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BIOMEDICAL AND BEHAVIORAL SCIENCES

(FOUO 2/80)

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22 February 1980

USSR REPORT

BIOMEDICAL AND BEHAVIORAL SCIENCES

(FOUO 2/80)

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CONTENTS PAGE

AGROTECHNOLOGY

Improvement of the Microbiological Industry Control System
(E. V. Yezhov; MIKROBIOLOGICHESKAYA PROMYSHLENNOST', No 1, 1979) 1

Determination of the Lytic Activity of Lysosubtilin Using Different Substrates
(O. V. Kislukhina and T. A. Kuznetsova; MIKROBIOLOGICHESKAYA PROMYSHLENNOST', No 1, 1979 5

Growth of Pleurotus Ostreatus in a Deep Culture
(N. I. Shmatov, et al; MIKROBIOLOGICHESKAYA PROMYSHLENNOST', No 1, 1979) 10

PHYSIOLOGY

Physiological Problems of Automatic Identification of Speech
(L. A. Chistovich, et al; VESTNIK AKADEMII NAUK SSR, No 9, 1979) 12

PSYCHIATRY

Recent Directions of Clinical Research in Soviet Psychiatry
(E. Sternberg; FORTSCHRITTE DER NEUROLOGIE PSYCHIATRIE, Vol 47, 1979) 24

CONTENTS (Continued)

Page

PUBLICATIONS

Book Analyzes Action of Neutron Radiation on Animal Epithelium
(B. I. Monastyrskaya, et al; RANNYYE EFFEKTY DEYSTVIYA NEYTRONOV NA KLETKI EPITELIYA ZHIVOTNYKH,31 Oct 78)..... 45

Book Analyzes Social Psychology in the USA
(P. N. Shikhirev; SOVREMENNAYA SOTSIAL'NAYA PSIKHOLOGIYA SShA, 1979)..... 49

Psychological Problems Related to Space Flights
(L. G. Rodionova; PSIKHOLOGICHESKIYE PROBLEMY KOSMICHESKIKH POLETOV, 12 Dec 79)..... 55

Book Analyzes Effects of Hyperbaric Environment on Human Body
(G. L. Zal'tsman, et al; OSNOVY GIPERBARICHESKOY FIZIOLOGII, 18 Apr 79)..... 60

RADIOBIOLOGY

Chemical Prophylaxis of Radiation Injury
(Aleksandr Sergeyevich Mozzhukhin and Foma Yur'yevich Rachinskiy; KHIMICHESKAYA PROFILAKTIKA RADIATSIONNYKH PORAZHENIY [CHEMICAL PROPHYLAXIS OF RADIATION INJURY], 1979)..... 69

SCIENTISTS AND SCIENTIFIC ORGANIZATIONS

First Conference of Ural Hydrobiologists
(I. V. Kozlova and Yu. G. Andreyashkin; GIDROBIOLOGICHESKIY ZHURNAL, No 5, 1979)..... 72

Obituary Notice: Yakov Pavlovich Frumkin
(ZHURNAL NEVROPATOLOGII I PSIKHIATRII, No 9, 1979)..... 77

AGROTECHNOLOGY

UDC 85:663.1

IMPROVEMENT OF THE MICROBIOLOGICAL INDUSTRY CONTROL SYSTEM

Moscow MIKROBIOLOGICHESKAYA PROMYSHLENNOST' in Russian No 1, 1979
pp 38-40

[Article by E. V. Yezhov, All-Union Scientific Research Institute of Bioengineering]

[Text] Improvement of the sector's control structure means organizing all-union industrial, production, and scientific-production associations. In light of this, the sector administrations of the USSR Council of Ministers Main Administration of Mircrobiological Industry have been transformed into all-union industrial associations, which in turn contain both enterprises representing independent legal persons on one hand, and production and scientific-production associations on the other. Transformation of sector administrations into all-union industrial associations and organization, within their composition, of industrial associations are fundamental changes within the existing microbiological industry control system. All-union industrial associations and production associations are units that operate on the basis of economic accountability, which is a method for controlling socialist production, while sector administrations were purely administrative organs.

