grain	haulm	tubers
Calcium (%)						
Soil without fertilizer	0.22	0.050	0.36	0.06	1.86	0.06
With:						
N <sub>200</sub> P <sub>200</sub> K <sub>200</sub>	0.26	0.057	0.39	0.07	2.09	0.08
N <sub>200</sub> P <sub>200</sub> K <sub>150</sub>	0.27	0.055	0.39	0.06	1.95	0.09
N <sub>200</sub> P <sub>200</sub> K <sub>100</sub>	0.25	0.052	—	—	1.79	0.08
N <sub>200</sub> P <sub>150</sub> K <sub>200</sub>	0.26	0.057	0.38	0.06	2.31	0.09
N <sub>200</sub> P <sub>100</sub> K <sub>200</sub>	0.31	0.062	0.42	0.07	2.03	0.09
N <sub>200</sub> P <sub>150</sub> K <sub>150</sub>	0.24	0.050	0.24	0.07	2.11	0.08
<sup>90</sup> Sr (millions of strontium units)						
Soil without fertil.	1.0	0.34	0.52	0.35	1.1	1.8*
With:						
N <sub>200</sub> P <sub>200</sub> K <sub>200</sub>	0.67	0.14	0.30	0.20	0.79	0.76
N <sub>200</sub> P <sub>200</sub> K <sub>150</sub>	0.52	0.16	0.32	0.25	0.77	0.57
N <sub>200</sub> P <sub>200</sub> K <sub>100</sub>	0.80	0.21	—	—	0.82	0.55
N <sub>200</sub> P <sub>150</sub> K <sub>200</sub>	0.69	0.19	0.27	0.21	0.69	0.55
N <sub>200</sub> P <sub>100</sub> K <sub>200</sub>	0.48	0.16	0.23	0.17	0.69	0.55
N <sub>200</sub> P <sub>150</sub> K <sub>150</sub>	0.66	0.26	0.23	0.13	0.70	0.52

In the spring, the soil had the following agrochemical parameters: salt extract pH 6; hydrolytic acidity 1.2 mg·eq/100 g soil; total absorbed bases 5.0 mg·eq/100 g soil; aluminum content 4.6 mg/100 g soil; labile forms of phosphorus and potassium 12.6 and 6.1 mg/100 g soil, respectively.

The experiments were repeated 4 times. The plot studied was 4 m<sup>2</sup> (2×2) in size with a 1-m protective zone between tests. The plots were separated from one another with plastic buried in the ground at a depth of 25 cm. The radioisotope was introduced in the form of chloride, in a dosage of 2 μCi/kg soil. The tests were made with Vyatka winter rye, Mironovskaya 808 winter wheat and Belorusskiy Ranniy potatoes.

There was a 1.5-2-fold decrease in <sup>90</sup>Sr content of rye, wheat and potato harvest under the influence of the complete mineral fertilizer, as compared to unfertilized soil (Table 1). The lowest <sup>90</sup>Sr content in wheat harvest was

FOR OFFICIAL USE ONLY

observed in the variant with high doses of phosphorus and potassium fertilizers ( $N_{100}P_{240}K_{240}$ ) and in potato tubers with the use of high doses of potassium fertilizers ( $N_{100}P_{80}K_{240}$ ).

Migration of radiostrontium into man and animals is determined not only by the nuclide content per unit mass feed and foodstuffs, but the correlation with calcium, i.e., magnitude of strontium units.

An essentially analogous correlation between accumulation of radiostrontium and different doses of mineral fertilizers is observed when the radionuclide is expressed in strontium units (Table 2).

Thus, the amount of strontium units in potato tubers was 3.3 times lower in the variant with high doses of phosphorus and potassium fertilizers ( $N_{100}P_{240}K_{240}$ ) than in the variant without fertilizers and 1.5 times lower than in the variant with lower doses of fertilizers ( $N_{100}P_{80}K_{80}$ ).

In a number of cases, the number of strontium units in the harvest, with the use of high doses of phosphorus fertilizers decreased to a greater extent than absolute accumulation of strontium 90. This is attributable to the fact that the use of fertilizers, particularly superphosphate, increases somewhat the calcium content, as we mentioned above.

Table 3. Strontium 90 content of harvest (pCi/kg) with soil contamination density of 1 Ci/km<sup>2</sup>

Variant of experiment	Wheat		Potatoes		
	straw	grain	haulm	tubers	
Soil without dolomite + $N_{100}P_{80}K_{80}$	9657	1066	127 143	2247	
Soil + dolomite, 10 tons/ha, after frost-damage plowing (background)	3163	333	35 764	832	
Soil+background+ {	$N_{100}P_{80}K_{80}$	1931	233	26 306	1032
	$N_{200}P_{80}K_{80}$	2131	233	25 008	866
	$N_{200}P_{80}K_{240}$	2597	300	24 675	733
	$N_{200}P_{240}K_{80}$	1731	200	26 806	832
	$N_{200}P_{240}K_{240}$	1631	200	23 409	832
	1232	133	24 808	832	

In view of the fact that dolomite was introduced into the soil in the fall, it was interesting to compare the <sup>90</sup>Sr levels in the harvest raised in soil without dolomite to accumulation thereof in soil treated with dolomite (Table 3). As can be seen from the data listed in this table, addition of dolomite lowered accumulation of <sup>90</sup>Sr in wheat harvest by 3-3.2 times.

Fertilizers in a dosage of  $N_{100}P_{80}K_{80}$  against the background of dolomite lower accumulation of radiostrontium in wheat grain and straw by 4.4-5 times, and with a dosage of  $N_{100}P_{240}K_{240}$  by 8 times, as compared to the radiostrontium content of plants raised in soil untreated with this mineral. An analogous correlation is observed for potatoes.

FOR OFFICIAL USE ONLY

Thus, the use of mineral fertilizers, particularly high doses of phosphorus fertilizers, aids in further lowering of level of contamination of harvests by radiostrontium.

BIBLIOGRAPHY

1. Gulyakin, I. V., and Yudintseva, Ye. V. IZVESTIYA TSKHA [News of the Timiryazev Agricultural Academy], No 3, 1959.
2. Gulyakin, I. V., et al. AGROKHIMIYA [Agrochemistry], No 11, 1965.
3. Idem, DOKLADY TSKHA [Reports of Timiryazev Agricultural Academy], No 183, 1972.
4. Kvaratskheliya, N.G., and Arnautov, G. N. "Radioactive Isotopes in Soil and Plants," Leningrad, Kolos, No 18, 1969.
5. Shirshova, R. A. POCHVOVEDENIYE [Soil Science], No 3, 1962.
6. Yudintseva, Ye. V., and Levina, E. M. IZVESTIYA TSKHA, No 5, 1963.
7. Yudintseva, Ye. V., et al. Ibid, No 4, 1967.
8. Yudintseva, Ye. V., and Folomkina, Z. M. DOKLADY TSKHA, No 133, 1968.
9. Anderssen, A. I. SOIL SCI. SOC. AMER. PROC., 35, No 1, 1971.
10. Libby, W. F. SCIENCE, Vol 128, No 3332, 1959.

COPYRIGHT: Izdatel'stvo "Kolos", "Doklady VASKHNIL", 1979

10657  
CSO: 1840

FOR OFFICIAL USE ONLY

AGROTECHNOLOGY

UDC 631.42:77.058.1

EXPERIENCE IN VISUAL AND INSTRUMENTAL INTERPRETATION OF AERIAL PHOTOGRAPHS  
OF CULTIVATED LANDS

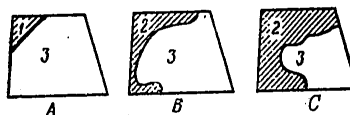
Moscow DOKLADY VASKHNIL in Russian No 4, 1979 pp 22-23

[Article by Cand Ag Sci V. L. Andronikov, Order of the Red Labor Banner Soil  
Institute imeni V. V. Dokuchayev]

[Text] Much attention is presently being devoted in our country and abroad to using modern electron optics to study soil cover as represented on aerial and space photographs. Use of these new technical resources permits us to quantitatively evaluate qualitative differences in soils documented on the photographs. As an example the Kvantimet-720 electron-optic image analyzer has been used to evaluate the structure of soil cover from aerial photographic images of it taken in a steppe zone and in an irrigated desert zone (1,2). Moreover the instrument is capable of differentiating different shades (64 shades of gray) on what appear to be visually unvaried photographs bearing images of land contours or agricultural crops that are almost white, gray, or almost black. This has important significance to soil cartography employing aerial and space photographs. There is considerable interest in studying this differentiation of shades, since it is associated with differences in soils, with the degree of their cultivation and fertility, and with differences in the condition and developmental stage of agricultural crops.

Medium-scale aerial photographs were taken of soils and crops of the Kurskaya Experimental Station in spring. The soil cover consisted of typical, leached, and dug-up chernozem (surchina). A field of winter rye, the photograph of which was uniform and almost black to the eye, was chosen for analysis. Analysis of the photographic image of this field with the Kvantimet-720 revealed differences in shades (see Figure). A certain difference was discovered in contours appearing on the print and film, but on the whole the general character of the images was the same. The first level of the darkest shade of the winter rye image was discovered at an intersection of two roads beside a population center (Figure A). The second level was detected along roads leading from the population center (Figure B). It could be hypothesized that these areas were cultivated and fertilized the most. This hypothesis was confirmed by an on-site inspection. Figure C shows the large proportion of weakly cultivated area.

FOR OFFICIAL USE ONLY



Levels of Gray (1, 2, 3) Revealed on Aerial Film With the Kvantimet-720 Instrument: 1--The brightest shade on the film (darkest on the positive print), 2--bright, 3--moderately bright shade.

Table 1. Concentration of Humus, Phosphorus, and Potassium in Soil Subjected to Different Levels of Cultivation in One of the Fields of the Kursk Section. Soils--Typical, Leached, and Dug-Up Chernozem (Surchina)

(1) Гумус, по Тю- рину (%)		(2) Фосфор, по Чиркову		(3) Калий, по Масловой	
(4) мг/100 г					
0-20	30-40	0-20	30-40	0-20	30-40
(5) 1-й уровень					
6.35	5.55	10.4	8.6	20	18
6.66	6.20	10.4	8.0	20	16
6.71	5.98	12.1	8.6	18	15
6.09	5.67	12.0	9.2	18	16
6.79	6.61	11.2	6.3	16	15
6.50	6.35	9.5	7.7	17	15
6.22	5.61	8.2	6.8	17	15
(8) Среднее 6.48	6.00	10.5	7.7	18	16
(6) 2-й уровень					
6.60	5.96	8.0	—	17	15
6.71	6.07	9.9	7.2	15	15
6.79	5.87	7.6	5.0	17	15
6.60	6.18	6.9	5.9	20	16
6.79	6.72	—	6.1	18	17
6.44	6.20	6.1	6.1	17	16
6.20	5.74	8.2	7.8	16	15
6.50	6.35	8.1	7.6	20	15
6.66	5.69	9.0	8.0	15	14
6.18	5.43	6.8	6.1	14	14
5.26	5.08	6.6	6.1	15	15
6.18	5.43	8.9	8.2	15	14
6.16	6.94	8.2	6.1	16	17
6.60	6.02	9.2	8.2	15	14
6.73	6.42	8.2	8.2	15	14
6.86	5.98	10.2	7.6	15	15
6.24	5.86	8.2	7.8	16	15
5.89	5.58	8.2	—	15	15
6.60	6.42	9.0	8.6	18	16
5.71	5.58	7.5	6.1	17	14
6.60	5.70	8.2	7.7	17	16
(8) Среднее 6.40	5.87	8.5	7.0	16	15

[Table 1 continued on following page]



FOR OFFICIAL USE ONLY

(7) 3-й уровень

6,37	6,29	5,9	—	15	13
6,35	5,10	5,7	3,8	13	12
6,11	5,23	6,1	5,2	15	12
6,11	5,63	6,6	6,6	13	13
6,42	5,29	7,4	7,6	15	14
6,38	5,54	6,4	3,2	15	13
6,68	6,42	6,5	6,2	14	13
6,44	6,38	7,5	6,5	17	17
(8) Среднее 6,38	5,36	6,5	5,6	14	13

Key:

- |                                  |                 |
|----------------------------------|-----------------|
| 1. Humus, Tyurin's method (%)    | 5. First level  |
| 2. Phosphorus, Chirikov's method | 6. Second level |
| 3. Potassium, Maslova's method   | 7. Third level  |
| 4. Mg/100 gm                     | 8. Average      |

Table 2. Clover (Aftercrop) Yields in Areas Containing Soils Subjected to Different Levels of Cultivation

(1) Колличество учетных площадок	(2) 1-й уро- вень	(3) 2-й уро- вень	(4) 3-й уро- вень
1	1200	750	550
2	1100	820	620
3	1200	800	600
4	950	800	700
5	1200	700	500
6	1300	700	820
(5) среднее	1160	760	600

Raw weight (gm); quadrat area--1 m<sup>2</sup>; date--9 October 1975.

Key:

- |                       |                |
|-----------------------|----------------|
| 1. Number of quadrats | 4. Third level |
| 2. First level        | 5. Average     |
| 3. Second level       |                |

Table 1 shows data on the concentration of humus and mobile phosphorus and potassium for this field. The soils of the three levels examined here are the same in relation to humus concentration in the topsoil and underlying soil. Differences are observed in the concentrations of phosphorus and potassium, being especially noticeable between the first and third levels.

The clover (aftercrop) yield from the three levels of the field, revealed by means of aerial photographs and the Kvantimet-720 image analyzer, was

FOR OFFICIAL USE ONLY

estimated in the fall. Data presented in Table 2 show differences in the yields harvested from the three levels of soil isolated.

Thus shade differences on the photographs (often visually indistinguishable) revealed with the help of modern electron-optical image reading instruments can be used to delineate soils in relation to their level of cultivation, and to determine the yields of agricultural crops. By breaking down the initial unvaried half-tone photographic image of soil and plant cover into a number of intervals and then subjecting them to discrete quantitative coding, we can isolate areas on the photograph with similar half-tone intervals easier. This insures better visual interpretation of slight changes in brightness on the photograph being analyzed, and it raises the clarity with which indistinct borders of soil and plant types are perceived. Image processing with the Kvantimet-720 insures fuller and more accurate solution of the problem of soil interpretation using aerial and space photographs.

#### BIBLIOGRAPHY

1. Andronikov, V. L., and Stolbovoy, V. S., in "Tezisy dokladov III soveshchaniya po strukture pochvennogo pokrova" (Abstracts of Reports at the Third Conference on Soil Cover Structure), Moscow, 1976.
2. Mazikov, V. M., and Stolbovoy, V. S., in "Tezisy dokladov III soveshchaniya po strukture pochvennogo pokrova," Moscow, 1976.  
[661-11004]

COPYRIGHT: Izdatel'stvo "Kolos", "Doklady VASKHNIL", 1979

11004  
CSO: 1840

FOR OFFICIAL USE ONLY

FOR OFFICIAL USE ONLY

AGROTECHNOLOGY

UDC 619:576.858

ANALYSIS OF THE ELECTROPHORETIC MOBILITY OF THE STRUCTURAL PROTEINS OF CLASSICAL SWINE FEVER VIRUS

Moscow DOKLADY VASKHNIL in Russian No 4, 1979 pp 32-34

[Article by VASKHNIL Academician N. V. Likhachev, Dr Med Sci L. A. Mel'nikova, and N. P. Nikolayeva, All-Union State Scientific Control Institute of Veterinary Preparations]

[Text] The structural proteins of different virus strains must be analyzed and determined so as to permit both revelation of the nature of differences among virus strains and classification of viruses--determination of their membership to one group or another. Electrophoresis in polyacrylamide gel (PAAG) is presently being employed successfully to determine protein quantities and their molecular weight (1,4,5).

Classical swine fever virus (SFV) is placed in family Tagaviridae on the basis of its physicochemical properties (3). Only one work has been published so far on the structural proteins of SFV (8). The authors of this work studied two SFV strains (ALD-970 and PAV), in which they found three structural proteins with molecular weights of 55,000, 46,000, and 36,000 Daltons.

This article presents data from a study of the polypeptide composition of four SFV strains (K-cultural, K-lapinized, Goodson, and O-virulent) by electrophoresis in PAAG; five proteins with molecular weights from 95,000 to 12,000 Daltons were revealed, and a difference in the protein composition of the epizootic strain from that of others was discovered.

Primary swine embryo kidney cell cultures were employed. The growth medium consisted of lactalbumin hydrolyzate solution (0.5 percent) floated on Henke's solution mixed with 10 percent cattle serum. The maintenance medium was as above, but without serum. The seeding rate was one to two particles per cell. Time of adsorption was 1 hour. The virus-containing fluid was concentrated and purified in a 10-60 percent (weight by volume) sucrose concentration gradient (2).

PAAG electrophoresis was performed in parallel tubes as suggested by Laemmli (6). The proteins were analyzed in separating gel with an acrylamide

FOR OFFICIAL USE ONLY

concentration of 8-10 percent; the bisacrylamide to acrylamide ratio was 1:38. In all cases we used 3 percent focusing gel. Following electrophoresis, the gels were stained with 0.2 percent amido-black or with 0.2 percent (kumassi) blue R 250. Washed gels were photographed and scanned with a Joyce Chromoscan apparatus at a wavelength of 570 nm.

We used the following as labels to determine the molecular weight of the proteins: bovine serum albumin and its dimer (molecular weight 68,000 and 136,000 Daltons respectively), egg albumin (45,000 Daltons), lysozyme (17,000 Daltons), and RNA-ase (molecular weight 14,000 Daltons). Protein concentrations were determined by Lowry's method (7) using bovine serum albumin as the standard.

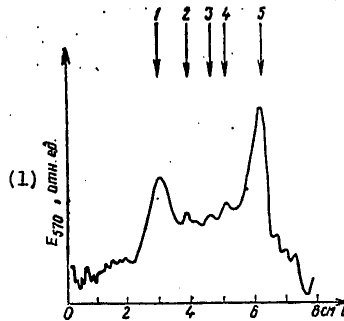


Figure 1. Densitogram of K-Cultural Strain SVF Proteins: 8 percent polyacrylamide gel, length 10 cm; numbers above graph indicate protein numbers (see Table)

Key:

1. Relative units

In the first stage we determined the positions of individual polypeptides of strain K-cultural in 8-10 percent gels. PAAG electrophoresis revealed five proteins (see Table). We established that changing the concentration of acrylamide from 8 to 10 percent does not influence the quantity of proteins or their mobility. However, in a number of cases additional peaks were recorded on the densitogram (Figure 2). In certain experiments the position of the peak representing the lightest protein corresponded to a molecular weight of 24,000 Daltons.

In the next stage we subjected four strains to comparative analysis by the method of electrophoresis in parallel tubes. As a result we revealed a difference in the mobility of the lightest protein of the virulent strain

FOR OFFICIAL USE ONLY

FOR OFFICIAL USE ONLY

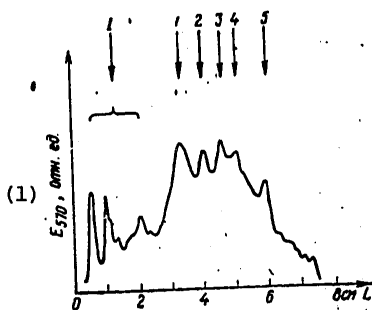


Figure 2. Densitogram of K-Cultural Strain SFV Proteins: 8 percent polyacrylamide gel, length 10 cm; I--additional peaks produced aggregation of SFV proteins

Key:

1. Relative units

Molecular Weight of the Structural Polypeptides of SFV\*

(1) № белка	(2) Молекулярная масса (X10 <sup>3</sup> ) Дальтон			
	(3) ШТАММ			
	(4) К-культуральная	К-лапинизированная (5)	Гудзон (6)	О-вирулентная (7)
1	95 ± 1,5	95 ± 1,5	95 ± 1,5	95 ± 1,5
2	63,5 ± 2,5	63,5 ± 2,5	63,5 ± 2,5	63,5 ± 2,5
3	50 ± 2	50 ± 2	50 ± 2	50 ± 2
4	39 ± 2	39 ± 2	39 ± 2	39 ± 2
5	12,2 ± 0,5	12,2 ± 0,5	12,2 ± 0,5	14,1 ± 1

\* Mean molecular weights and mean square deviations, calculated from 11 experiments on six preparations prepared independently of one another, are given.

Key:

- |  |                |
|--|----------------|
| 1. Protein number                                | 5. K-lapinized |
| 2. Molecular weight (× 10 <sup>3</sup> ) Daltons | 6. Goodson     |
| 3. Strain  | 7. O-virulent  |
| 4. K-cultural                                    |                |

FOR OFFICIAL USE ONLY

FOR OFFICIAL USE ONLY

(Table). A difference in electrophoretic mobility of proteins was not revealed for other strains.

To permit evaluation of the degree of contamination of the final virus preparation by soluble proteins, we performed experiments to purify and concentrate equal volumes of culture fluid not containing virus and being in equal conditions with the cell system in which the virus was accumulated. The control culture fluid was analyzed in a linear sucrose density gradient and in PAAG. Proteins were determined in all stages of purification. When the control preparation was applied to the gel and subsequently stained, we did not reveal any protein fractions at all, which made it possible to conclude that cellular proteins were absent from the SFV preparations analyzed.

Absence of stained bands in the control preparation allowed us to hypothesize that bands corresponding to cell proteins were absent from the protein bands revealed in the gel (we know that bands containing not less than 3 µg protein could be revealed when amido-black and (kumassi) blue are used).

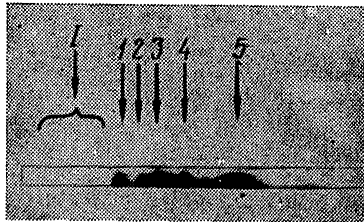


Figure 3. Electrophoresis of K-Cultural SFV Proteins: 8 percent polyacrylamide gel, length 10 cm; arrows indicate locations of virus protein; I--aggregated protein fraction

FOR OFFICIAL USE ONLY

FOR OFFICIAL USE ONLY

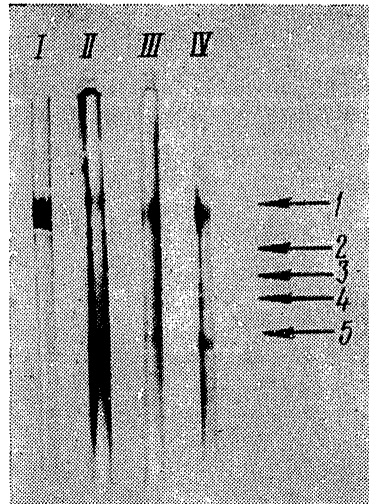


Figure 4. Electrophoresis of Proteins From Different SFV Strains: 10 percent polyacrylamide gel, length 10 cm; arrows indicate locations of virus proteins.

Purified and concentrated SFV preparation having an infectiousness titer exceeding the initial titer by 2 lg was used in the experiment.

PAAG electrophoresis of four SFV strains revealed five polypeptides (Figure 1). The molecular weights of some polypeptides agree with the results of other authors (8). However, despite the rigid conditions under which the purified virus preparation was processed prior to PAAG electrophoresis (boiled for 3 minutes in buffer containing 2 percent sodium dodecylsulfate and 5 percent 2-mercaptoethanol), a tendency for proteins of this virus to aggregate was noted (Figures 2, 3). The protein with the molecular weight of 95,000 Daltons is possibly a dimer of the protein with the molecular weight of 50,000 Daltons.

Analysis of structural proteins from four SFV strains revealed a difference in the electrophoretic mobility of the lightest protein. The molecular weight of protein from the virulent strain was 14,500 Daltons, while protein from strains K, K-lapinized, and Goodson had a molecular weight of 12,200 Daltons.

We can see from the data presented here that change in biological properties of the strains is associated with profound changes in subunit structure. This is reflected in the change in rate of migration (and consequently the

FOR OFFICIAL USE ONLY

FOR OFFICIAL USE ONLY

the molecular weight) of virus protein. Thus electrophoretic mobility of light and heavy virus protein chains in PAAG can be used as a labeling characteristic by which to differentiate among different SFV strains and identify newly discovered ones.

BIBLIOGRAPHY

1. Ivanova, V. T., et al., VOPROSY VIRUSOLOGII, No 3, 1978.
2. Likhachev, N. V., et al., DOKLADY VASKHNIL, No 12, 1975.
3. Fenner, F., et al., "Biologiya virusov zhiivotnykh" (Biology of Animal Viruses), Moscow, Vol 1, 1977.
4. Shapiro, S. C., and Bratt, M. A., "Proceedings of the Society for Experimental Biology and Medicine," Vol 136, 1971, pp 834-838.
5. Moore, N. F., and Burke, D. C., J. GEN. VIROL., Vol 25, 1974, pp 275-289.
6. Laemmli, U. K., NATURE (Lond.), Vol 227, 1970, pp 680-684.
7. Lowry, O. H., et al., J. BIOL. CHEM., Vol 193, 1951, pp 255-275.
8. Enzmann, P. J., and Rehlberg, H. Z., NATURFOSCH., Vol 32, No 5/6, 1977, pp 456-458.  
[661-11004]

COPYRIGHT: Izdatel'stvo "Kolos", "Doklady VASKHNIL", 1979

11004

CSO: 1840

FOR OFFICIAL USE ONLY



FOR OFFICIAL USE ONLY

## INSTRUMENTS AND EQUIPMENT

UDC 574.5.08

## NEW FILMING APPARATUS FOR STUDYING THE SWIMMING KINEMATICS OF AQUATIC ANIMALS

Kiev GIDROBIOLOGICHESKIY ZHURNAL in Russian No 4, 1979 pp 116-121

[Article by V. A. Gogolev, A. P. Dubravyn, and L. F. Kozlov, Ukrainian SSR Academy of Sciences Institute of Hydrodynamics]

[Text] The cinematographic method for studying the kinematic swimming characteristics of aquatic animals has enjoyed widespread acceptance (1-10). Both conventional and stereophotogrammetric movie and still cameras are employed. An analysis of data obtained in research on freshwater and marine animals and some cetaceans and fishes (dolphins in particular) has made it possible to formulate the basic requirements on filming apparatus intended for studying the swimming kinematics of aquatic animals. A unique complex of stereophotogrammetric apparatus was planned and manufactured on this basis. Labeled the MSA-2 (marine stereophotographic assembly-2), it is used to study the swimming kinematics of marine animals, and it contains three stereophotogrammetric systems--SFK-1, SFK-2, and SFK-4 (see Table).

The SFK-1 system is intended for stereo photography of marine animals by a group of cameras located under water. Each system outfit (Figure 1) includes three stereophotogrammetric cameras 1, a control console 2, a timer 3, and a cart 4. The cameras are housed by waterproof boxes that can be submerged to a depth of 15-20 meters. The front of each box bears a porthole. Presence of the glass of the porthole was considered in the design of the Gidrorussar-2 optical system of objectives, which was corrected for distortions caused by refraction of light rays passing through the water-glass and glass-air interfaces between optically heterogeneous mediums. The mounting of each porthole is equipped with attachments for securing the boxes to underwater objects. The SFK-2 (Figure 2) is intended for stereophotography of aquatic animals on the water surface. It consists of two stereophotogrammetric cameras 1, a control console 2, a timer 3, a cart 4, and a tripod 5. The tripod makes it possible to change the distance between the cameras, set the cameras at the needed height, track the object of photography, turn the cameras about the vertical axis, and tilt them forward relative to the horizontal axis.

FOR OFFICIAL USE ONLY

FOR OFFICIAL USE ONLY

Basic Specifications of Stereophotogrammetric Systems  
 Intended for Research on Swimming Kinematics of Marine Animals

Specifications	SFK-1	SFK-2	SFK-4
Number of cameras in outfit	3	2	1
Type of objectives	Gidrorussar-2	Russar-49	Gidrorussar-2
Objective focal distance, mm			
in water	62.7	-	62.7
in air	47	63	47
Horizontal angle of field of view, °			
in water	81	-	81
in air	97	80	97
Objective's relative aperture	1:10	1:6.8	1:10
Shutter	Focal plane central	Focal plane central	leaf
Distance between objectives, mm	105	105	105
Effective exposure times	1/15, 1/30, 1/60, 1/120	1/50, 1/100, 1/200, 1/400	1/15, 1/30, 1/60
Stereo pair frame dimensions, mm	70 × 80	70 × 80	70 × 80
Number of stereo pairs in full-length film roll	330	330	330
Film employed	Type 15 or 17 unperforated, width 19 cm		
Operating mode	Single exposures and automatic filming		
Power supply voltage	27 volts direct current, and 50 Hz alternating current		6 volts direct current
Stereo camera weight, kg	50	20	35

FOR OFFICIAL USE ONLY

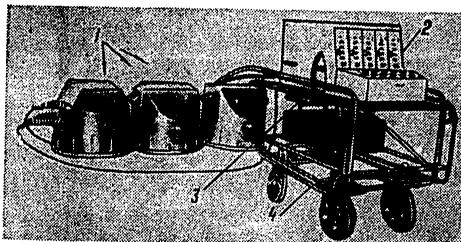


Figure 1

See text for explanation of figures

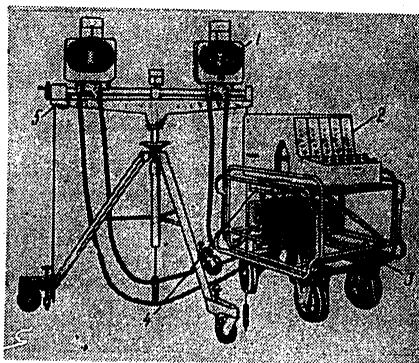


Figure 2

FOR OFFICIAL USE ONLY

FOR OFFICIAL USE ONLY

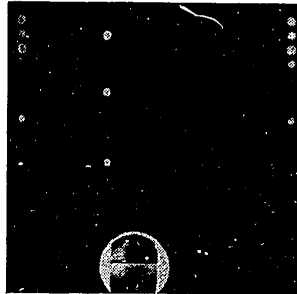


Figure 3

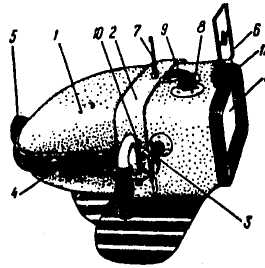


Рис. 4.

Figure 4

The same control console and timer are used in the two systems. Three SFK-1 cameras and two SFK-2 cameras can be connected to the control console simultaneously, and they can be controlled separately or simultaneously. The console is used to monitor the work of the cameras, to set their exposure times and the delay in tripping of the shutters of successive cameras, and to prepare the cameras for operation in the following modes:

FOR OFFICIAL USE ONLY

- a) photographing a series of successive frames at a time interval between frames of 1.5-15 seconds with one camera, a group of cameras, or all five cameras with exposure times of 1/15, 1/30, 1/60, and 1/120 for the SFK-1 and 1/50, 1/100, 1/200, and 1/400 for the SFK-2;
- b) photographing single frames with one camera, a group of cameras, or all five cameras;
- c) photographing single frames in the middle of a series ("cutting in");
- d) photographing single frames or a series with a given delay in operation of successive SFK-1 or SFK-2 cameras;
- e) photographing single frames with one camera in response to a signal from a pickup unit mounted within the field of vision of the operating camera.

The signal panel of the control console can be used to monitor presence of power, tripping of shutters, movement of film in the cameras, operability of circuit breakers, the power supply to individual cameras, and the number of frames taken by each camera.

The timer is used to determine the actual time intervals between two successively operating cameras, and to transmit the measurement results in binary code to the light diode block of a photorecorder. Knowing the actual time intervals, we can eliminate errors caused by instability in operation of the shutter mechanisms of the cameras; its measurement accuracy is  $\pm 1$  msec. The measurement results are recorded on the photorecorder's film in binary code (Figure 3).

The SFK-4 system is intended for stereo photography of marine animals by a SCUBA diver under water. This automatic stereophotogrammetric manually controlled camera (Figure 4) can be used in natural and artificial illumination. The camera is easy to use and dependable, and it is watertight. Owing to its streamlined, elongated shape and its minimum possible frontal resistance, it is sufficiently maneuverable. It consists of a box, a camera, and a film holder.

The box serves as the carrier, and it consists of two halves--housing 1 and body 2--casted out of AL2 alloy. The joint between the housing and body is sealed by a hand clamp and a rubber sealing ring fitting in the inner groove of the body. The hand clamp consists of a steel cast coupling frame 4 and a handle 5. The frame can rotate on fixed semi-axes rigidly secured to the body. When necessary the film holders can be removed for reloading. For this purpose handle 5 is turned until its spherical end emerges from the depression in the central part of housing 1, and frame 4 is tilted in either direction as far as stops 10 on body 2.

A bracket on the housing bears a peephole through which the photographer can see the numbers of the frame counter. Safety glass 11 in the front

FOR OFFICIAL USE ONLY

part of the body admits light rays into the camera. Ornamental frame 12, secured to the body forward of the safety glass, acts as a lens hood. The top of the box bears a mechanical viewing device (consisting of frame 6 and viewer 7) and two control knobs 8 and 9. Control knob 8 is used to set the camera's operating mode, and control knob 9 is used to set the exposure time.

The lower part of the box contains a plug connection for an electric flash attachment. The camera is stabilized by two wings and a keel. For operating convenience the box bears two handles, with the shutter lever 3 located on the right one. The camera is secured to the inner part of the box on special lugs.

The camera is powered by a 6 volt battery block. The camera can take single frames, and it can be operated automatically.

Average consumed power for one film roll (330 stereo pairs) is 0.6 watts. Battery pack capacity consumption is 0.1 amps per film roll.

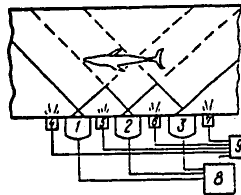


Figure 5

Figure 5 shows a typical set-up for recording the swimming kinematics of aquatic animals with one SFK-1 outfit mounted in a water canal or a net channel. Cameras 1, 2, and 3 are rigidly secured to one of the walls of the water canal or net channel in such a way as to insure the necessary overlap of the stereoscopic fields of vision of neighboring cameras within the zone of intended movement of the object to be filmed. The coordinate systems of the cameras are placed in mutual orientation by photographing a test object in the MSA-2 complex having the form of a standard cube. The test object is successively placed in the overlap zones of the stereoscopic fields of vision of neighboring cameras, and photographed synchronously.

When an aquatic animal enters the field of vision of one of the cameras at the far ends (1 or 3) control console 8 is used to transmit a command successively turning on the other cameras at prescribed time intervals. The

FOR OFFICIAL USE ONLY

FOR OFFICIAL USE ONLY

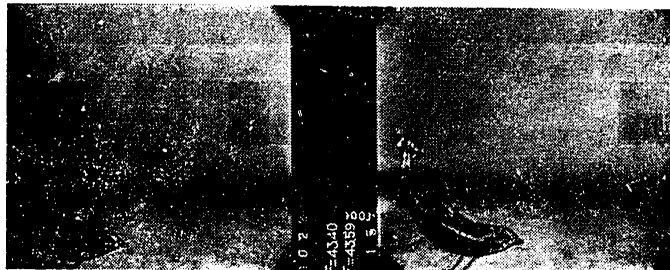


Figure 6

latter are computed on the basis of the animal's expected speed and the distance between the cameras.

The control console's electric circuit permits use of pickup elements that automatically turn on each of the cameras at the moment the object being photographed enters the field of vision.

When photographing in natural lighting, a number of stereo pairs (and, correspondingly, phases of movement of the object) equal to the number of cameras used can be obtained for each path of an aquatic animal. This does impose certain limitations, though several SFK-1 outfits could be used, controlled from the same console.