Despite the fact that the foundations of enterprise economic accountability were laid back in the 1920's, economic accountability of associations is a new form of khozraschet. This goes a long way to explain the absence of theoretical research on this problem. Consequently the sectors face complex problems concerning the development (refinement) of certain premises of khozraschet in application to microbiological industry; we cannot wait for the scientific research to end before we solve these problems. And there are a rather great deal of such problems. As an example it was noted in the recommendations of the All-Union Scientific Conference "The Problems of Creating Complete Economic Accountability in the Economy of Developed Socialist Scoiety" that creation of a khozraschet system adequate to the economy of developed socialism would be possible only within the framework of a unified complex of measures calling for alteration of the economic mechanism, to include mutually coordinated and successive improvement of the planning methods, the organizational structure

of control, the distribution of capital investments, and reinforcement of economic stimuli and the mutual relationships between enterprises and the state budget. The conference went on to indicate a number of priority problems that await their solution, particularly the theoretical problems of khozraschet (creation of a unified khozraschet system including sector, regional, and program aspects; revelation of optimum forms of centralized planned control of the activities of khozraschet units in conjunction with their economic independence; creation of a system of long-term planned economic standards and a price-forming system; work on the theoretical problems concerned with the economic mechanism of capital investments, and so on); problems associated with improving the organization of khozraschet (transfer of the principal operational functions of management to large industrial, production, and scientific-production associations, transformation of the ministries into scientific-technical and economic centers, and so on); the problems of improving the system of economic levers and stimuli (establishment of mutually coordinated criteria of capital investment effectiveness to be used in relation to all participants of production, conversion of the bulk of capital investments to a self-paying and self-financing system, development of new depreciation norms with a consideration for economically grounded values for the life and obsolescence of fixed capital, and so on).

The effectiveness of the work of khozraschet associations can be insured by creating economic stimulation funds, reserves, and a system for their sensible use. Of special significance in this case is the question of creating a system of fund-forming indicators which would be selected as a rule by the associations themselves with a consideration for the concrete tasks they face and the specific features of their production operations. The urgency and importance of making a correct choice of fund-forming indicators stem from the fact that in the end, they influence the action of the mechanism of economic accountability.

The question as to the place (level) of formation of different funds and reserves, and of the principle of their distribution and utilization is becoming no less important. In this case it is important to centralize some of the functions, the ones having to do with directing the activities of individual enterprises toward completion of certain tasks facing the association, and at the same time to decentralize other functions concerned with the use of funds and reserves, so as to insure the necessary independence of the enterprises within the association.

Another urgent problem is that of establishing the order of forming and utilizing reserves for economic regulation when organizing concrete industrial and production associations. Science cannot offer ready-made recipes in this regard at the moment. Moreover the different ministries and departments follow different procedures for forming and utilizing reserves. As an example the USSR Ministry of Instrument Making, Automation Equipment, and Control Systems permits acquisition of equipment with assets from the reserve of depreciation deductions earmarked for

overhaul, while other ministries do not. We can cite many such examples, and this means that if we are to organize concrete associations in microbiological industry, we would have to make concrete decisions related to the choice of the ways for forming and utilizing reserves.

Among all of the problems we need to solve when creating the khozraschet mechanism, that of defining the enterprise as a legally independent person has special place. The Statute on The Socialist Enterprise states that if an enterprise is a legally independent person, then it must possess a charter, an independent bookkeeping balance, and a separate bank account, and it may maintain independent accounts with suppliers, buyers, and the budget. But the statute does not clearly spell out whether all of these components must be present, or if presence of just one would be enough. This is a very important question, and apparently it must be resolved in each concrete case with a consideration for the unique features of the association being created (the number of enterprises, its dimensions, its territorial integrity, the complexity of the production operations, the cooperative and marketing relationships of the enterprises, and so on).

In light of the above, the Main Administration of Microbiological Industry finds itself facing a number of problems of methodological and practical nature, solution of which would make it possible to create effectively operating industrial and production associations. Foremost among them are: determination of the economic and legal status of enterprises within the association; creation of funds and systems of fund-forming indicators insuring successful introduction of fundamental khozraschet principles; creation of economic reserves; stimulation of enterprises to solve scientific-technical problems associated with technical progress; centralized development of a system of material, financial, and labor standards; development of a system of planning and accounting indicators for industrial, production, and scientific-production associations, enterprises bearing the rights of a legal person, and enterprises without the rights of a legal person; development of the forms and sector-specific procedures of drawing up the plans and accounts of the associations; development of sector-specific procedures to be used in the application of estimated prices when forming and utilizing reserves in the associations, and the methods for computing a working capital standard for the association insuring correct and uniform allocation of working capital and creating the conditions for formation of the association's working capital; improvement of the wage system with the goal of raising its effectiveness, and so on.

The scale of the work and the complexity of controlling industrial, production, and scientific-production associations require that the system that is to control these complexes must insure a sensible relationship between centralization and decentralization, a combination of vertical (linear-functional) and horizontal control (interfunctional); optimum distribution of rights and responsibilities; finally, effective utilization of the information and computer systems.

Obviously when we create a concrete control structure we must utilize new organizational concepts insuring effective control over specific technical programs for creating and assimilating new products, raising and maintaining their quality, arriving at integrated solutions to production problems, and so on. This in turn requires that each concrete association (industrial, production, and scientific-production) develop a matrix-type control structure which would organically unite, at different levels of the control structure, the linear-functional relationships in the control apparatus with the branched interfunctional coordinating system.

If we are to create control structures by which to unite microbiological industry associations, we would need to carefully analyze the existing structure and study the experience we have accumulated in creating association control systems in other sectors; we would need to arrive at a clear idea of the goals and tasks facing the association for which the structure is being developed. Finally, the developed structure must be tested at a concrete facility.

As we develop the control structure of the association and create the khozraschet mechanism, we must remember that all of the problems associated with this process must be worked out in integrated fashion. In my opinion the existing microbiological industry control structure should be transformed into a new system based on khozraschet complexes by the Main Administration of Microbiological Industry in accordance with a completely developed master plan for improving the control system of microbiological industry. Considering the complexity, scope and urgency of the problems that must be solved when organizing associations on a khozraschet basis, it would be desirable to organize a special subdivision dealing with the problems of improving control of microbiological industry. As I see it, this subdivision should solve the problems of tying in the tasks and functions of the production unit with the control structure, with the principles of khozraschet and the forms of economic stimulation; this subdivision must develop the instructions and methods applicable to these problems, it should study the experience of other sectors, and it should utilize this experience for the needs of microbiological industry. [543-11004]

11004
CSO: 1840

AGROTECHNOLOGY

UDC 577.15.087.5

DETERMINATION OF THE LYTIC ACTIVITY OF LYSOSUBTILIN USING DIFFERENT SUBSTRATES

Moscow MIKROBIOLOGICHESKAYA PROMYSHLENNOST' in Russian No 1, 1979 pp 22-24

[Article by O. V. Kislukhina and T. A. Kuznetsova, All-Union Scientific Research Institute of Bioengineering]