A method described in the literature (3) can be used to increase the number of phases of animal movement recorded. Synchronous contacts mounted on the control console 8 permit use of the SFK-1 system jointly with stroboscopic light sources 4, 5, 6, and 7, the control block 9 of which is connected to the camera control console 8.

Figure 6 shows a stereo pair of a dolphin taken by an SFK-1 camera in natural illumination. The typical points that can also be recorded with stroboscopic artificial lighting are marked on the animal's body. The camera number (No 001), the film number (15), the stereo pair number (0022), and the photogrammetric focal distance of the objectives are printed in the interval between frames of the stereo pair.

The SFK-2 system is suited to the sort of filming operations described in (1,2,4). However, the most interesting variant is that of using the SFK-1 and SFK-2 systems together, which insures full investigation of problems associated with the kinematics of marine animals swimming in an aquatic environment.

FOR OFFICIAL USE ONLY

The first experiment in which the MSA-2 complex was used demonstrated its great potential as a means for obtaining qualitatively new experimental data on the swimming kinematics of aquatic animals.

BIBLIOGRAPHY

1. Golgolev, V. A., Dubravin, A. P., Kozlov, L. F., et al., "Use of Film Recording to Study the Swimming Parameters of Aquatic Animals in the Horizontal Plane," in "Bionika" (Bionics), Kiev, Izd-vo Nauk. dumka, No 10, 1976, pp 75-78.
2. Dubravin, A. P., and Kozlov, L. F., "Use of Photogrammetry to Study Dolphin Kinematics," GIDROBIOL. ZHURN., Vol 10, No 2, 1974, pp 124-126.
3. Dubravin, A. P., and Kozlov, L. F., "Use of Stereoscopic Photography to Study Dolphin Swimming Kinematics," in "Bionika" (Bionics), Kiev, Izd-vo Nauk. dumka, No 9, 1975, pp 33-36.
4. Kozlov, L. F., Dubravin, A. P., Gogolev, V. A., et al., "Investigation of the Swimming Kinematics of Marine Animals by the Stereophotogrammetric Method," GIDROBIOL. ZHURN., Vol 12, No 6, 1976, pp 94-98.
5. Pyatetskiy, V. Ye., "Kinematic Characteristics of the Swimming of Some Fast-Swimming Marine Fishes," in "Bionika" (Bionics), Kiev, Izd-vo Nauk. dumka, No 4, 1970, pp 11-20.
6. Pyatetskiy, V. Ye., et al., "Cord Film Box for Underwater Filming From Moving Vessel," in "Bionika" (Bionics), Kiev, Izd-vo Nauk. dumka, No 3, 1969, pp 90-96.
7. Pyatetskiy, V. Ye., and Kayan, V. P., "Characteristics of Lake Trout Swimming," in "Bionika" (Bionics), Kiev, Izd-vo Nauk. dumka, No 5, 1971, pp 13-18.
8. Pyatetskiy, V. Ye., and Kayan, V. P., "Some Kinematic Characteristics of the Swimming of the Common Dolphin," in "Bionika" (Bionics), Kiev, Izd-vo Nauk. dumka, No 6, 1972, pp 18-21.
9. Pyatetskiy, V. Ye., Kayan, V. P., and Kravchenko, A. M., "Experimental Set-Ups, Apparatus, and Methods for Studying the Swimming Hydrodynamics of Aquatic Animals," in "Bionika" (Bionics), Kiev, Izd-vo Nauk. dumka, No 7, 1973, pp 91-101.
10. Semenov, N. P., Babenko, V. V., and Kayan, B. P., "Experimental Investigation of Some Features of Dolphin Swimming Hydrodynamics," in "Bionika" (Bionics), Kiev, Izd-vo Nauk. dumka, No 8, 1974, pp 23-31.  
[004-11004]

COPYRIGHT: Izdatel'stvo "Naukova dumka", "Gidrobiologicheskiy zhurnal", 1979

11004  
CSO: 1840

34  
FOR OFFICIAL USE ONLY



FOR OFFICIAL USE ONLY

INSTRUMENTS AND EQUIPMENT

COLLECTION OF CYBERNETIC TECHNIQUES IN BIOMEDICAL RESEARCH

Moscow and Leningrad KIBERNETICHESKIY PODKHOD K BIOLOGICHESKIM SISTEMAM in Russian 1976 pp 2-4, 157-158

[Annotation, preface, and table of contents of book "Kiberneticheskiy Podkhod k Biologicheskim Sistemam" (The Cybernetic Approach to Biological Systems) edited by N. I. Moiseyeva]

[Excerpts] Annotation

This collection presents summaries of work by associates at the Institute of Experimental Medicine of the Academy of Medical Sciences USSR in recent years in the field of biocybernetics and the application of computer technology in biomedical research.

The collection contains the results of studies concerning the problems of collecting signals of biological origin, feeding them to the computer, and mathematical analysis of them. It describes a large number of techniques of analyzing various types of data, from investigating neuron activity to program-based stereotaxic operations on the brain.

The articles in the main section of the anthology are devoted to investigations of biological systems for adaptive regulation.

This anthology will be of great interest to specialists in various fields: biologists, physiologists, medical scientists, engineers, and mathematicians, who are working on questions of analyzing biomedical information using computers, as well as persons interested in the processes of regulation in biological systems.

[The book was published in an edition of 1,000]

Preface

During the struggle in the formative stage of the field of cybernetics Academician A. Kolmogorov defined his attitude towards its potential in the form of a statement: "I am one of the absolutely confirmed

FOR OFFICIAL USE ONLY

cyberneticists who sees no fundamental limitations in the cybernetic approach to the problems of life and believes that it is possible to analyze life in all its fullness, including the human consciousness in all its complexity, by the methods of cybernetics."\* Today there is no need to establish the importance of cybernetics for the study of biological systems, but there is an unquestionable need to develop and improve cybernetic approaches in order to find answers to the traditional questions of the science of life: how and why. How and why does a biological system function? How can the data of biological studies be analyzed?

The present collection of articles, which summarizes the work of researchers at the Scientific Research Institute of Experimental Medicine of the Academy of Medical Sciences USSR in recent years in the field of cybernetics and the application of computer technology and biomedical research, was compiled to answer these questions. But this, of course, does not mean in general, but rather in application to specific problems.

The first sections of the book present results from studies concerned with the problems of organizing the collection of signals of biological origin, feeding them to the digital computer, and mathematical processing techniques.

These developments have quite a broad range of application, from techniques for studying neuron activity and multicellular activity to methods of evaluating the actions of a human operator; from procedures for determining the parameters of superposed peaks of the gas-chromatograph curve to programmed stereotaxic operations on a human being performed for purposes of research and therapy.

The articles in the third section of the book investigate systems of adaptive regulation with feedback not only for the purpose of understanding how and why the biological system functions but also to formulate ways to control the state of the human brain by influencing its homeostatic systems.

Thus, the articles in this collection are very diverse, which to some extent reflect the current tendency in the developments of cybernetics, which has not borne out hopes that it would bring about an integration of diverse knowledge in specialized sciences, which instead are experienced in a process of differentiation. Nonetheless, all the articles are joined by a common goal: the search to optimize study of the parameters of biological systems.

Table of Contents

I. Improving Methods of Feeding and Representing Data in the Computer

---

\* Kolmogorov, A., "Automata and Life," in "Vozmozhnoye v Kibernetike" [The Potential of Cybernetics], Moscow, 1963, p 11.

FOR OFFICIAL USE ONLY

Moiseyeva, N. I., Ampilov, B. A., Sergeyev, V. A., Simonov, M. Yu., Sysuyev, V. M., and Khoptyar, V. P., "Ways to Optimize Machine Processing of the Data of the Biomedical Scientific Research Institute" . . . . . 5

Simonov, M. Yu., and Kaminskiy, Yu. L., "The Organization of Collection and Feeding Bioelectric Signals to the Digital Computer" . . 18

Romanov, S. F., and Shelemekha, A. S., "Feeding Analog and Pulsed Signals to the Nairi-2 Computer" . . . . . 22

Sergeyev, V. A., "Modular Programming Subsystem for the Minsk-32 Computer, Oriented to Processing a Flow of Data During the Solving of Scientific Research Problems" . . . . . 26

Polonskiy, Yu. Z., "Roentgenogram Structures Using the Computer" . . . 28

Annaraud, D. K., and Usov, V. V., "Algorithms of Stereotaxic Computer Catalog-Atlas" . . . . . 35

Anichkov, A. D., Annaraud, D. K., Yefimenkova, N. A., Polonskiy, Yu. Z., and Usov, V. V., "Software for Stereotaxic Operations" . 47

Kozlov, Yu. Ya., "The Nomogram Method of Analyzing Macrobiorhythms" . . 52

II. Methods of Analyzing Biomedical Data on the Computer

Usov, V. V., "Program Modeling of Short-Term and Long-Term Memory" . . 57

Vasil'yev, N. M., Silakov, V. L., Starshinov, A. I., Taganova, A. A., and Zarkashev, E. G., "The Use of One of the Methods of Stereotaxic Classification to Determine the Effects of Conditioning" . . . . . 63

Bukreyeva, N. N., and Stepanov, I. I., "The Application of Generalized Dispersion Analysis to Identify Differences in the Spectral Characteristics of Electrograms of the Brain" . . . . . 70

Boymler, Kh. Kh., and Sysuyev, V. V., "Methodology for Analyzing Pulsed Activity Using Walsh Functions" . . . . . 73

Slautsitays, V. V., and Sysuyev, V. M., "Study of the Possibility of the Periodogram Method in Models of Average Frequency of Cardiac Rhythm" . . . . . 81

Roshchektayeva, S. A., and Sytinskaya, T. V., "The Application of Cluster Analysis of the Spectral Characteristics of Human ESKoG [expansion unknown] in the Study of Operational Memory" . . 84

FOR OFFICIAL USE ONLY

Polonskiy, Yu. Z., and Suvorov, N. B., "Analysis of Postinterval Distributions with Directed Reorganizations of Pulse Flows" . 88

Bekshayev, S. S., Suvorov, N. B., Soroko, S. I., Kutuyev, V. B., "Methods of Evaluating the Activity of a Human Operator During Visual Motor Tracking" . . . . . 92

Katinas, G. S., Matveyev, V. V., and Lyashko, O. G., "Identification of the Trend of a Process by the Technique of Computing the Moving Average" . . . . . 96

Simonov, M. Yu., "Determining the Parameters of Superposed Peaks of the Gas Chromatograph Curve Using the Computer" . . . . .101

III. Systems of Adaptive Regulation with Feedback

Dan'ko, S. G., Kambarova, D. K., and Kolosov, F. I., "Some Neurophysiological Aspects of Devising an Automated System to Control the State of the Brain in the Treatment of Epilepsy" . .108

Chernigovskaya, N. V., and Tsukerman, A. S., "Adaptive Biocontrol as a Way to Affect Homeostatic Systems of the Brain in the Norm and in Pathology" . . . . .116

Aleksanyan, Z. A., Sysuyev, V. M., and Sidorov, Yu. A., "The Possibilities of Using Computer Equipment to Study the Interrelation of the Pulse Activity of Neurons and Fluctuations of Arterial Pressure" . . . . .125

Soroko, S. I., Suvorov, N. G., Kutuyev, V. B., and Bekshayev, S. S., "Work Capability in Control Systems with Feedback by Periods of Human Adaptation in Antarctica" . . . . .129

Kropotov, Yu. D., "Some Principles of Organization of Slow Processes in the Human Brain" . . . . .135

Tumanyan, S. A., Usov, V. V., and Belyayev, V. V., "Dynamic Leading in the System of Biopotentials of the Cerebral Cortex" . . .142

Bibliography . . . . .150

COPYRIGHT: Nauchnyy sovet po kompleksnoy probleme. Kibernetika AN SSSR, 1976 [68-11,176]

11176  
CSO: 1863

FOR OFFICIAL USE ONLY

INSTRUMENTS AND EQUIPMENT

UDC 616.51-001-07:681.3

EXPERIENCE IN THE OPERATION OF A CONSULTATIVE-DIAGNOSTIC POINT OF A COMPUTER DIAGNOSTIC SYSTEM FOR ACUTE CRANIAL-BRAIN TRAUMA

Leningrad OPYT RABOTY KONSUL'TATIVNO-DIAGNOSTICHESKOGO PUNKTA VYCHISLITEL'NOY DIAGNOSTIKI OSTROY CHEREPNO-MOZGOVOY TRAVMY in Russian 1977 pp 2, 136

[Annotation and table of contents from the book "Opyt Raboty Konsul'tativno-Diagnosticheskogo Punkta Vychislitel'noy Diagnostiki Ostroy Cherepno-Mozgovoy Travmy" by Natal'ya Ivanovna Moiseyeva and Grigoriy Danilovich Luchko, Izdatel'stvo Meditsina, signed to press 20 October 1977, 3,000 copies, 136 pages]

[Text] ANNOTATION

In this book the authors generalize their personal experience in the matter of rendering consultative assistance (using the capabilities of computer technology) to practical physician-traumatologists and neurosurgeons when a rapid diagnosis of acute cranial-brain trauma is needed. They discuss the difficulties of the diagnostic process, the causes of medical errors, the capabilities and limitations of computer diagnosis, the possible accuracy of a diagnosis achieved by the computer method, and its profitability.

They define more precisely the selection of symptomatology and their general approach to the separation of diagnostic groups during the rapid diagnosis of acute cranial-brain trauma. They also describe the general organization of the operation of a computer diagnostic point, with detailed methodological directions and a description of the order of actions of the medical personnel in a hospital and the workers at the consultative point.

This book is intended for neuropathologists, neurosurgeons, traumatologists and emergency room physicians.

The book contains 20 tables, 2 figures and a bibliography of 167 titles.

FOR OFFICIAL USE ONLY

TABLE OF CONTENTS

	Page
Introduction. . . . .	3
Chapter 1. Difficulties in Diagnosis and Causes of Errors in the Treatment of Occult Cranial-Brain Trauma. . . . .	7
Classification of Occult Injuries of the Brain. . . . .	9
Forms of Occult Injuries of the Brain Most Frequently En- countered in Clinical Practice. . . . .	12
Analysis of the Causes of Physicians' Errors in Identifying Occult Cranial-Brain Trauma . . . . .	34
Chapter 2. Goals, Problems and Possibilities of the Use of Computer Diagnostics in the Identification of Forms of Brain Pathology . . . . .	41
Chapter 3. Development of a Computer Diagnostics System for Cranial-Brain Trauma and Organization of the Op- eration of a Consultative Computer Diagnostic Point. . . . .	53
Chapter 4. Results of the Medical Diagnosis of Cranial- Brain Trauma Using the Consultative Assistance of a Digital Computer. . . . .	85
Chapter 5. Treatment of Acute Cranial-Brain Trauma. . . . .	93
Special Features of the Observation of Patients With Oc- cult Cranial-Brain Trauma . . . . .	93
Treatment of Patients With Brain Concussion . . . . .	97
Treatment of Patients With Contusions of the Brain. . . . .	102
Treatment of Patients With Intracranial Hematomata. . . . .	110
Conclusion. . . . .	116
Appendix. Coding List of Symptoms and Indicators of Acute Cranial-Brain Trauma . . . . .	122
Bibliography. . . . .	128

COPYRIGHT: Izdatel'stvo "Meditsina," Moscow, 1977  
[95-11746]

11746  
CSO: 1863

40  
FOR OFFICIAL USE ONLY

FOR OFFICIAL USE ONLY

LIMNOLOGY

UDC 551.481.1

DEVELOPMENT OF LIMNOLOGY IN THE USSR

Moscow VESTNIK AKADEMII NAUK SSSR in Russian No 7, 1979 pp 69-75

[Article by USSR Academy of Sciences Corresponding Member O. A. Alekin, based on the author's report given in a session of the USSR Academy of Sciences Department of Oceanology, Atmospheric Physics, and Geography]

[Text] Sensible use and protection of natural waters is presently acquiring increasingly greater significance. A significant part of our country's water resources are represented by lakes. It would be sufficient to recall that there are about 3 million lakes (with an area greater than 1 hectare) in the USSR, 19 of them having an area greater than 1,000 km<sup>2</sup>. Of the 22 world's largest lakes (with an area greater than 5,000 km<sup>2</sup>), 7 are in our country, to include the deepest and broadest freshwater lake--Baikal.

As in many other areas of the natural sciences, the origin and development of limnology depended in many ways in our country on the level of its productive capacity and practical needs, on development of associated sciences (mainly geography and hydrology, which deal in part with limnology), on the goals and possibilities of research, and on the scientific viewpoints of the researchers. The content and direction of limnology, its goals and tasks, its place among associated sciences, and its methodological foundations have been subjected to extensive discussion, and reexamined critically many times.

We can divide, with a certain degree of arbitrariness, the development of limnology in our country into three periods--the first prior to the October Revolution, the second up to the 1950's, and the third embracing the last three decades (1950-1980).

In the first period lake research was incidental in nature, being associated either with development of fisheries or with general geographic exploration. It was not until the second half of the 19th century that information on lakes began to be accumulated owing to development of Russian's industry and its natural resources. This accumulation was promoted by expeditions of the Academy of Sciences, the Geographical Society, the Society of Natural Historians, and institutions dealing in land development and improvement of communications.

FOR OFFICIAL USE ONLY

Limnology is said to have begun in our country with the work of D. N. Anuchin and L. S. Berg in the late 19th and early 20th centuries. One of the greatest geographers of our country, Anuchin is said to be the first limnologist. Basing himself on his own research, he wrote several works on Russia's lakes in which he indicated a close relationship between the particular features of lakes and their genesis on one hand, and topography, climate, and the hydrologic cycles of river and ground water on the other.