[Text] Cell walls or the cells of different microorganisms are used as substrates to determine the activity of lytic enzymes by the turbidimetric method. The choice of the substrate depends on the specific action and sphere of application of the lytic enzyme or complex of lytic enzymes. *Micrococcus lysodeikticus* cells or cell walls are used as the specific substrate for determining the activity of bacteriolytic glycosidase. The activity of a complex of yeast-decomposing enzymes is determined from their action on the cells of yeast in the genus *Candida*. In addition to lytic enzymes with clearly pronounced specificity, such as the lytic glycosidases, there exist lytic enzymes with a broad spectrum of action--lytic proteases and peptidases. Owing to the presence of protein compounds in the cell walls of all microorganisms, these enzymes lyse the cells of various microbes to one extent or another. Studying the specificity of lytic enzymes in a lysosubtilin preparation obtained from a *Bacillus subtilis* 402 culture, we discovered two lytic peptidases in the preparation, exhibiting differing specificity in relation to synthetic peptides. The preparation lysed the cells of Gram-positive and Gram-negative bacteria, fungi, and yeasts. Use of the preparation is most promising in relation to lysis of bacteria in the *E. coli* group, and yeasts. The substrates we selected for lytic activity determinations were *E. coli* and *C. guilliermondii* yeast cells, as well as cells of the lysosubtilin producer *B. subtilis*, which we had used for this purpose previously. The goal of our work was to find a substrate to be used in standard determination of the lytic activity of lysosubtilin, and to clarify the possiblitity for comparing the bacteriolytic and yeast-decomposing activity of lysosubtilin. The latter is extremely significant to regulation of the preparation's production and use, since it can be used in hydrolysis of both yeast and bacterial biomass.

When bacterial and yeast cells are exposed to lytic enzymes produced by *B. subtilis*, maximum activity occurs at low ionic strength and at a pH value close to neutral (Table 1).

Table 1. Some Indicators Acquired From Determination of the Lytic Activity of Lysosubtilin Using Different Substrates

Indicator	Enzyme Preparation	*Bacillus subtilis* Producer strain	Indicators Obtained With Different Substrates		
			Escherichia coli	*Bacillus subtilis*	*Candida guilliermondii*
Optimum pH for a 0.01 M concentration of Na_2HPO_4	Culture fluid	402	—	6.9	7.2-8.0
	Lysosubtilin G25kh	402	—	7.9	—
As above, at a 0.02 M concentration	Lysosubtilin G3kh	402	7.3-7.5	6.95	7.2-8.0
	Lysosubtilin G10kh	402	7.3-7.5	7.8	—
Optimum concentration of Na_2HPO_4, in moles, at the optimum pH	Culture fluid	402	0	0.015	0
	Lysosubtilin G3kh	402	0	0.015	0
	Lysosubtilin G10kh	402	0	0.015-0.01	0
Maximum substrate hydrolysis, proportional to the quantity of enzymatic preparation, percent	Culture fluid	402	35-39	5	15
	Lysosubtilin G3kh	402	30-32	5	15
	Lysosubtilin G10kh	402	23	5	15
	Lysosubtilin G10kh	797	20-30	5	12-14
	Lysosubtilin G10kh	R2	34-36	—	12-15
Ratio of activity values determined at 40 and 30°C	Lysosubtilin G3kh	402	1.40	1.17	3.6
	Lysosubtilin G10kh	402	—	0.90	—
As above, at 50 and 40 °C	Lysosubtilin G3kh	402	1.46	1.47	2.8
	Lysosubtilin G10kh	402	—	1.03	—

Variation of the temperature within 30-50°C produces an insignificant impact in the case of bacterial substrates; this is especially true for lysosubtilin G10kh from *B. subtilis* 402, which has a temperature optimum of 30°C. The effect of temperature was more strongly pronounced when the activity of lysosubtilin was measured in relation to its effect upon yeast cells. The ratio of activities measured at the end point of the 30-40 and 40-50°C intervals was 3.6 and 2.8 respectively. The former value somewhat exceeds the temperature factor of the rate of chemical reactions following van't Hoff's law. Following the lead of other researchers, we selected a temperature of 40°C for standard measurements of the activity of lysosubtilin in relation to yeast cells.

E. coli cells, which underwent 80-90 percent lysis, were found to be the most sensitive substrate for determining the degree of substrate lysis by lysosubtilin G10kh in equal conditions (temperature--40°C, time of exposure to enzyme preparation--1 hour, lysosubtilin concentration--1 mg/ml reaction mixture at a preparation activity of 1,000 units/mg *E. coli* substrate; buffer solutions were not added to the reaction mixture). When lytic activity is determined in standard conditions, the limits of this substrate's hydrolysis may be 20-39 percent, while when activity is determined with yeast and *B. subtilis* cells the range of a direct proportional dependence between the amount of enzyme and the degree of substrate hydrolysis decreases by 12-15 and 5 percent respectively (see Table 1). The scatter in permissible values of the degree of hydrolysis can be explained by the complex nature of the preparations which contain, in addition to lytic enzymes, neutral protease and trace quantities of β-glucanase. Neutral protease is capable of lysing bacterial and yeast cells. The yeast-decomposing action of the enzyme grows considerably when it is combined with β-glucanase. The optimum conditions for synthesizing bacteriolytic enzymes, neutral protease, and β-glucanase differ; therefore the ratio of these components in the lysosubtilin enzymatic complex depends on the conditions under which fermentation proceeds, on the producer strain employed, and on the closeness with which the production conditions are maintained in the preparation isolation stage.

One significant requirement governing the choice of substrates to be used in determining lytic activity is presence of a range of substrate optical density values within which determination of activity would provide identical values, given maintenance of a permissible degree of substrate hydrolysis--that is, within which the absolute value by which the optical density of the reaction mixture decreases does not depend on its initial optical density. The reason for this requirement lies in the fact that lytic enzyme substrate suspensions are standardized in relation to optical density, and not concentration by weight. We cannot arrive at an exact correspondence between these values, since optical density does depend to a certain degree on the procedure used to prepare the suspension. We had demonstrated earlier that an initial optical density of 0.8-1.5* for

* Optical density values greater than 1 were measured in cuvettes 3 or 5 mm thick.

Table 2. Lysosubtilin Lytic Activity Measured With Different Substrates

Enzyme Preparation	*Bacillus subtilis* Producer Strain	Lytic activity, units/mg, Measured with Different Substrates			Ratio of Activities
		Escherichia coli	*Bacillus subtilis*	*Candida guilliermondii*	
Culture fluid	402	13,000*	49,800*	—	1:3.83
Lysosubtilin G3kh	402	253	1022	160	1:4.04:0.63
	797	221	890	174	1:4.03:0.79
Lysosubtilin G10kh	402	2160	8330	951	1:3.86:0.44
	797	1150	4540	424	1:3.94:0.37
	797	1490	—	610	1:0.41
	R2	687	—	390	1:057

* Units/ml.

a suspension of *E. coli* cells and within 0.5-1.5 units for *B. subtilis* cells does not have an influence on the determination of lysosubtilin activity, given a permissible degree of substrate hydrolysis. The absolute value of the decrease in optical density experienced by a suspension of *C. guilliermondii* cells having an initial optical density of up to 3.6 units increases as the initial density rises, even though the degree of substrate hydrolysis remains within permissible limits (11.7-14.7 percent).

The obtained results prevent us from recommending the use of *C. guilliermondii* yeast cells for standard determination of the lytic activity of lysosubtilin. Nevertheless we did use yeast cells when comparing the activity of lysosubtilin in relation to different substrates, selecting a reaction mixture optical density of 1.6 units as the standard.

We can see from Table 2 that the ratio of activities measured in relation to *E. coli* and *B. subtilis* cells is constant--1:4. Activities measured in relation to bacterial cells and yeasts do not correspond obviously. This is understandable, if we consider that the mechanism of enzymatic lysis of bacteria and yeast differs, and that lysosubtilin has a complex nature.

We believe on the basis of our research that it would be suitable to use *E. coli* cells when determining the lytic activity of lysosubtilin. [543-11004]

11004
CSO: 1840

AGROTECHNOLOGY

UDC 582.28-113

GROWTH OF PLEUROTUS OSTREATUS IN A DEEP CULTURE

Moscow MIKROBIOLOGICHESKAYA PROMYSHLENNOST' in Russian No 1, 1979 p 22

[Abstract by N. I. Shmatov of "Experience in Deep Cultivation of *Pleurotus ostreatus* Mycelium in Complex Mediums" by A. S. Bukhalog, E. F. Solomko, L. A. Parkhomenko, M. N. Martynenko, and R. K. Pchelintseva in "Proizvodstvo vysshikh s"yedobnykh gribov v SSSR" (Production of Higher Edible Fungi in the USSR), Kiev, Izd-vo Naukova dumka, 1978, pp 29-32]

[Text] The ease with which a mycelial culture can be obtained from the fruiting bodies of *Pleurotus ostreatus*, the rapid growth of the mycelium, and this mushroom's unpretentiousness in relation to nutrient sources makes it a convenient object of cultivation in liquid nutrient mediums.