Another great work that served as a landmark in development of domestic limnology was the monograph "Aral'skoye more" (The Sea of Aral) by L. S. Berg, which for the first time in domestic literature provides a deep description of a water basin on the basis of a complex of sciences--geology, climatology, cartography, hydrochemistry, biology, and ichthyology. Nor should be fail to mention the works of B. I. Dybovskiy and E. Godlevskiy, who conducted research on Lake Baikal in the 1870's, at the dawn of scientific limnology.

All of these works were written almost simultaneously with publication of the works of the Swiss scientist F. A. Forel, said to be the founder of scientific limnology abroad.

Arisal of scientific limnology in our country was predetermined by progressive ideas of domestic geographic science, developed in this time by a brilliant group of scientists--P. P. Semenov-Tyan-Shanskiy, D. N. Anuchin, A. I. Voyeykov, V. V. Dokuchayev, and others.

Beginning with the first years of Soviet rule, research on lakes was started with the goal of utilizing their natural resources for power production, fisheries, and water transportation. The Olanetskaya Scientific Limnological Expedition was organized as early as in 1918 in accordance with G. Yu. Vereshchagin's far-reaching plan. Although the material gathered by this expedition was not published in its entirety, its results had great significance to development of the methods of expeditionary work and to training research personnel.

Extensive expeditions were conducted to large lakes in the 1920's and 1930's by the Hydrometeorological Service (the Hydrologic Institute), the Academy of Sciences, and universities. The Sea of Aral, Baikal, Issyk-Kul', Balkhash, Teletskoye, Ladoga, Onega, and Chudsko-Pskovskoye lakes were studied.

Research was also conducted on small lakes, mainly for hydrobiological and fisheries purposes. More-extensive integrated geographic problems were also posed concurrently. It was precisely in this period that research on regional limnology was started. So-called limnological surveys were conducted in 1933 and 1934 with the purposes of describing and systematizing the enormous quantity of small lakes; the program embraced the entire complex of divisions in limnology. Limnological surveys were performed in different regions offering different physicogeographic conditions. Groups of lakes were explored on the Kola Peninsula, in Karelia, in Leningrad Oblast, in Central European USSR, in the Altay, and in the Yakut ASSR.

FOR OFFICIAL USE ONLY



FOR OFFICIAL USE ONLY

Because expeditions offered limited possibilities for studying lake hydrologic cycles, biological scientific stations had to be created at the lakes. As early as in 1892 N. V. Zoograf founded the first hydrobiological station at Lake Glubokoye. In 1896 the Borodinskaya Biological Station was established at Lake Bologovskoye, to be subsequently moved to Lake Seliger and then into the Karelian ASSR. A. A. Lebedintsev conducted precise stationary studies to determine oxygen cycles in Lake Pestovo in 1908. Generally speaking, hydrobiologists engaged in floristic and faunistic research on aquatic organisms made a great contribution to development of limnology while developing their own areas of scientific knowledge. Many researchers would not limit themselves to taxonomy and morphology of organisms, preferring to delve into ecological problems.

The Borodinskaya Biological Station in the Karelian ASSR attained widespread fame in the 1930's owing to the work of B. V. Perfil'yev, who created the teaching on microzones in sedimentary deposits and proposed construction of a number of instruments to study sediments (stratometer, microisolator, plunger sampler). A biological station began operating in 1925 at Lake Sevan. Here, V. K. Davydov conducted research, excellent for those times, on local conditions, the hydrologic cycle, components of the water budget, the lake's thermal cycle, and the water's chemical composition in connection with construction of a series of hydroelectric power plants.

The Academy of Sciences decided to organize a research base at Lake Baikal in 1916, when the Baikal Commission was organized under the chairmanship of Academician N. V. Nasonov. The Academy of Sciences' first research station at Lake Baikal was organized in 1918 in the village of Bol'shiye Koty. In 1921 this station was transferred to Irkutsk University. The Academy of Sciences created a second research base--the Baikal Expedition--in June 1925. On G. Yu. Vereshchagin's initiative this base was used in 1928 as the framework for establishment of the Academy of Sciences Baikal Limnological Station. This limnological station, our country's largest, made a valuable contribution to development of domestic limnology not only by studying this unique lake, the world's deepest, but also by working on theoretical and methodological problems and investigating the thermal, glacial, and hydrochemical cycles and Baikal's endemic life forms.\*

The Kosinskaya Biological Station also had great significance to development of limnology in our country. L. L. Rossolimo, the station director, and his colleagues devised a budget of accumulation and cycling of matter in lakes, and they worked out a quantitative budget of energy assimilated through photosynthesis and released into the water basin upon transformation of matter; these budgets became a basic principle of modern limnology.

---

\* For greater detail on research conducted on Lake Baikal, see Galaziy, G. I., "Scientific Research on Lake Baikal," VESTNIK AN SSSR, No 12, 1976.

FOR OFFICIAL USE ONLY

FOR OFFICIAL USE ONLY

The second period of limnology's development is typified not only by expansion of research and change in its direction but also by creation of a new methodology, particularly by development of the integrated approach.

Our country's greatest limnologist, G. Yu. Vereshchagin, was a proponent of integrated research on lakes. According to his views limnology is an integrated scientific discipline based on physics, chemistry, geology, botany, and zoology. Interpreting the water basin as a whole, limnology makes it its objective to study processes and phenomena proceeding in a lake, in their interaction among themselves and with the surrounding environment. Vereshchagin felt that limnology's objectives included not only asserting the empirical dependencies between individual processes and phenomena occurring in natural waters but also determining the genetic relationships among these phenomena. An example of the integrated approach can be found in the research conducted in 1918-1924 under Vereshchagin's supervision by the Olonetskaya Scientific Expedition.

A large part of the expeditionary lake research conducted in the second period of development of limnology in our country made use of the integrated method. However, the integrated approach was far from universally accepted. Some studies on lakes (particularly by the Hydrometeorological Service), performed beginning in the late 1930's, failed to include hydrobiological and, frequently, hydrochemical research among the limnological projects. The reason for this lay in differences in interpretation of the essence of limnology by some researchers. The fact is that some hydrologists exclude hydrobiology from the complex of limnological sciences, feeling that hydrology, of which limnology is a part, involves itself only with the physical essence of phenomena. The other extreme is the point of view taken by some hydrobiologists who feel that aquatic organisms and biological processes are the main subject of limnology, and who interpret everything else as simply the habitat of aquatic life forms.

The extreme points of view on the objectives of limnology are in our opinion the product of an insufficient understanding of the fact that sciences of natural objects must base themselves on a complex of fundamental sciences (physics and biology in this case). However, in addition to integrated research on lakes as natural objects we also need deeper detailed research on individual processes associated with lakes.

There are other viewpoints on the objectives of limnology as well. Despite the fact that the term "limnology" literally means science of lakes, some researchers believe limnology to be a scientific discipline concerning itself not only with lakes but also in general with all waters on the surface of land, to include rivers. In particular, this is the point of view taken by a significant proportion of scientists in the International Association of Theoretical and Applied Limnology, the membership of which consists mainly of biologists. But we can hardly accept taking the same approach to studying lakes and to studying rivers just on the basis of the community of aquatic

FOR OFFICIAL USE ONLY

FOR OFFICIAL USE ONLY

organisms alone. Although there is much that is evolutionarily common to a lake and a river, there are great differences in the morphology of a lake basin and a stream bed in terms of water cycling, the dynamics of water masses, bottom deposits, thermal and hydrochemical cycles, and other characteristics.

The third period of the development of limnology in our country is associated with unprecedented growth in industry and the entire national economy, and urban construction. The demand for water resources for hydroelectric power, irrigation, and water supply to growing cities increased dramatically in the country. All of this necessitated detailed study of lake cycles, and a knowledge of their extremes. Significant development of hydrophysical research methods based on theoretical premises and developed with the help of mathematical analysis methods and modern apparatus led to a deeper understanding of physical, chemical, and biological processes occurring in water basins.

In 1961 the Baikal Limnological Station was reorganized as the Limnological Institute of the Siberian Branch of the USSR Academy of Sciences, and the limnological laboratory created in 1944 in Leningrad as part of the Division of Geological-Geographic Sciences was reorganized in 1971 as the USSR Academy of Sciences Institute of Limnology. In the last two decades these institutes completed a great volume of research on Baikal, Ladoga, Onega, and other lakes. The research results were published in specialized institute collections and monographs.

Lake research is also being conducted by hydrobiological institutions--the Institute of the Biology of Inland Waters, the Ukrainian SSR Academy of Sciences Hydrobiological Institute, and by Institutes of the USSR Ministry of Fish Industry, universities, and other scientific institutions.

During this period, the practice of maintaining continuous observations on lakes (particularly those under the jurisdiction of the Hydrometeorological Service) began to develop, and hydrometeorological observatories and specialized lake stations making integrated hydrological and meteorological observations were created. The goal of these observations was to establish the laws governing the water, thermal, glacial, and hydrochemical cycles of different types of water basins, and to develop forecasting methods.

Integrated lake research assumed dominance in our country in these years. The need for an integrated approach became especially clear in relation to the problem of protecting natural waters from pollution. Investigation of self-purification, control of water basin eutrophication, and analysis of biological water indicators are directly associated with the biological nature of these processes, and hydrobiological and hydrochemical laws define physical processes occurring in a lake.

In the last two decades limnology found itself facing major tasks, new to a certain extent, in connection with man's greater influence upon natural

FOR OFFICIAL USE ONLY

FOR OFFICIAL USE ONLY

waters as well as in connection with the problem of transferring some of the river discharge from the north to the south. The influence of man's technical activities on nature, particularly on natural waters, is extremely diverse. Regulation of water discharge, redistribution of water among different basins, creation of reservoirs, alteration of lake cycles through construction of hydraulic engineering structures, agricultural land reclamation, agrotechnical measures implemented on watersheds, and alteration of discharge cycles are far from a complete list of man's effect on water basins and water flow. This effect has an especially dangerous influence upon water quality.

Rapid postwar growth of industry and cities led to greater water consumption (and, correspondingly, to greater discharge of waste water), and it created the danger of worsening water quality.

Growth in surface runoff from agricultural fields, farms, and animal husbandry complexes also influences water quality. In the last 15-20 years the water treatment problem has become an important part of an even greater problem--that of protecting the environment from pollution.

While rivers--natural courses of surface runoff--are more easily subjected to pollution but can purify themselves more quickly due to fast water cycling, substances of manmade origin accumulate in lakes. One part of these substances is carried out with lake discharge, and another part is subjected to complex transformation as a result of complex physical (sedimentation), physicochemical (coagulation, adsorption), chemical (oxidation, complex formation), biological, and microbiological processes occurring in lakes. Despite self-purification, as a result of mineralization of organic matter biogenic substances taking the form of phosphorus and nitrogen compounds remain in the water basin. These substances promote development of biological processes in the lake.

Research on the influence of the anthropogenic factor on change in lacustrine trophism has become one of the most important tasks of limnology in recent decades. While in previous times protection of natural waters from pollution was the province of organizations associated directly with the use of natural waters and control over the state of lakes and streams, now this issue has become fundamental to all scientific organizations studying natural waters in the different forms of their existence.

The nature conservation problem needs to be subdivided into three parts in application to lakes. The first consists specifically of the fight against pollution, the effort to minimize the volume of waste water and the quantity of contaminants introduced. For this purpose we need to build treatment plants, develop new methods of wasteless production, utilize waste water better for various purposes, organize intraplant water recycling, and much else.

Waste water treatment is a multifaceted problem of industrial technology, since it is a unique form of production in which dirty water is the raw

FOR OFFICIAL USE ONLY

material and clean water is the product. The main obstacles to solving the waste water treatment problem are associated with continuous growth in the quantity of wastes, which are now measured in the dozens of cubic kilometers per year, as well as with the extreme diversity of this water's composition.

The task of complete water treatment--that is, of processing waste water to the purity of natural water, is extremely complex. First, given the existing volumes of waste water it is technically difficult to treat this amount, and secondly the cost of treatment grows dramatically as the degree of purification rises.

The second part of the problem consists of systematic monitoring of the purity of waste water discharged into water basins, and the state of water basins near points of waste water discharge. This monitoring is performed by the Sanitary Inspection of the Ministry of Public Health, the Basin Inspection of the Ministry of Water Management, and the Fish Inspection.

The third part of the water conservation problem has to do with research on the influence of pollutants upon the condition of lakes with the goal of creating scientific principles of water basin protection. The task is to improve the methods for indicating the condition of a water basin, to study the rates of eutrophication and self-purification; to establish regions of anthropogenic eutrophication, and to develop measures to control eutrophication, forecasting methods, and recommendations on reducing harmful consequences. To solve all these problems, we will need to deeply study biological and chemical processes defining the rate of formation of organic matter in lakes, its destruction, and recycling and regeneration of biogenic substances. In natural conditions, these processes depend in turn on the particular features of the water basin, particularly on its morphometry, the water budget, the dynamics of water masses, the thermal and hydro-chemical cycles, the nature of sedimentary deposits, and the lake's evolution. They depend to an equal degree on the physico-geographic conditions in which the lake exists, and for this reason, given presence of an anthropogenic influence, the role of the watershed acquires special significance to an understanding of eutrophication processes. This part of the water conservation problem is within the province of the objectives of limnology.

Major successes have been achieved in domestic limnology as a scientific discipline in the years of Soviet rule. Let me briefly indicate the most significant ones.

We have arrived at a definition of a lake as a natural object, the genesis, morphology, and all characteristic parameters of which are closely associated with the physico-geographic conditions of the surrounding environment. Lake characteristics have been found to exhibit zonal features in the USSR.

FOR OFFICIAL USE ONLY

The structural complexity of lakes and the causes of variations related to lake area and depth have been established. The principal traits of the water, thermal, hydrochemical, and hydrobiological cycles of lakes as well as their dependence on lake basin morphometry, and the climatic, soil, and lithological conditions of the watershed have been studied.

Our understanding of the mutual relationships existing among all processes occurring in a lake, some of which can be described quantitatively, has grown stronger. Lake self-purification processes and methods of pollution monitoring are being studied successfully. The factors of anthropogenic lake eutrophication, the conditions influencing its rate, and the measures for controlling it have been revealed.

Paleolimnological research has been started; this will permit us to gain an understanding of the history and laws governing development of water basins so that trends in changes occurring in lakes could be described scientifically. Interesting results have been obtained on change in the rhythm of natural processes, particularly in the humidity of lake basins. The scientific foundations for forecasting and altering the principal characteristics of a lake and its hydrologic cycle have been laid.

Limnological practice now makes use of mathematical methods for computing the dynamics of water masses (currents, waves, water surges), techniques for modeling processes and phenomena occurring in a lake, and modern physical apparatus.

All of this has promoted transformation of limnology into an independent scientific discipline performing its own fundamental research and capable of solving important national economic problems.  
[638-11004]

COPYRIGHT: Izdatel'stvo "Nauka", "Vestnik Akademii nauk SSSR", 1979

11004  
CSO: 1840

FOR OFFICIAL USE ONLY

PUBLICATIONS

UDC 577.17.016:615.27:612.014.1+616-003.725

CYCLIC NUCLEOTIDES AND ADAPTATION OF THE BODY

Leningrad TSIKLICHESKIYE NUKLEOTIDY I ADAPTATSIYA ORGANIZMA in Russian 1978  
signed to press 11 Aug 78 pp 2-4, 181-182

[Annotation, introduction and table of contents from book by Dorofeyev,  
G. I., Kozhemyakin, L. A. and Ivashkin, V. T., Izdatel'stvo "Nauka", 182  
pages, 2200 copies]

[Text] The monograph examines modern concepts of the role and general biological importance of cyclic nucleotides in the regulation of cellular metabolism, the provision and mediation of functional activity of organs and physiological systems. Starting from the wonderful multiformity of the physiological-biological effects of cAMP and cGMP and, also, of their functions in the perception and transformation of neurohormonal regulatory influences, the authors--on the basis of literature and their own data--have undertaken to establish the participation of the cyclonucleotides in the pathogenesis of myocardial ischemia, bronchial asthma, gastro-intestinal diseases, some endocrinopathies and extremal states. Emphasis is placed on the decisive importance of changes in the character and dynamics of the cAMP-cGMP ratio in the organs and tissues for formation of processes of adaptation and control action on the resistance of the body to the action of extremal factors of the environment. References 935; figures 39; tables 20.

Introduction

Study of the role and importance of cyclic nucleotides has determined principally new paths of research on neurohormonal regulatory influences on cellular systems of the body.

It has been found that the cyclic nucleotides are secondary hormonal messengers and leading cellular mediators and any given hormone and neurotransmitter acts upon the cell through a system of cyclic nucleotides--universal and unique regulators of the metabolism, proliferation and differentiation of cells.

FOR OFFICIAL USE ONLY

## FOR OFFICIAL USE ONLY

Regulation of practically all aspects of metabolism in the various cell systems by cyclic nucleotides determines the special importance of disturbance of their metabolism in the etiopathogenesis of many pathological states. At the present time it is difficult to overestimate the contribution made as the result of studies of cyclase systems to the interpretation of the pathogenesis, the diagnosis and the establishment of the principles of metabolic therapy of many human diseases; their study in the clinic has made it possible to generalize and to approach freshly the solution of many general theoretical and applied aspects of medicine.

Disruptions in cyclase systems have been found with a number of pathological disturbances and, as their consequence, they cause a change in the sensitivity of the cell and tissue to neural and hormonal influences, which, in turn, can lie at the basis or aggravate the development of bronchial asthma, chronic diseases of the gastroduodenal system, acute enterites, hypertension, etc.

The molecular basis of the etiopathogenesis of disease can be different variants of disturbances in the system of cyclic nucleotides at the level of subunits of the cyclases or their interaction, rates of synthesis or hydrolysis of cyclic nucleotides of the system of 3',5'-AMP and cAMP-dependent proteinkinases. It must be especially emphasized that at all levels there is the possibility of occurrence of disturbances of the ratio in the system of cyclic nucleotides and enzymes of their metabolism.