Cultivation of *P. ostreatus* in mediums containing different nutrient sources demonstrated that growth occurs fastest, with formation of the largest biomass, in complex mediums containing higher plant extracts or decoctions. The authors propose a nutrient medium for *P. ostreatus* containing a 10 percent red clover decoction, sucrose, peptone, and mineral salts; this medium produced a high yield in a test tube agitator--up to 20-30 gm of mycelium per liter. Good results were also obtained with the same medium in which peptone was substituted by urea (up to 17 gm ASV [not further identified] per liter on the third day and up to 22 gm on the fifth day).

P. ostreatus was subjected to a number of fermantation steps in a stand fermenter. It was demonstrated that the method by which the seeding material is prepared has a tremendous influence on the length of the lag phase. When the seeding material is cultivated on the surface of the culture medium for 5 days the lag phase lasts 10-12 hours, while when the seeding material consists of mycelium grown in medium in a fermenter the lag phase is practically absent, and the growth rate is significantly higher. In one of the experiments the mixing rate was increased at the end of the exponential growth phase from 350 to 500 min^{-1}, which resulted in a doubling of biomass in 6 hours. Despite the fact that biomass continued to increase following a longer period of cultivation (more than 3 days), the increase in cultivation time led to a decrease in the quantity of crude protein from 27 to 18 percent.

The morphology of culture growth must be kept under control, since large mycelial balls contain many degenerative vacuolated cells having a low protein content. Formation of large smooth mycelial balls was noted when growth occurred in agitated flasks seeded with a small quantity of seeding mycelium (up to 10 percent by volume). The dimensions of the balls decreases when the quantity of the inoculate is increased to 1 gm ASV/liter, or when it is grown in flasks containing baffles which promote better mass exchange and aeration.
[543-11004]

11004
CSO: 1840

PHYSIOLOGY

UDC: 612.85

PHYSIOLOGICAL PROBLEMS OF AUTOMATIC IDENTIFICATION OF SPEECH

Moscow VESTNIK AKADEMII NAUK SSSR in Russian No 9, 1979 pp 27-35

[Article by L. A. Chistovich, doctor of biological sciences; V. A. Kozhevnikov, doctor of biological sciences, and Zh. A. Pershin]

[Text] The problem of automatic identification of speech was put to engineers about 20-25 years ago, in connection with the appearance of electronic computer technology. It soon was separated into two tasks. One was to identify isolated command words from a limited vocabulary. This task can be performed quite well by means of formal mathematical methods, and it does not require investigation of either perception processes or speech formation.

The second task related to automatic identification of natural continuous speech without vocabular restrictions underwent significant evolution, and it began to be formulated as the task of comprehending the meaning of a verbal communication, emerging into a greater problem, that of man's communication with a machine in the natural human language. There is no need to prove the importance of this problem. For example, the possibility of verbal dialogue with a computer over a telephone would open up utterly new prospects of computer applications.

It became obvious about 10 years ago that the only proper formulation of the problem of automatic comprehension of continuous speech is to define it as a problem of modeling processes of perception and comprehension of human speech. Soviet researchers were the first to demonstrate the inevitability of such an approach. At present it is accepted everywhere; there has been a drastic intensification all over the world of basic research directed toward defining the process of perception and comprehension of human speech.

We know that the first variants of systems that could, if we were to stretch the point, be called systems of comprehension of coherent speech, were developed in the last 2 years. Although there are still some serious restrictions with regard to the system's operating conditions, it became obvious that the task had moved from the realm of science fiction to reality. Another perceptible result of the research that was done is that the principles of organization of the system were largely defined. It became

known which successive units of information processing this system must contain and which questions pertaining to these different units are the most important.

In general, a certain new scientific direction was formed, which not only combined branches of knowledge that seemed to be remote from one another, but defined the tasks that are within the competence of, let us say, acoustics specialists, physiologists, phoneticists or mathematical linguists.

Processing of a human verbal signal begins with auditory analysis of this signal. Different scientists (Darwin, Sechenov, Pavlov) expounded the view long ago that upon perceiving an acoustic verbal signal man reconstructs verbal movements corresponding to this sound. In the 1960's, our team at the Institute of Physiology imeni I. P. Pavlov, USSR Academy of Sciences, conducted a cycle of studies for the purpose of experimental verification of this hypothesis.

We used a very simple procedure. Verbal signals (natural or artificial--synthetic) were presented to a subject, and he had to repeat them as accurately and rapidly as possible. A system of sensors was developed, which made it possible to record concurrently with speech the set of articular phenomena, i.e., to observe the movements and sequence thereof made by man. First of all, the obtained results revealed that there is very rapid recoding of verbal signals into movement: the lag of articulatory reactions from the time that a sound is presented to a subject constitutes 150-200 ms.

These data are of basic significance; they show that the requirements with regard to volume of immediate auditory memory of the model are not very high; the model must process simultaneously a relatively short segment of the signal. Longer segments of speech can be memorized in concise form, as a program of articulatory movements, rather than an auditory image.

Recoding of a perceived verbal signal into a program of articulatory movements is tantamount to description of the signal in the form of a sequence of discrete elements, which can really be designated by phonetic signs. This thesis is confirmed by experiments, in which subjects imitate synthetic signals. It was found that the a group of auditory signals, which differ physically from one another but are within a certain common range of parameters, induces the same response, while a group of signals falling into another range induces a different reaction. The number of such reactions is rather limited.

Recoding of a verbal speech signal into a series of discrete elements, phonetic images, is a mandatory prerequisite for singling out and analyzing words in the communication, i.e., to find the semantic meaning of a word and its grammatic characteristics. In other words, as soon as a verbal signal is transformed into a series of discrete elements it passes to the input of the next level of information processing. Development of a model of this level, which is called a model of the analyzing part of language, is in the hands of mathematical linguists, psycholinguists and neurolinguists.

In this report we shall discuss only the lower levels of signal processing, the levels on which transformation of a verbal signal into discrete phonetic elements occurs. In computer language, these levels are referred to as the unit of primary processing that singles out the useful tags in the signal and the unit of phonetic interpretation.

The key question in developing such units [or modules] is the nature of the useful tags isolated in the signal.

The initial verbal signal constitutes sonic pressure that changes in a certain way in time. It can be recorded with an oscillograph. Figure 1 illustrates an example of such a tracing, in general, for a very simple word "kakoy" [which]. The oscillograms of verbal signals are quite variable in different people, and it is virtually impossible to determine from them what was uttered. Processing of these signals is needed. What sort of processing?

All serious researchers have long since abandoned an empirical search for methods for processing the initial signal. Two routes became delineated: one oriented on a model of speech formation and one oriented on a model of perception.

The former route appeared very attractive at the start, since an acoustical model of word formation has already been developed in a rather good approximation. Using some simplifications, the model can be described with a relatively small number of parameters. Thus, it remains for us to find mathematical methods of processing a sonic signal that would enable us to reconstruct the current values of these parameters and, from them, make a phonetic interpretation. However, expressly the research teams that took this route before others and investigated it the best have become disappointed with this approach. Now, more and more attempts are being made to try the second route, i.e., to address oneself to the mechanisms of hearing.

One can arbitrarily single out two parts in the auditory system: peripheral and central. The peripheral part refers to the cochlea of the middle ear, which is a complex hydrodynamic system that begins to oscillate in response to sonic signal. This is where spectral analysis of sound is actually made. Here too, in the middle ear, there is a system of receptors, sort of sensors, that are situated along the cochlea and transform mechanical oscillations of different regions of the cochlea into nervous impulses that flow along the fibers of the acoustic nerve.