The material presented is based on clinical and experimental studies of the role of cyclic nucleotides in adaptation of the body to new or unusual conditions of its existence, to some extremal actions. The importance of cyclic nucleotides in the mechanisms of adaptation of the body is dictated not only by their unique mediator functions of neurohormonal messengers but, in the same degree, their versatile role of regulators and integrators of cellular metabolism. This testifies to the basic importance of clarification of the patterns of changes in the system of 3',5'-adenosinmonophosphate-3',5'-guanosinmonophosphate (3',5'-AMP-3',5'-GMP), in the structure of the response reaction of the body to endogenous changes and to the action of environmental factors.

## Table of Contents

	Page
Introduction	3
Chapter 1. Cyclic nucleotides--the regulators of cellular activity and resistance	5
1.1 Cyclic adenosinmonophosphate	5
1.2 Adenylatecyclase	11
1.3 Cyclic Guanosinmonophosphate	14
1.4 Phosphodiesterase	17
1.5 Proteinkinase	19
1.6 Cyclic nucleotides in regulation of the activity and biosynthesis of proteins--enzymes	22



## FOR OFFICIAL USE ONLY

	Page
Chapter 2. Regulation by cyclic nucleotides of reactions of adaptive reconstruction of the heart	38
2.1 Role of cAMP in mediation of inotropic effects	38
2.2 Cyclic nucleotides in the regulation of metabolism of the myocardium	40
2.3 Regulation by cyclic AMP of ion pumps of the sarcolemma	42
2.4 Regulation by cyclic AMP of the calcium pump of sarcoplasmic reticulum	46
2.5 Participation of cAMP in the regulation of contractile proteins of the myocardium	48
2.6 Cyclic nucleotides and coronary blood flow	50
2.7 Participation of cyclic nucleotides in adaptation of the heart to great loads	51
2.8 Cyclic nucleotides and acute myocardial ischemia	62
Chapter 3. Cyclic nucleotides and allergies	68
3.1 Theory of beta-adrenergic blockade in allergic diseases	68
3.2 Disturbances in the system of cyclic nucleotides in the paroxysmal period of bronchial asthma	70
3.3 Tasks of pharmacological action in the paroxysmal period of bronchial asthma	75
3.4 Cyclic nucleotides and principles of therapy in remission of allergic diseases	76
Chapter 4. Cyclic nucleotides in the regulation of functional activity of the stomach	82
4.1 Cyclic AMP and HCl secretion	82
4.2 Role of AC-cAMP in the pathogenesis of diseases, of the gastroduodenal system	85
4.3 H <sub>2</sub> -histamine reception in the mucous membrane of the stomach	90
Chapter 5. Cyclic nucleotides in the regulation of functional activity of the pancreas	93
5.1 Transport of electrolytes	93
5.2 Secretion of enzymes	97
Chapter 6. Cyclic nucleotides in the regulation of water-electrolyte transport in the small intestine	101
6.1 Factors which regulate secretion and absorption of water and ions by the mucous membrane of the small intestine	101
6.2 Influence of cholera toxin on the system AC-cAMP in water-electrolyte flow in the small intestine	103

FOR OFFICIAL USE ONLY

	Page
Chapter 7. cAMP-dependent physiological systems under conditions of hypokinesia	113
Chapter 8. Cyclic nucleotides in mechanisms of adaptation of the body to extremal actions	126
8.1 Cyclic AMP and some metabolic patterns of the bodily adaptive reaction	126
8.2 Cyclic nucleotides of the CNS in formation of bodily resistance	131
8.3 Directed changes in the ratio of cyclic nucleotides	142
8.4 Concept of the adreno- and cholin- ergic phases of the bodily adaptive reaction	144
8.5 Clinical aspects of study of the role of cyclic nucleotides in mechanisms of adaptation to acute hypoxic states	147
Conclusion	151
Bibliography	155

COPYRIGHT: Izdatel'stvo "Nauka", 1978

8586  
CSO: 1840

FOR OFFICIAL USE ONLY

FOR OFFICIAL USE ONLY

PUBLICATIONS

NEW BOOK ON SCIENCE'S ROLE IN IMPROVING THE ENVIRONMENT

Moscow PROBLEMY OPTIMIZATSII V EKOLOGII (Optimization Problems in Ecology) in Russian 1978 signed to press 5 Dec 78 pp 2-4, 324-325

[Annotation, Introduction, and Table of Contents from book edited by I. B. Novik (Editor in Chief), Ye. S. Geller, A. G. Doskach, and V. A. Los', Izdatel'stvo "Nauka", 3,650 copies, 325 pp]

[Text] Annotation

This book examines the basic methodological problems concerning the mutual relationships between society and the environment in the conditions created by the modern scientific-technical revolution. The question of optimizing the environment is analyzed from the standpoint of both the interaction of nature and society, and sciences studying these problems. The book also illuminates problems concerning optimization of the urban environment, sensible use of natural resources, and so on.

CONTENTS

Page

Introduction (D. M. Gvishiani) . . . . .	3
I. The Optimization Problem: General Approaches	
Interaction of Nature and Society, and the Tasks of Constructive Geography (I. P. Gerasimov) . . . . .	5
Nature and Economics (N. P. Fedorenko, N. F. Reymers) . . . . .	23
Reason and the Biosphere (I. D. Laptev) . . . . .	40
Methodological Principles of the Interaction of Man and the Biosphere (I. V. Novik, V. A. Los', A. V. Katsura) . . . . .	58
II. Problems of Transforming and Optimizing the Natural Environment	
The Scientific Principles of Organizing Surveillance Over the State of the Environment in the USSR (Yu. A. Izrael') . . . . .	76
Scientific Principles of Writing Master Plans for Trans- formation of Nature (I. P. Gerasimov, V. S. Preobrazhenskiy, T. P. Kupriyanova, A. D. Armand) . . . . .	85

FOR OFFICIAL USE ONLY

FOR OFFICIAL USE ONLY

The Problems of Transforming and Protecting the World's Aquatic Resources (M. I. L'vovich) . . . . .	107
Economic Influences Upon the USSR's Aquatic Resources, and the Principles of Their Optimization (A. M. Grin, N. I. Koronkevich) . . . . .	111
Methodological Problems of Environmental Optimization, and Hygienic Science (A. V. Bykhovskiy) . . . . .	125
The Geographic Aspects of Optimizing the "Man-Natural Environment" System (An Anthropoecological Approach) (Ye. L. Raykh) . . . . .	135
Problems of Optimizing and Organizing Environmental Protection in Some European Socialist Countries (A. I. Kozyrev) . . . . .	142
III. The Dynamics of the Natural Environment, and the Problems of Controlling It	
Biogenic Transformations of Energy and Their Ecological Significance (G. F. Khil'mi) (Deceased) . . . . .	159
The Energetics of the Biosphere and Its Basic Systems (Yu. L. Rauner, M. M. Chernavskaya) . . . . .	175
Equilibrium and Stability in Nature, and Environmental Optimization (L. S. Abramov) . . . . .	186
Equilibrium of Geographical Systems (A. G. Doskach) . . . . .	189
Control of the Natural Environment in "Technoites" (A. Yu. Reteyum) . . . . .	205
The Gene Pool as the Theoretical Precondition for Maintaining Standards in Natural Ecosystems (A. A. Nasimovich) . . . . .	212
IV. Optimization of the Urban Environment and Resource Availability	
Optimization of the Urban Environment as an Area of Application of the Ideas and Methods of Modern Geography (Yu. V. Medvedkov) . . . . .	219
Urbanization and the Aspects of Its Optimization (G. M. Lappo) . . . . .	230
Modern Urbanization: Its Essence, New Forms, and Some Trends of Three-Dimensional Evolution (Yu. L. Pivovarov) . . . . .	239
Problems of Optimizing the Use of Resources, Developing Territory, and Protecting the Northern Environment (G. A. Agranat) . . . . .	253
V. Natural System Modeling Problems	
Stability and the Optimum in Models of Biological Communities (Yu. M. Svirezhev, D. O. Logofet) . . . . .	271

FOR OFFICIAL USE ONLY

Some Problems of Mathematical Modeling of the Interaction  
Between Man's Economic Activity and the Environment  
(Yu. A. Anokhin, A. Kh. Ostromogil'skiy) . . . . . 291

Some Methodological Problems of Global Modeling (V. A.  
Gelovani, S. V. Dubovskiy, V. V. Yurchenko) . . . . . 308

Introduction

In the second half of the 20th century, in the conditions of the scientific technical revolution, interaction between man and the biosphere, between society and nature, is becoming an increasingly more important problem. The principal issues presently troubling extensive circles of the public in various countries are: the sufficiency of natural resources to support the needs of the world's fast-growing population, and the influence human activity has on the natural environment. The ecological problems are organically associated with worldwide problems of modern times such as peace and relaxation of tension, cessation of the arms race, and provision of energy and resources to a growing mankind. The welfare of present and future generations and the development of modern civilization depend to a significant extent on constructive solution of the problems of biosphere optimization. All mankind is interested in successfully solving this ecological problem.

Our country devotes the most serious attention to these issues. Evidence of this can be found in the USSR Constitution, which emphasizes that nature conservation and sensible use of natural resources are a national task.

The paths we must take in research on habitat conservation and on more-sensible use of natural resources were spelled out at the 25th CPSU Congress, which noted that "...environmental and population problems that have become urgent in recent times must not fall out of the field of vision of Soviet scientists. Improvement of socialist nature exploitation and development of an effective demographic policy is an important task of an entire complex of natural and social sciences."\*

Integrated modern scientific knowledge allows us to evaluate the specific features of the evolved ecological situation within which mankind has put to its use practically all renewable and nonrenewable resources lying close to the surface of the globe. The systems approach, which permits us to consider, in our models, the relationship ecological processes have with socioeconomic processes and with food and energy production, is extremely important to such integration of the data of different scientific disciplines, and to their use in computer modeling.

---

\* "Materialy XXV s"yezda KPSS" (Proceedings of the 25th CPSU Congress), Moscow, 1976, p 73.

FOR OFFICIAL USE ONLY

The technique presently being developed for computer-modeling of global processes allows us to arrive at a more accurate description of real trends in world economic development, such that in the future we will be able to progress from descriptive models to more-strictly grounded controlling influences upon the supercomplex "society-nature" planetary system.

Despite the fact that this book examines the different aspects of the mutual relationships between society and the environment surrounding it, it concentrates materials essentially around just a single problem: How do we make the fullest use of the objective preconditions, created by the socialist structure, for optimizing "society-nature" relationships?

Using as our basis the conceptual grounds implied by the principles of the philosophy of dialectic and historical materialism, we can create a theoretical mechanism which would allow us to scientifically optimize, to one extent or another, the consequences of the influences of social production and man's activities on the habitat as a whole. Computer programming efforts play an extremely large role in this task. By modeling socioecological processes at both the regional and global levels, we will be able to arrive at a set of alternatives for important decisions concerning control of the national economy and social development.

The research presented here, which includes a number of reports discussed at an interdepartmental theoretical conference on the interaction of the sciences in development of socioecological problems (held June 1976 in Obninsk), can be interpreted as one of the stages along the way to forming a general conception of "quantified" modeling of the mutual relationships between society and the environment.

[63-11004]

COPYRIGHT: Izdatel'stvo "Nauka", 1978

11004  
CSO: 1840

56  
FOR OFFICIAL USE ONLY

FOR OFFICIAL USE ONLY

PUBLICATIONS

MILITARY MEDICAL TRAINING DESCRIBED IN NEW BOOK

Moscow VOYENNO-MEDITSINSKAYA PODGOTOVKA (Military Medical Training) in Russian, amended and enlarged third edition, 1978, signed to press 28 Jun 78 pp 2, 3-8, 372-375

[Annotation, foreword and table of contents from the book edited by D. D. Kuvshinskiy, Moscow, Meditsina, 373 pages, illustrated]

[Text] Annotation

The third, amended and enlarged edition of this textbook contains a systematic presentation of the fundamentals of the main scientific branches of military medicine: organization and tactics of the medical service of the Soviet Army, military field surgery, military field therapy, military hygiene, military epidemiology and medical supply. The textbook spells out the objectives and bases for organizing therapeutic and preventive measures in a chast'[unit] (podrazdeleniye [subunit]) in peacetime and wartime, as well as ways and means of organizing medical support of chast'i, podrazdeleniya and soyedineniya. [units] in different forms of modern warfare. Relevant sections of the book deal with the fundamentals of military field surgery and military field therapy, principles involved in rendering medical care to the wounded and sick with the use of modern weapons, as well as organization of treatment thereof at the different stages of medical evacuation. The main theses are expounded of sanitary-hygienic and epidemic-control support of the troops and organization of medical supply in the Armed Forces. In preparing the third edition of this textbook, due consideration was given to changes in the condition of the military medical service, supply thereof and organization of medical support of the troops. The textbook was written in accordance with the syllabus for military medical training, and it is intended for students at medical and pharmaceutical schools.

Foreword

Military medical training of students at secondary medical and pharmaceutical institutions is an important part of the syllabus, and it provides for the study of organization of medical support of combat operations of the troops, fundamentals of military field surgery, military field therapy, military hygiene and epidemiology, as well as special field supply and organization

FOR OFFICIAL USE ONLY

FOR OFFICIAL USE ONLY

of medical supply of podrazdeleniyes, chasts and institutions of the medical service.

It is very important for the military feldsher and pharmacist to learn the fundamentals of military medicine to the extent required for these positions for them to function well in troop chasts of the Armed Forces and formations of Civil Defense. Good military medical training will help those who will be called up in the ranks of the Soviet Army after graduating from medical and pharmaceutical schools, in successfully performing the difficult, diverse and important tasks of medical support of personnel, in becoming capable and reliable aids to military physicians. It will also be useful to graduates who will work in medical institutions of the civil health care service.

If, in spite of the peace-loving efforts of the people, imperialists succeed in launching a world war, the knowledge gained will help medical school graduates take a worthy place in the ranks of military physicians and honorably perform their duty to the Homeland on the battlefields.

The experience of the Great Patriotic War showed convincingly that the many thousand strong army of feldshers, pharmacists, nurses, corpsmen and corpswomen played an outstanding role in achievement of the good results of medical support and returning casualties to the ranks. Being present in the troop combat formations and sharing with them all the problems, misfortunes and dangers of march and combat life, they displayed endless loyalty to the Homeland, fearlessness, mass scale heroism and high professional qualities.

The position of military feldsher is difficult and responsible. He performs a set of measures, upon which depend the health, combat fitness and, in some cases, the life of podrazdeleniye servicemen. Excellent special training, courage and selflessness are required of the feldsher to perform these tasks well.

During the years of the Great Patriotic War, the military feldshers earned the love and deep respect of Soviet servicemen with their selfless labor. More than 15,000 feldshers received orders and medals of the Soviet Union. Many of them displayed genuine heroism and crowned themselves with everlasting glory. Ten feldshers received the highest award, the title of Hero of the Soviet Union. Their feats were vivid evidence of great spirit, valor and loyalty to the lofty duty of a Soviet medical man.

Lt Med. Serv S. V. Grigor'yan, a graduate of the Khar'kov Military Medical School, was commander of a medical platoon in the 19th Airborne Guard Regiment. Participating in the battles to liberate the Ukraine and crossing the Dnepr in force, Grigor'yan skillfully and bravely supervised the work of corpsmen and corpsman instructors, aiding the seriously wounded and evacuating them to the rear. The personnel of his platoon carried 250 casualties from the battlefield, 40 of whom were carried by Grigor'yan himself. In one of the battles, this brave feldsher destroyed a fascist



FOR OFFICIAL USE ONLY

tank that broke through to the location of the battalion. On 4 October 1943, in a fierce battle with the fascists who were trying to capture a bridgehead occupied by our troops on the western bank of the Dnepr, Grigor'yan saved the life of the battalion commander, shielding him with his body. By ukaze of the Presidium of the USSR Supreme Soviet dated 20 December 1943, the title of Hero of the Soviet Union was bestowed posthumously upon S. V. Grigor'yan.

F. A. Pushina volunteered for the front after graduating from the Izhevsk Feldsher School. For about 2 years, she worked as a feldsher in the medical company of the regiment devoting all her strength and knowledge to the care of wounded soldiers. In November 1943, the regimental medical post deployed in the suburbs of Kiev was submitted to intensive bombing. Several bombs fell on the medical post building. A fire started. The life of wounded and sick was in danger. Then Fedora Pushina dashed into the flaming building and, along with her comrades, started carrying out the wounded servicemen in her arms. Gasping from the smoke and flames, the medics went back into the building again and again, trying to carry out everyone before the roof fell in. The wounded were saved, but feldsher F. A. Pushina died of severe burns and trauma. To the very end she fulfilled her duty, sacrificing her life to save the wounded. The title of Hero of the Soviet Union was bestowed upon her posthumously.

Sr Lt Med Serv I. G. Iovenko, feldsher of the division guard, was outstanding for his courage and fearlessness. He followed the war from Stalingrad to Prague. He was among the first to cross the Dnepr, Visla and Oder, acted bravely on the captured bridgeheads, rendering aid to the wounded and, with them, repulsed the fascist attack. This brave feldsher personally was responsible for the death of more than one of the enemy. The Order of the Red Star, to orders of the Patriotic War and two "For Valor" medals were bestowed upon Iovenko for valor and skillful work on the battlefield, and for saving many casualties. Iovenko was outstanding for his high professional skill, ability to render aid to the wounded under the most difficult combat conditions, his ability to act competently and decisively.

These qualities were inherent in the vast majority of military feldshers. Wherever they had to work--on the battlefield, battalion and regimental medical posts, sites of epidemics, field medical institutions--they always succeeded in performing their duties. The main grounds for this was their good professional training, firm knowledge and practical skills, and much experience.

The decades that have passed since the Great Patriotic War have added many innovations to military science and military medicine. The Soviet Armed Forces have changed beyond recognition. They are supplied with powerful nuclear rocket weapons, modern combat technology and armament. The nature of combat operations of the Armed Forces has changed, their combat capabilities have increased drastically. There has been a change in military labor, troop living conditions and lifestyle.

## FOR OFFICIAL USE ONLY

New and exceptionally difficult tasks have been also put to the military medical service. A modern war, if launched by the imperialists, will differ radically from all prior wars. The possible use by an aggressor of mass strike weaponry--nuclear, chemical and bacteriological--would lead to mass scale casualties with particularly severe and complex injuries. There will be a drastic change in the structure of casualties. While gunshot wounds were the main form of injury in the last war, such forms of combat trauma as burns, radiation sickness, combined injuries of various types--lacerated, contused and crushed wounds, multiple fractures of different localizations, closed injuries to internal organs in various combinations with burns and radiation lesions--will be prominent in a modern war.

In view of the refinement of "ordinary" types of weapons, faster firing rate, greater initial velocity of projectiles and bullets and use of new ammunition, there will also be substantial changes in nature of gunshot wounds. They will be characterized by greater severity, complexity and they will be difficult to treat.

Burns due to napalm and other incendiary mixtures will be a serious form of combat injury. Lesions due to modern toxic agents and bacterial products may be exceptionally serious.

Thus, in a modern war the casualties will be notable for mass scale and instantaneous occurrence, complexity of structure and severity of injuries. A considerable number of wounded and sick will require immediate medical attention. Under such conditions, the medical service must be able to advance medical chasti and institutions to the sites of mass scale casualties and to render rapid and prompt medical care to thousands of casualties.

Prompt administration of first aid on the battlefield acquires special importance because of the mass scale of casualties. As shown by the experience of the Great Patriotic War, the results of subsequent treatment of the wounded depends largely on proper and prompt first aid. The sooner first aid was administered and the sooner the wounded were delivered to the stages of medical evacuation--regimental medical posts, medical battalion--the more successful was treatment, the less frequent complications and the sooner complete recovery was obtained. According to the data referable to the operation of medical chasti and institutions during the years of the Great Patriotic War, it was established, for example, that when surgical care was administered 13-24 h after injury was sustained the incidence of fatalities among operated casualties was double the incidence in cases where surgical care was administered at the early stages (up to 6 h after injury). However, already in the last war, the medical personnel could not render first aid on the battlefield to all the wounded that needed, there simply were not enough people. In a significant number of cases, the wounded rendered first aid to themselves, or else their comrades did so.

FOR OFFICIAL USE ONLY

For example, according to the data of the Sixth Army of the Southwestern Front, during the battle of Stalingrad 44% of the wounded rendered first aid to themselves, comrades gave first aid to 31% of the casualties and corpsmen and medical officers did so in only 25% of all cases. During the Berlin operation, according to data of the 69th Army of the First Belorussian Front, self-help and mutual aid were rendered in 23.1% of all cases. On the average, 38% of all cases of rendering first aid to the wounded was referable to self-help and mutual help over the entire Great Patriotic War.

The share and importance of self-help and mutual help will increase even more in a modern war with occurrence of mass scale casualties. Each soldier and officer must know how to render first aid to himself or a comrade swiftly, efficiently and competently in cases of gunshot wounds, serious trauma, burns, lesions due to toxic agents, etc. It is only then that he can save life and combat fitness, and perform the combat mission. The military feldsher participates actively in organizing and implementing military medical training of servicemen, inculcating in them firm practical skills in self and mutual help in cases of injury by modern weapons.

The military feldsher plays an exceptionally important role in successful implementation of medical support of a chast' (soyedineniye) as a whole. It would not be an exaggeration to state that the feldsher is constantly on the front line of military medicine, in the most responsible and important sector. In peacetime, during the days of intensive study, the feldsher comes in hourly contact with soldiers of his podrazdeleniye; he is deeply involved in all aspects of their work, life, leisure, shares with them the burdens of field marches and exercises. In wartime, he is a plenipotentiary representative of the medical service, concerned with the combat fitness of podrazdeleniye soldiers, organizing speedy removal of casualties from the battlefield, rendering medical care and evacuating them to the rear.

The legal position of the military feldsher and his military rank (the feldsher is assigned the rank of "praporshchik") enable him to successfully perform the duties imposed upon him, with the cooperation of commanders and political workers of podrazdeleniya.

At the same time, these duties and position impose much responsibility on the feldsher, require good, comprehensive training and diverse practical skills. He must be well-informed about the nature and distinctions of different types of combat injuries; he must be proficient in the methods and procedures of first medical and premedical care of the wounded and sick; he must have the necessary methodological skills to train personnel. As head of a battalion medical post (BMP), the feldsher organizes first aid, removal and evacuation of casualties from the battlefield, implementation of therapeutic-preventive and sanitary-hygienic measures under different conditions of the field [combat] march life of his podrazdeleniye. In order to perform these difficult tasks well and properly supervise subordinate junior medical personnel, the feldsher must be informed about

FOR OFFICIAL USE ONLY

the specific purpose (tactical employment) of his chast' (podrazdeleniye) and the main elements of organization of medical support of the troops under different conditions. In a medical battalion, medical detachment, field hospital and other medical units and institutions, the feldsher, who is the physician's assistant and, in some cases, substitute, performs complex and important measures pertaining to medical care.

Thanks to the concern of the Communist Party and Soviet government, the medical service of our Armed Forces has received in recent years a number of new drugs, special instruments, apparatus and units that make it possible to take broad advantage of the latest achievements of medical science to preserve and strengthen the capabilities and health of servicemen, to render a high quality of treatment to the wounded and sick, to organize effective medical support in any situation. The feldsher, who must be well-informed about and proficient in the use of special equipment, field medical techniques, evacuation and transport resources, plays an important role in prompt, proper and fullest use of these resources.

This textbook submits in brief information on the main aspects of organization of medical support of our Armed Forces in peacetime and wartime. They develop, explain and enlarge upon a number of theses and requirements spelled out in relevant statutes, instructions and manuals.

The authors have tried to help students in assimilating the fundamentals of military medical training, to acquaint them with the current status of the medical service, to provide as much information as possible of immediate practical interest. Of course, this textbook can only offer a general idea about the numerous, diverse and complex problems that will be encountered in the army by graduates of medical or pharmaceutical schools. There will be many new things for them to learn; they will have to expand and deepen the knowledge they have gained and acquire new skills. At the same time, assimilation of the syllabus on military medical training and good knowledge of this textbook will help students acquire the profession of military feldsher (pharmacist) and make their contribution to the performance of honorable and important tasks of preserving and restoring the health of Soviet servicemen.

In preparing this third edition, we took into consideration the many years of experience in teaching military medicine at secondary medical educational institutions using prior editions of the textbooks, suggestions and desires concerning further upgrading thereof. Obsolete information has been excluded. The textbook contains new material reflecting the current status of military medical science and the medical service.

## FOR OFFICIAL USE ONLY

CONTENTS	Page
Foreword	3
Section I. Fundamentals of Organization and Tactics of the Medical Service of the Soviet Army	
Chapter 1. Tasks and Fundamentals of Organization of the Medical Service of the Soviet Army in Wartime (D. D. Kuvshinskiy)	9
Tasks of the medical service of the Soviet Army	9
Fundamentals of organization of the medical service of the Soviet Army	28
Chapter 2. Fundamentals of Organization of Therapeutic and Preventive Measures in a Chast' (Podrazdeleniye) (A. V. Voropay)	35
Chapter 3. Fundamentals of Organization of Therapeutic and Evacuation Measures in a Chast' (Podrazdeleniye) (V. V. Meshkov)	48
Concept of casualties of war and classification thereof	48
Structure of casualties	52
Extent of casualties	57
Concept of wartime medical care	57
Types of medical care	63
Medical evacuation	65
Medical classification [sorting]	67
Chapter 4. Rendering First Aid to the Wounded on the Battlefield and Removal Thereof (V. A. Zhulin, A.I. Komarov)	70
First aid on the battlefield	70
Medical equipment used to remove (collect) casualties from the battlefield	84
Means of reaching casualties and removing them to a shelter	90
Moving casualties on stretchers	94
Rules for moving casualties under different conditions	96
Chapter 5. Medical Support of Podrazdeleniya (V. V. Meshkov)	98
Medical support of motorized rifle company	98
Medical support of company during offensive operations	100
Medical support of company during defensive operations	103
Medical support of motorized rifle battalion	105
Medical support of motorized rifle battalion during offensive operations	107
Medical support of motorized rifle battalion during defensive operations	113
Chapter 6. General Information About Organization of Medical Support of Chast' and Soyedineniye (V. V. Meshkov)	115
Tasks of chast' medical service	115
Regimental medical station [post]	117
First medical aid	123
Fundamentals of medical sorting of wounded and sick at a PMP [regimental medical station]	125
PMP Maneuvers	125
Medical records at PMP	126
Duties of PMP feldsher	128

## FOR OFFICIAL USE ONLY

	Page
Tasks, organization of work and principles of use of medical battalion (separate medical detachment)	130
Organization of deployment and operating principles for a MedSB (OMO) [medical battalion (separate medical detachment) in combat	132
Feldsher's duties when working at MedSB(OMO)	137
Use of personnel and resources of chast' (soyedineniye) medical service to eliminate the consequences of enemy's use of mass strike weapons	139
Section II. Supplies of the Medical Service of the Soviet Army	
Chapter 1. T/O Supply of the medical service (V. A. Kur'yevov)	142
Chapter 2. Individual Supplies for Personnel. T/O Supply of Podrazdeleniye (chast') (V. A. Kur'yevov)	145
Chapter 3. Field Medical and Sanitation (V. A. Nikonov)	146
Standard equipment of field medical institutions	156
Sanitation equipment and mobile medical installations	162
Chapter 4. Sanitation and Evacuation Equipment. Tents Used by the Medical Service (V. A. Zhulin)	169
Sanitation and evacuation equipment	169
Tents used by the medical service	181
Section III. Fundamentals of Military Field Surgery	
Chapter 1. Organization of Surgical Care of Casualties in the Field Forces (I. I. Deryabin)	187
Content and tasks of military field surgery	187
Medical care and stage treatment of gunshot wounds	190
Combined injuries	192
Principles of medical care and treatment of combined radiation lesion	194
Chapter 2. Traumatic Shock and Traumatic Toxicosis (I. D. Deryabin)	195
Traumatic shock	195
Principles of prevention and treatment	197
Stage-by-stage treatment of shock	199
Traumatic toxicosis	200
Principles of treatment	202
Stage-by-stage treatment	202
Chapter 3. Thermal Burns (I. I. Deryabin)	203
Stage-by-stage treatment of burns	209
Section IV. Fundamentals of Military Field Therapy	
Chapter 1. Organization of Therapeutic Care in the Field Forces (F. I. Komarov)	213
Content and tasks of military field therapy [medicine]	213
Distinctions of combat trauma. Scope and types of medical care	214
Chapter 2. Radiation Lesions (F. I. Komarov)	215
Biological effects of ionizing radiation and pathogenesis of radiation sickness	215

FOR OFFICIAL USE ONLY

	Page
Acute radiation sickness	216
Stage-by-stage treatment	220
Chronic radiation sickness	221
Treatment	222
Chapter 3. Injuries Inflicted by Toxic Agents (F. I. Komarov)	223
Nerve gases	224
Stage-by-stage treatment	226
Vesicants	226
Stage-by-stage treatment	228
Systemic poisons	229
Stage-by-stage treatment	230
Asphyxiants	230
Stage-by-stage treatment	231
Psychomimetic agents	231
Stage-by-stage treatment	232
Irritant and tear gases	233
Stage-by-stage treatment	233
Chapter 4. Visceral Diseases With Gunshot Wounds, Thermal Burns, Frostbite and Effects of Detonation Waves (F. I. Komarov)	234
Diseases of internal organs in the wounded	234
Burn sickness	236
Frostbite	241
Effects of detonation wave	242
Chapter 5. Distinctions of Onset, Course and Treatment of Internal Diseases in Wartime (F. I. Komarov)	244
Section V. Fundamentals of Military Hygiene	
Chapter 1. Fundamentals of Organization of Sanitary and Hygienic Measures in the Field Forces (I. A. LAVORV)	247
Chapter 2. Hygiene of Deployment of Troops in the Field (V. A. Arkayev)	248
Chapter 3. Hygiene of Troop Nutrition (I. A. LAVORV)	254
Chapter 4. Hygiene of Troop Water Supply (V. A. Arkayev)	258
Water consumption standards	259
Water sources	260
Water reconnaissance	263
Water treatment	265
T/O water treatment equipment	271
Water supply centers	273
Chapter 5. Hygiene of Troop Movement (V. A. Arkayev)	274
Chapter 6. Distinctions of Hygiene of Some Types of Troops (I. A. LAVORV)	279
Medical supervision of military working conditions	280
Some distinctions of military working conditions in the troops	287
Hygienic specifications for uniforms	292

## FOR OFFICIAL USE ONLY

	Page
Section VI. Fundamentals of Military Epidemiology	
Chapter 1. Tasks and Basic Principles Involved in Epidemiological Protection of Troops (V. I. Agafonov and V. P. Volgin)	293
Subject and tasks of military epidemiology	293
Methods of military epidemiology	295
Conditions contributing to penetration and development of infectious diseases in the troops	299
System of epidemic-control measures in the troops	300
Duties of military fieldsher in the area of epidemiological protection of troops	305
Chapter 2. Characteristics of Epidemic-Control Personnel and Resources (V. I. Agafonov and V. P. Volgin)	306
Chapter 3. Epidemiological Protection at Stages of Medical Evacuation (V. I. Agafonov and V. P. Volgin)	309
Measures for the prevention of intramural infections	310
Organization of admission of casualties from a site of bacteriological infection	311
Chapter 4. Fundamentals of Epidemiological Protection of Troops When the Enemy Uses Bacteriological Warfare (V. I. Agafonov and V. P. Volgin)	313
Section VII. Fundamentals of Organization of Medical Supply of the Soviet Army	
Chapter 1. Organization of Military Medical Supply (V. A. Kur'yerov)	318
Chapter 2. Standards for Supply and Classification of Medical Equipment (V. P. Lapin)	320
Chapter 3. Organization of Medical Supply for a Podrazdeleniye (Chast') (V. A. Kur'yerov)	322
Chapter 4. Deployment, Supply and Scope of Work of Chast' Pharmacy (V. P. Lapin)	325
Chapter 5. Organization of Medical Supply for a Soyedineniye (V. A. Kur'yerov)	327
Chapter 6. Deployment, Supply and Scope of Work of Medical Battalion and Hospital Pharmacies (V. P. Lapin)	330
Chapter 7. Storage and Transportation of Medical Equipment Under Field Conditions (V. P. Lapin)	338
Chapter 8. Protection of Medical Equipment Against Damage by Modern Weapons (V. P. Lapin)	349
Chapter 9. Records and Accountability in Pharmacies of Troop Chasti, Therapeutic Institutions and Medical Warehouses (V. P. Lapin)	352
Appendixes	360
[68-10,657]	

10,657  
CSO: 1840



FOR OFFICIAL USE ONLY

RADIOBIOLOGY

PROBLEMS OF THE RADIOECOLOGY OF WATER-COOLED NUCLEAR POWER STATIONS

Sverdlovsk EKOLOGIYA in Russian No 4, 1979

[Review by R.M. Aleksakhin and V.A. Yegorova, All-Union Scientific Research Institute of Agricultural Radiology, of the Proceedings of the Institute of Plant and Animal Ecology, Ural Scientific Center, USSR Academy of Science. Volume 110, Sverdlovsk, 1978, 119 pages.]

[Text] Conversion to nuclear energy as a solution for the current energy problems raises a series of ecological questions. Research is being conducted on migration of radionuclides in the environment which through small doses of ionizing radiation effect genetic characteristics. These changes are produced by a combination of the influence of radiation, chemical and thermal factors. Questions on the radioecology of water cooled nuclear power stations is of central importance. These plants are essentially recepticals for surplus quantities of heat and a potential place to treat certain strictly controlled amounts of radionuclides.

The reviewed collection explores two groups of questions of water radioecology related to water cooled nuclear power stations: the absorption of radionuclides by hydrobionts and the biological effect of ionizing radiation on fish. Unfortunately, the influence of radiation on other types of water faunae and florae are not touched upon.

In the lead article, N.V. Kulikov examines a complex of problems confronting radioecological science in plans to expand the number of water cooled nuclear power stations. Attention is focused on the inadequate understanding of the ecological consequences of storing radiated water in these water systems, the effect of possible mechanical damage to small hydrobionts and the impact of radiational factors and increase in temperature. The need for ecological standardization of the contents of radioactive substances in water systems is stressed (that is, calculation of the influence of irradiation on hydrobionts). The radiational hygenic principle for standardization as it relates to agricultural use of reservoirs (water for drinking purposes, fish cultivation, production of other hydrobionts for food purposes, irrigation of agricultural lands etc.) is also explored.

FOR OFFICIAL USE ONLY

## FOR OFFICIAL USE ONLY

Radioecological research stations, located near water cooled nuclear power stations, may play an important role in future plans to solve these fundamental problems.

A radiational hygienic approach to the problem of water cooled nuclear power stations is developed in the article by D.I. Gusev and co-authors who point to the need for a multifaceted evaluation of the possible agricultural use of these reservoirs from the radioecological point of view. Concentration ranges of the most prevalent artificial radionuclides found in sea water, reservoirs and rivers near the disposal zone of the nuclear power station are computed for use as standards of hygienic normalization for the radionuclide content in water used for the cultivation and production of fish and for drinking water supplies.

One specific characteristic of radionuclide accumulation by hydrobionts living near water cooled nuclear power stations is that the process of radionuclide assimilation occurs as a result of increased temperature. Pollution of these reservoirs is responsible for the increased accumulation of various radionuclides in hydrobionts. The quantitative estimation of the increase in the rate of radionuclide accumulation in fish, presented in the articles by N.V. Kulikov et al., V.G. Kulikova et al. and A.Ye. Katkov et al., has significance for standardization of radionuclide concentrations in water used in the food chain which ultimately enters into the human diet. A.Ye. Katkov and co-authors propose a mathematical formula to estimate the change in the coefficient for radionuclide accumulation in fish in relation to temperature.

The description of the mechanism for transmission of radioactive substances in water and peri-water biogeocenosis includes discussion on the migration of the most prevalent long-lived radionuclides  $^{90}\text{Sr}$  and  $^{137}\text{Cs}$  (A.I. Il'enko and I.A. Ryabtsev, Z.K. Kalninya-Seisuma et al.). The little-understood problems of the distribution of natural radionuclides of the uranium and thorium families are presented in articles by A.A. Iskra, V.G. Kulikova and F.V. Kozhevnikova. On the basis of mobility (rate of diffusion) of these radionuclides in water ecosystems, the sequence of  $\text{Th} > \text{Ra} \geq \text{U}$  was developed.  $^3\text{H}$  is one of the important radionuclides which are introduced in the hydrosphere as a result of the functioning of nuclear power stations. The problem of the introduction of  $^3\text{H}$  in the hydrosphere and its inclusion in the biological chain of migration through the participation of hydrobionts are elucidated by Yu.I. Moskalev and V.F. Zhuravlev.

An important role is played by radionuclides absorbed by ground deposition in the activation of a radiation field in water biogeocenosis (particularly the effect of this source of irradiation on sea bottom organisms). The transfer of radionuclides from the water phase to ground sediments and the subsequent migration of radioactive substances in silts is important in estimating the rate of absorption of radionuclides by hydrobionts. The mechanisms for migration of  $^{90}\text{Sr}$  in silt sediments of reservoirs are analyzed in the article by N.G. Safronova et al.

FOR OFFICIAL USE ONLY

One of the most difficult problems of water radioecology is how to estimate the influence of ionizing radiation, the source of which is contained in the radionuclides found in water where the most important hydrobionts fish, live. Many unanswered questions in this area remain such as the minimum harmful dose level of irradiation for acute and chronic exposure, the process of radioadaptation and ecological displacements caused by irradiation of reservoirs. On the basis of multi-year laboratory and environmental observations on the effect of chronic exposure to irradiation, I.A. Shekhanova et al. stress that decrease in the hardiness of fish and depression of reproductive function in them are the first indications of radiational changes which have ecological significance. These changes occur with absorbed doses 100-200 times greater than normal (at this level, morphological changes are not noted in fish). These data indicate strongly the need for a careful approach to evaluation of the consequences of storing radioactive wastes in a water environment.

G.B. Pitkyanen et al. consider that the limiting factor in standardization of storing radioactive substances in reservoirs is not the developmental stage of the hydrobionts, but the agricultural utilization of these water reserves by man (as drinking water and for fish products). However, this question also requires detailed experimental data on the ecological displacements caused by the effect of ionizing radiation. The results of experimental studies on the biological effects on fish of  $^{90}\text{Sr}$  and  $^{137}\text{Cs}$  contained in water reservoirs (S.P. Peshkov et al.) confirm the need for careful evaluation of the ecological impact of prolonged irradiation of fish populations. The biological effect of ionizing radiation on hydrobionts is discussed in the article by M.I. Shal'nov. The dependence of radiosensitivity and mutability of living organisms on the dimensions and structures of the genome is described.

Methodological questions of monitoring for radiational conditions at water cooled installations such as the Belyarck nuclear power station are outlined in the article by N.V. Beskrestnov et al.

In considering the reviewed book as a whole, one must note that the radioecological literature has been expanded by this valuable publication. It opportunely draws the attention of ecologists to the complex of important problems related to water cooled nuclear power stations. The book not only acquaints the reader with the results of national radioecological investigations but also defines clearly the unanswered questions. The timeliness of the publication is based on the universally accepted thesis that the general progress of nuclear energy depends on find the solution to these ecological problems. The book is without doubt of interest for ecologists in many fields, geneticists, radiobiologists and specialists in the field of environmental conservation.

COPYRIGHT: Izdatel'stvo "Nauka", "Ekologiya", 1979

[41-9139]

9139  
CSO: 1840

69

FOR OFFICIAL USE ONLY

FOR OFFICIAL USE ONLY

## VETERINARY MEDICINE

UDC 636.5.539.163

THE METABOLISM OF Co<sup>60</sup>, Zn<sup>65</sup>, Fe<sup>59</sup> and H<sup>3</sup> IN POULTRY

Moscow DOKLADY VASKHNIL in Russian No 6, 1979 pp 27-29

[Article by A. N. Sirotkin, Doctor of Biological Sciences, S. S. Prister, L. N. Tyumenev, A. I. Grishin, Presented by VASKHNIL Academician N. A. Korneyev]

We know that hen eggs and poultry meat have a definite place among the various items in man's diet through which artificially radioactive nuclides enter the body (3,4). The basic patterns for the metabolism of Sr<sup>90</sup>, Cs<sup>137</sup>, I<sup>131</sup>, Mo<sup>99</sup>, Fe<sup>132</sup> and other products of nuclear fission in poultry are explained in references (3, 7). There is little published information on the metabolism of the major products of neutron activation in poultry (2, 4, 6). The purpose of our investigation was to study the metabolism of Zn<sup>65</sup>, Co<sup>60</sup>, Fe<sup>59</sup> and H<sup>3</sup> in the poultry organism with a single and prolonged intake of the radionuclides.

The experiments were performed on 35 hens and 16 roosters of the Russian white strain 120 - 730 days old. Prior to and during the course of the experiments, the birds were fed rations insuring normal metabolism (1). Depending on the objective of an experiment, indicator quantities of radionuclides were given to the birds once or continuously orally or parenterally.

In the first series of experiments, the quantitative characteristics of Zn<sup>65</sup> and Co<sup>60</sup> intake in the gastro-intestinal tract were determined as was their distribution throughout the organs and tissues and their deposition in the bodies of the roosters and hens. Three two-year old hens and three two-year old roosters were given 6.0 micro-Curies of <sup>65</sup>ZnCl<sub>2</sub> one time orally for this purpose while three hens and three roosters of the same age were each given 6.0 micro-Curies of this radionuclide intraperitoneally one time. Ten 120-day old roosters divided into two equal groups each received 6.0 micro-Curies of Co<sup>60</sup> by the same routes one time. Twenty four hours after the poisoning, the birds were sacrificed and organs and tissues were taken to determine the level of the radionuclides. By juxtaposing the values for the deposition of Zn<sup>65</sup> and Co<sup>60</sup> in total in the organs and tissues of the birds after oral and intraperitoneal administration, the resorption of the radionuclides in the gastro-intestinal tract was computed.

FOR OFFICIAL USE ONLY

## FOR OFFICIAL USE ONLY

Materials from the test indicate that the absorption of  $Zn^{65}$  in the gastro-intestinal tract of adult roosters and hens was 60.2 and 68.0% of the quantity administered, respectively, and does not depend on the gender of the bird. Resorption of  $Co^{60}$  in the gastro-intestinal tracts of four-month old roosters equalled 35.2%. A comparison of the coefficients obtained makes it possible to say that the uptake of  $Co^{60}$  in poultry occurs in considerably lower quantities than that for  $Zn^{65}$ . Actually, where in young, rapidly growing roosters,  $Co^{60}$  absorption was 1.7 times less than  $Zn^{65}$  absorption, it is possible to assume that this difference will be even more substantial in the adults.

Radionuclides entering the blood from the gastro-intestinal tract are transported to the organs and tissues. The distribution among them is not equal for  $Zn^{65}$  and  $Co^{60}$ .

Here, there was no substantive difference in the distribution of  $Zn^{65}$  in roosters and hens receiving the radionuclide orally and parenterally.

The unevenness of  $Co^{60}$  distribution in the bodies of four-month old roosters was almost the same as for  $Zn^{65}$  in adult roosters and hens. It is likely that this may indicate that the nature of the localization process for nuclides in the poultry organism is monotypical. The results from the experiments support the stated premises. In all cases, the maximum concentration of  $Zn^{65}$  and  $Co^{60}$  was recorded in the liver while the minimum was found in the muscles.

Apparently the liver serves as a functional depot for zinc and cobalt from which the microelements enter the bloodstream and organs. This is supported by the experimental findings of references (2, 5, 6) involving hens and laboratory animals.

Since resorption of  $Zn^{65}$  and  $Co^{60}$  from the gastro-intestinal tract of poultry is variable, the level of radionuclide concentration in the organs and tissues that are most important in the food sense is unequal (Table 1).

The concentration of  $Zn^{65}$  occurs approximately 10 times more intensively than that for  $Co^{60}$  in the muscles and skeletons of orally poisoned roosters.

The concentration of  $Zn^{65}$  in the byproducts is greater than that for  $Co^{60}$  by a factor of 1,000. These figures argue convincingly that the given radionuclides have a selective attraction for strictly defined organs and tissues. In this instance, neither the concentration nor the level of  $Zn^{65}$  and  $Co^{60}$  in the organs and tissues had any association with the gender of the bird (Table 2) but rather, depends on the route of ingestion.

After intraperitoneal administration of  $Zn^{65}$  and  $Co^{60}$  in roosters and hens, the level of radionuclides in the body was 1.5 - 2.8 times higher than after oral ingestion (Table 2). The differences noted are the result of incomplete uptake of the radionuclides in the gastro-intestinal tract.

Deposition of  $Zn^{65}$  and  $Co^{60}$  after a single oral or intraperitoneal dosage was much higher in the byproducts and bony tissues and minimal in the muscles.

FOR OFFICIAL USE ONLY

Table 1

Concentration of Zn<sup>65</sup> and Co<sup>60</sup> in the organs and tissues of poultry after a single oral and parenteral administration (% of dosage amount per 100 grams of raw substance)

Sex	Age (days)	Muscles		Skeleton		Byproducts	
		routes for administering radionuclides					
		oral	parenteral	oral	parenteral	oral	parenteral
Zn <sup>65</sup>							
Roosters	730	0.8±0.2	2.4±1.8	3.7±0.7	3.3±0.8	10.0	12.6
Hens	730	0.5±0.2	2.1±1.9	6.5±2.6	7.7±3.2	7.7	10.4
Co <sup>60</sup>							
Roosters	120	0.08±0.01	0.3±0.04	0.4±0.1	2.0±0.04	1.0	0.3

Thus, the deposition of Zn<sup>65</sup> and Co<sup>60</sup> in poultry is associated with the route of ingestion of the radionuclides into the body and their properties regardless of the sex of the bird.

Studying the pattern of nuclide transfer from the feed to the eggs in hens with chronic ingestion is also of interest.

A second series of experiments was performed in connection with this. This series was performed on 30 egg-laying hens which were each given 2.7, 1.5 and 1.1 micro-Curies of Zn<sup>65</sup>, Fe<sup>59</sup> and H<sup>3</sup>, respectively for periods of 30, 60 and more than 60 days orally on a daily basis. The eggs were gathered daily and the level of radionuclides within them was determined.

Table 2

Level of Zn<sup>65</sup> and Co<sup>60</sup> in organs, tissues and poultry organism after a single oral and parenteral ingestion (% of dosage amount)

Sex	Age (days)	Muscles		Skeleton		Byproducts		Organism	
		routes for administering radionuclides							
		oral	parenteral	oral	parenteral	oral	parenteral	oral	parenteral
Zn <sup>65</sup>									
Roosters	730	6.8 ± 1.4	21.3 ± 15.0	7.0 ± 1.5	6.1 ± 1.3	13.2	20.1	27.0 ± 3.6	47.5 ± 12.4
Hens	730	3.7 ± 1.7	16.0 ± 2.0	10.7 ± 4.0	7.7 ± 3.2	15.5	22.1	30.0 ± 8.2	45.8 ± 14.8
Co <sup>60</sup>									
Roosters	120	0.5 ± 0.1	1.7 ± 0.1	0.7 ± 0.1	2.4 ± 0.1	1.4	3.4	2.6	7.5

FOR OFFICIAL USE ONLY

## FOR OFFICIAL USE ONLY

The results from the experiments showed that in conditions of chronic nuclide ingestion in hens, an ecological balance is struck between the amount taken in and that appearing in the eggs which occurs at different times in the process of metabolizing Zn<sup>65</sup>, Fe<sup>59</sup> and H<sup>3</sup>.

In this situation, 0.0001, 0.0006 and 0.3% Zn<sup>65</sup>, 0.0004, 0.001 and 0.2% Fe<sup>59</sup> and 1.9, 1.1 and 1.9% of the H<sup>3</sup> taken into the gastro-intestinal tract was found in one gram of egg white, shell and yolk, respectively.

The levels of Zn<sup>65</sup> and Fe<sup>59</sup> were highest in the yolk and lowest in the white. Conversely, the main quantity of H<sup>3</sup> entering the egg was concentrated in the white with the minimum amount appearing in the shell. Totals of 3.22% Fe<sup>59</sup>, 6.21% Zn<sup>65</sup> and 68.0% H<sup>3</sup> (of the amounts taken in with food) appeared in the eggs.

Since the metabolic processes in an egg take place with the active involvement of biological membranes, it can be expected that there will be a redistribution of the radionuclides in the cooking of an egg which is accompanied by a denaturing of the protein and disruption of the regulatory functions of the membranes. This did not occur, however. In raw as well as cooked eggs during the state of equilibrium and after cessation of Zn<sup>65</sup> and Fe<sup>59</sup> ingestion, their distribution was the same.

Thus, the data that we obtained can be used to set maximum safe levels for the quantities of radionuclides in poultry rations.

## BIBLIOGRAPHY

1. Georgievskiy, V. I.; "Mineral'noye pitaniye sel'skokhozyaystvennoy ptitsy" [Mineral Nutrition of Agricultural Powl], Moscow, "Kolos", 1970.
2. Yermenkov, K. I.; Georgiyevskiy, V. I.; DOKLADY TSKHA" [Reports from the Timiryazevskaya Agricultural Academy], 1972, No 185.
3. Koldayeva, K. A. et al.; In: "Radioaktivnye izotopy i organizm", Edited by Yu. I. Moskaleva, Moscow, "Meditsina", 1969.
4. "Radioaktivnost' i pishcha cheloveka" [Radioactivity and Human Nutrition] (Edited by Rassel, translated by R. M. Aleksakhin, F. A. Tikhomirov and edited by V. M. Klechkovskiy), Moscow, Atomizdat, 1971.
5. Khovanskikh, A. Ye.; S.-KH. BIOLOGIYA [Agricultural Biology], 1971, Vol 6.
6. Teiler, W. I.; "Zinc metabolism in farm animals. Mineral studies with Isotopes in Domestic Animals ", Proc. ofa Panel, Vienna, 1970, 23.

FOR OFFICIAL USE ONLY

7. Mraz, F. R.; "Fission product metabolism in hens and transference to eggs", HEALTH PHYS., 1964, No 10, 11, pp 777 - 782.

COPYRIGHT: Izdatel'stvo "Kolos, "Doklady VASKHNIL, 1979

9003  
CSO: 1840

FOR OFFICIAL USE ONLY



FOR OFFICIAL USE ONLY

VETERINARY MEDICINE

DETERMINING THE RELATIVE MOLECULAR MASS OF RNA FROM THE CLASSIC SWINE  
FEVER VIRUS IN POLYACRYLAMIDE GEL

Moscow DOKLADY VASKHNIL in Russian No 7, 1979 p 45

[Article by I.P. Nikolayeva, presented by VASKHNIL Academician N.V. Likhachev,  
submitted to the editors 27 April 1978]

[Text] At present, breaking down virus nucleic acids by the technique of electrophoresis in polyacrylamide gel (PAAG) is of great interest. Mixed polyacrylamide-agar gels have found extensive application in laboratory practice. We know that electrophoretic mobility is inversely proportional to the constant of sedimentation for substances being studied and that there exists a linear relationship between the logarithmic relative molecular mass and the mobility of RNA in polyacrylamide gell within a broad range of the relative molecular weight which makes it possible to use gel electrophoresis to determine relative molecular mass (2, 3).

We used four strains of the classic swine fever virus in our project: attenuated, lapinized, Hudson and 0-virulent. The virus was grown in a tissue culture of pig embryo kidney cells by the generally accepted method. The techniques of differential and gradient ultra-centrifuging were used to purify and concentrate the virus.

The viral RNA was isolated by the phenol-detergent technique. The preparations obtained were layered onto a 5-25% gradient the density of sucrose with sodium dodecyl sulfate in a final concentration of 0.5% and centrifuged for 17 hours at 16,000 rpm in a SW-25.1 rotor on a Spinco L2-65 centrifuge. The fractions corresponding to RNA were combined and studied in PAAG. The RNA preparations had an ultra-violet light absorption spectrum characteristic for nucleic acids with the maximum at a wave length of 258-260 nm. The  $E_{260}/E_{280}$  ratio was approximately 2 which is specific for pure preparations of high-polymer nucleic acids.

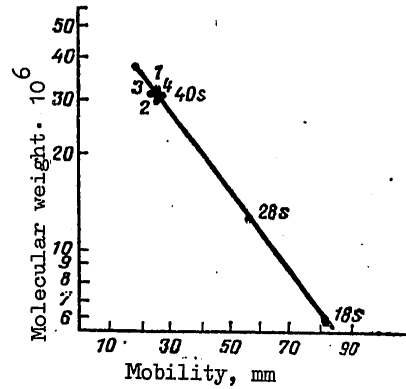
The RNA electrophoresis was carried out in 0.5% agarose, 1.8% polyacrylamide gel (4). The relative molecular mass was determined according to a calibration curve (see illustration).

FOR OFFICIAL USE ONLY

FOR OFFICIAL USE ONLY

An analysis of the RNA distribution in the four strains of swine fever virus demonstrated that all of the RNA was non-fragmented and consists of a single component with a relative molecular mass of  $3.2 - 3.4 \cdot 10^6$  Daltons which corresponds to a sedimentation coefficient of 40S.

In this way, the results obtained again confirm the appartenance of the classic swine fever virus to the family of togoviruses.



Determining the relative molecular mass of RNA from the classic swine fever virus. The figures indicate the distribution of the four strains examined:

1, 4 - K-cultural and O-virulent strains (relative molecular mass of  $3.2 \cdot 10^6$  Daltons), 2, 3- K-strain and Hudson (relative molecular mass of  $3.4 \cdot 10^6$  Daltons). Ribosomal RNA isolated from chick fibroblast cells with a relative molecular mass of  $0.6 \cdot 10^6$  (18 s) Daltons and  $1.4 \cdot 10^6$  (28 s) Daltons and RNA from the Newcastle virus with a relative molecular mass of  $3.2 \cdot 10^6$  Daltons (40 s) were used as markers

BIBLIOGRAPHY

1. Likhachev, N.V. et al.; "Doklady VASKHNIL", 1975, No 12.
2. Bishop, D.H.L. et al.; J. MOL. BIOL., 1967, Vol 26, p 373.
3. Bishop, D.H.L. et al.; PROC. NAT. ACAD. SCI., 1967, Vol 57, p 1474.

FOR OFFICIAL USE ONLY

FOR OFFICIAL USE ONLY

4. Shingarid, A.L. and Howatson, A.F.; VIROLOGY, 1972, Vol 49, No 3, pp 766-783.

COPYRIGHT: Izdatel'stvo "Kolos", "Doklady VASKHNIL", 1979  
[643-9003]

9003  
CSO: 1840

77

FOR OFFICIAL USE ONLY

FOR OFFICIAL USE ONLY

VETERINARY MEDICINE

UDC 576.551:576.093.4

SUBMICROSCOPIC ORGANIZATION OF ANAEROBIC BACTERIA PATHOGENIC FOR ANIMALS

Moscow DOKLADY VASKHNIL in Russian No 7, 1979 pp 31-33

[Article by A.V. Kulikovskiy, Candidate in Veterinary Sciences, presented by VASKHNIL Academician A.A. Polyakov; submitted to the editors 29 March 1978]

[Text] Some anaerobes that are pathogenic for animals have been described in sufficient detail in published material (1-5).

The purpose of this project is to describe the ultrastructure of the agents that cause tetanus and botulism which are among the least studied in veterinary microbiology.

Strains *Cl. tetani* No 247 and *Cl. botulinum* No 272 with typical cultural and biochemical characteristics were used in the research.

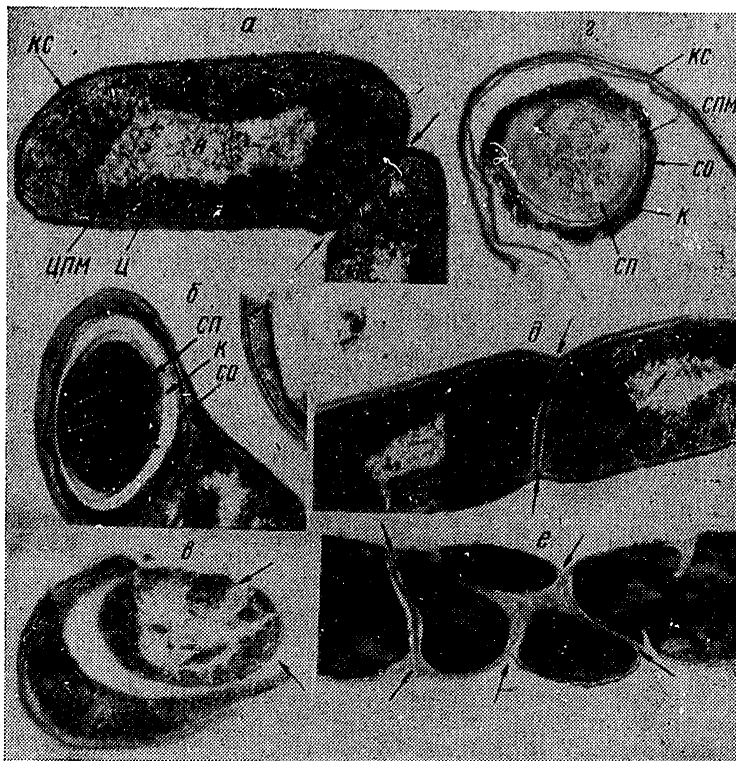
The microorganisms were cultured in blood-glucose agar in an anaerostat at 37°C. The cells were rinsed with a 0.5% osmium fixative at various stages as prescribed by Kellenberger et al. and centrifuged at 5,000 rpm for 20 minutes. The sediment was washed with osmium fixative and left overnight. The microorganisms were dehydrated and embedded in polymer resins by the generally accepted method. Ultra-thin sections were obtained in a LKB-4800 microtome and examined with a "Hitachi-12" electron microscope.

In the ultra-thin sections, the *Cl. tetani* cells had a bacilliform shape. The surface of the cell wall was smooth and had a complex lamellar structure. It was generally possible to differentiate its five layers (Figure a): three osmiophilic layers (outer, middle and inner), each 6-7 nm thick and the two osmiophobic (intermediate) layers, each 7-8 nm thick. The total thickness of the cell wall was 30-32 nm.

A three-layered cytoplasmic membrane 7-8 nm thick was clearly visible beneath the cell wall. The cytoplasm of the cells was dense and granular. Much larger granules--polyribosomes--appeared with the ribosomes throughout the cytoplasm. In the central portion of the cell there was a nucleoid with thin osmiophilic strands. Division of the microorganisms occurred through the formation of transverse membranes.

FOR OFFICIAL USE ONLY

FOR OFFICIAL USE ONLY



The submicroscopic organization of *Cl. tetani* and *Cl. botulinum*:

a - ultrastructure of the tetanus agent (vegetative cells; cw - cell wall, cpm - cytoplasmic membrane, c - cytoplasm, n - nucleoid); b - spore formation in one of the vegetative cell bands (sm - spore membrane, c - cortex, sp - sporoplasm); c - germination of spore of tetanus agent inside mother cell; d - ultrastructure of botulism agent, corrugated contours near cell wall (spm - sporoplasmic membrane); e - lysis of vegetative cell of botulism agent during spore formation; f - division of vegetative cells of botulism agent (by means of forming transverse membranes)

The tetanus bacillus actively formed spores (Figure b). Here, the structures of a future spore were formed in one of the vegetative cell bands (terminally). The latter became thickened and acquired the shape of a barrel-like rod. The formed (mature) spore of *Cl. tetani* remained inside the vegetative cell

FOR OFFICIAL USE ONLY



FOR OFFICIAL USE ONLY

which was not subject to autolysis and lysis as is seen in the spores of aerobic bacteria. In the mature spore it was possible to differentiate the thin, dense spore membrane up to 1.2 nm thick, a thickened osmiophobic region in the cortex from 11 to 20 nm thick and the sporoplasm which consisted of a homogeneous substance.

The germination of spores and formation of a young vegetative cell also took place inside the sporangium which is typical for these microorganisms. Spore germination is accompanied by swelling in the spore coverings. Granulation of the sporoplast was then noted as was the appearance within it of thin osmiophilic strands of the nucleoid indigenous to the vegetative cell. The outer spore membrane was broken while the inner layer of cortex became the cell wall for the daughter vegetative cell. The latter was surrounded by a light zone as a result of lysis to which the cytoplasm, the cytoplasmic membrane and the cell wall of the sporangium were also drawn (Figure c). The daughter vegetative cells that formed left the sporangium with a breach in its surface structures (Figure c).

In the ultra-thin sections of *Cl. botulinum* cells, there was a three-layered cell wall in which the outer electron-dense layer frequently had convoluted contours (Figure d). The five layers of the cell wall could be clearly distinguished among the lysed cells: three electron-dense layers and two layers with a lower density enclosed between them (Figure e). The total thickness of the cell wall was 35-40 nm. The cytoplasmic membrane was three-layered and 7-8 nm thick. The cytoplasm consisted of densely packed ribosome granules and polyribosomes. The nucleoid was compact and consisted of an osmiophobic zone with thin osmiophilic strands.

Division in *Cl. botulinum* occurred as in all gram-positive bacteria through the formation of transverse membranes.

Among the involutinal forms, it is possible to find a complex division where lengthwise and diagonal membranes form together with a single transverse membrane (Figure f).

A spore was formed inside the vegetative cell (Figure e). In contrast to *Cl. tetani*, during the ripening of a spore, lysis of the mother cell was generally noted. The mature spore had a lamellar spore membrane surrounded by a multi-layered sporangium. The porous substance of the cortex up to 80 nm thick was situated under the spore membrane. The sporoplasmic membrane which encloses the finely granular sporoplasm on all sides was attached to the inner surface of the cortex.

By analyzing the data that we obtained as well as published materials (1, 6, 9), it is possible to conclude that the submicroscopic organization of anaerobes pathogenic for animals are divisible into two basic bacterial subgroups: those with a five-layered cell wall (*Cl. tetani*, *Cl. botulinum*) and those with a three-layered cell wall (*Cl. perfringens*, *Cl. chauvoei*, *Cl. oedematiens*).

80

FOR OFFICIAL USE ONLY

FOR OFFICIAL USE ONLY

Bacterium necrophorum which does not form spores and which has a structure typical for the majority of aerobic gram-negative bacteria (2) occupies a special place in the anaerobic group.

Based on the nature of spore formation, the anaerobes that were studied can also be subdivided into two groups: those which form so-called "bare" spores, that is, spores whose maturation is accompanied by complete lysis of the mother cell (*Cl. botulinum*) and those that form mature spores inside the mother cell which begin to germinate within it (*Cl. tetani*, *Cl. perfringens*). The first type of spore formation is typical of spore-forming aerobes and was described by us in *Bac. cereus*, *Bac. anthracis* (3, 4).

Thus, the technique of electron microscopy of ultra-thin sections of bacteria has made it possible to establish that the vegetative cells of the studied anaerobes have a similar structure although the process of their sporogenesis and the generation of spores is somewhat different. The specific data can be used in differential diagnosis of anaerobic bacteria that are pathogenic for animals.

BIBLIOGRAPHY

1. Avakyan, A.A. et al.; "Atlas anatomii bakteriy patogennykh dlya cheloveka i zivotnykh" [Atlas of Anatomy of Bacteria Pathogenic for Man and Animals], Moscow, "Meditsina", 1972.
2. Kulikovskiy, A.V.; Balabanov, B.I.; VESTNIK S-KH. NAUKI [Journal of Veterinary Science], 1969, No 9.
3. Kulikovskiy, A.V.; Polyakov, V.A.; "Trudy VNIIVS" [Proceedings of the All-Union Scientific Research Institute for Veterinary Sanitation], 1973, Vol 45.
4. Kulikovskiy, A.V. et al.; VETERINARIYA, 1977, No 1.
5. Pavlova, I.B., Sergeeva, T.I.; ZHMEI [Journal of Microbiology, Epidemiology and Immunobiology], 1969, No 4.
6. Pavlova, I.B. Bulatova, T.I. ZHMEI, 1970, No 4.
7. Pavlova, I.B.; Kononenko, Yu. V.; "Trudy VNIIVS", 1975, Vol 15.
8. Shakhbanov, A.A.; "Trudy VNIIVS", 1972, Vol 41.
9. Takagi et al.; JAPAN J. MICROBIOL., 1960, No 4.

COPYRIGHT: Izdatel'stvo "Kolos", "Doklady VASKHNIL", 1979.  
[643-9003]

9003  
CSO: 1840

FOR OFFICIAL USE ONLY

VETERINARY MEDICINE

UDC 576.851:576.8.095.1

GENERATING ATOXIGENIC CLONES FROM CLOSTRIDIUM BOTULINUM TYPE C EXPOSED TO PHYSICAL AND CHEMICAL FACTORS

Moscow DOKLADY VASKHNIL in Russian No 7, 1979 pp 33-34

[Article by A.A. Shakhbanov, Candidate in Veterinary Sciences, presented by V.P. Onufriyev, Corresponding Member of VASKHNIL; submitted to editors 18 July 1978]

[Text] Works that point to a connection between the toxigenicity of bacteria and a phage (2,3) are now available. The production of certain bacterial toxins is associated with lysogenization by specific bacteriophages (4,5). This phenomenon has been called "phage conversion." Treating cultures containing bacteriophages with acridine orange and ultraviolet light has resulted in the development of atoxigenic variants within a population although with reinfection by the phage, there is restoration of toxigenicity (3, 6-8).

Ye. V. Perova et al. (1) report that of ten strains of Cl. botulinum types A and B subjected to the effects of UV-light and ethidene bromide, only three showed any loss of toxigenicity with this occurring in type B. However, heating the spores did not result in the generation of any atoxigenic clones. In contradiction to this, M. Eklund (6,7) was able to obtain 80% atoxigenic clones in Cl. botulinum type D both by heating and by treating with antiphage serum. As we can see, there is not as yet any single opinion in regard to the generation of atoxigenic clones as a result of various physical and chemical factors.

We resolved to study the possibility of obtaining atoxigenic variants of Cl. botulinum type C (strain 59) through exposure to acridine orange, UV light, chloramine and heating the spores.

The process of phage development within clostridia and its presence in the filtrate from cultures has been established by electron-microscopic studies.

Previously cloned variants from cultures obtained through two-three part reinoculations from individual colonies were used for the project. The toxigenicity of Cl. botulinum was established in white mice by injecting

FOR OFFICIAL USE ONLY



FOR OFFICIAL USE ONLY

them intraperitoneally with culture fluid. The activity of toxin from two-three day-old cultures was 7-9 thousand lm/ml.

Antoxigenic variants were obtained by incubating cultures of *Cl. botulinum* in the logarithmic phase of growth in Kitt-Tarocci medium containing 10 mkg/ml acridine orange. This concentration was selected in preliminary tests. Day-old cultures as well as cultures from second and third reinoculations in the Kitt-Tarocci medium with acridine orange were set up in Petri dishes with blood agar and incubated in an anaerostat at 37°C for a period of two days. The toxigenicity of isolated colonies was studied after 2-4 days of growth in the Kitt-Tarocci medium. Control variants were not treated with stain.

A subbacteriostatic concentration of chloramine (0.200 mg) was also used in the studies. These tests were run analogously to those with the acridine orange.

Significant spore production was noted in *Cl. botulinum* on the fifth day of the clostridium's growth. The culture was then washed with a physiological solution and a suspension of 1 billion microbial cells per milliliter was made up. After heating in a water bath at 80°C, the spores were seeded on Petri dishes containing blood agar. The mature colonies were selected and their toxigenicity was determined as described above.

The culture obtained was distributed on the surface of the agar in the amount of 1 ml and was subjected to UV irradiation using a DB-30 lamp at a distance of 20 cm for 30-120 seconds after drying. After the irradiation, the culture was incubated in an aerostat and toxigenicity was determined for the mature colonies. Control plates with cultures were not subjected to irradiation.

The most effective formation of atoxigenic clones occurred with exposure to acridine orange. Of 174 colonies tested, 28 appeared to be atoxigenic which amounted to 16.09%. Heating the spores resulted in the generation of atoxigenic clones in 2% of the cases. None could be isolated from the control cultures or through exposure to chloramine.

White mice survived with the intraperitoneal injection of 0.5 ml of an undiluted culture of the atoxigenic clones. The atoxigenic properties of these clones were not destroyed even after activating them with trypsin. All the non-toxigenic clones were stable and did not regain their toxigenicity in the course of a year. Like toxigenic cultures, these clones were agglutinated with H-serum in the same dilutions. Other researchers (3,6,7) have also noted the rapid loss of toxigenicity among the B, C, and D types of clostridia on exposure to acridine orange, UV-light and ethidine bromide.

According to the findings of M. Eklund (6), the loss of toxigenicity in *Cl. botulinum* type D with UV radiation was 14%. In our studies on Type C and in the experiments by Ye. V. Perova et al. (1) on type B, the loss equalled 6.85 and 4.2% respectively. The authors have associated the high loss of

FOR OFFICIAL USE ONLY

toxigenicity in clostridium with extrachromosomal localization of the genetic determinants of toxigenicity. However, they have not been able to obtain atoxigenic clones of Cl. botulinum type A as a result of the experimental influences. The authors associate this type of phenomenon with a non-uniformity in the genetic determinants of toxigenicity in the various types of Cl. botulinum.

It has been possible to find phage particles in the cytoplasm region in electron microscopic studies of ultra-thin sections of toxigenic cultures.

The clostridia were surrounded by a five-layered cell wall. Here, the outer layer of the cell had convoluted outlines. Intercytoplasmic membranous structures were visible in the cytoplasmic region.

Thus, the completed studies are indicative of the possibility of obtaining atoxigenic clones of Cl. botulinum type C through exposure to acridine orange, UV light and heating while treating the clostridia with chloramine did not result in their generation.

BIBLIOGRAPHY

1. Perova, Ye. V. et al.; ZHMEI [Journal of Microbiology, Epidemiology and Immunobiology], 1975, No 6.
2. Dolman, C.E.; "Botulism". Publ. Health Serv. Publication, 1964, No 999-Fp-1, 43.
3. Inoue, K.; Iida, H.; JAP. J. MICROBIOL., 1970, Vol 14(1), p 87.
4. Groman, N.J.; BACTERIOL., 1953, Vol 66, p 184.
5. Matsuda, M.; Barksdale, I.; J. BACTERIOL., 1967, Vol 93, p 721.
6. Eklund, M.W. et al.; SCIENCE, 1971, Vol 172, p 480.
7. Eklund, M.W. et al.; NATURE, 1972, Vol 235, p 16
8. Idem, H.; JAP. J. MED. SCI. BIOL., 1971, Vol 24, p 53.

COPYRIGHT: Izdatel'stvo "Kolos", "Doklady VASKHNIL", 1979 [643-9003]

9003

CSO: 1840

END