The central auditory system consists of an entire set of accumulations of neurons organized in a specific way, ganglia that are situated in different parts of the brain and interconnected by neural pathways.

At the present time, the peripheral part of the auditory system is being studied intensively. Although the physical processes occurring in the cochlea are not yet completely understood, there are sufficient data characterizing the cochlea as a spectral analyzer to define the specifications

for a functional model thereof. The process of transformation of mechanical oscillations into neural impulses has been studied considerably less; however, even in this respect, we understand approximately which formal transformations of a signal must occur and which effects should be reproduced by the model.

Figure 1. Oscillogram of the word, "kakoy." There is 10-fold amplification on the bottom tracing. Time mark 20 ms

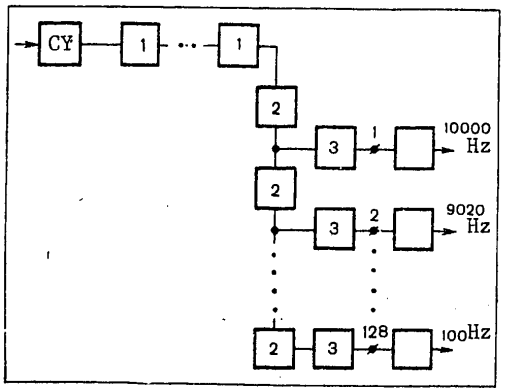

Figure 2. Block diagram of linear variant of model of peripheral auditory analysis

The situation is immeasurably worse with regard to investigation of the central part of the auditory system. All information available in this area is limited to a set of effects and functions obtained by

neurophysiologists dealing with the reactions to sound of neurons of central elements, on the one hand, and psychoacoustics specialists who deal with sound perception. For the time being, only some conjectures can be made on the basis of these data concerning the principles of signal transformation. But it is expressly central auditory processing of a signal that is of the most interest to those who investigate speech.

Having begun experimental studies in this direction, we soon became convinced that, first of all, we must have a model of the peripheral part of the auditory system; without it we simply do not know what image travels to the input of the central levels of sonic signal processing. In practice, we had to create this model in the form of an instrument, in order to obtain images of any sonic signals with the use thereof. We also had to supplement this model with the next, more "central" units [modules] for information process, which we are now developing.

The studies dealing with a functional model of the cochlea were conducted mainly by V. S. Shchuplyakov at the Institute of Physiology imeni I. P. Pavlov. Then specialists from the Ecole Nationale Supérieure d'Acoustique et Radio-Electricité in Grenoble joined in this part of the work, and with them we are presently conducting research on the topic of "Acoustic Dialogue Between Man and Machine." At the present time, this model has been executed in the form of two digital variants and an analog machine.

Figure 2 illustrates the block diagram of the model. The CY [synchronizer?] unit adjusts the input signal to the frequency characteristics of the middle ear. Units 1 are resonance filters with low Q factor that are connected successively and insulated [separated?] by buffer amplifiers. Their frequency characteristics multiply and, as a result, there is formation of frequency and amplitude characteristics with a very steep incline in the direction of high frequencies. Units 2 are resonance filters that form a long electric line reproducing passage of waves along the cochlea. Units 3 are resonance filters with average Q factor that provide for additional formation of frequency characteristics. The output signal from each filter represents oscillations of a specific circumscribed region along the axis of the cochlea. Thus, the entire system provides for "frequency--coordinate" transformation and serves as a parallel-action spectrum analyzer.

Figure 3 illustrates the model's response to the word "kakoy." The obtained image can be arbitrarily called an acoustic spectrogram. The frequency is plotted on the y-axis and time on the x-axis; the black areas reflect intensity of oscillations.

One of the key questions of automatic identification is that of segmentation of the signal. If the signal first separates into segments (such segments are clearly visible in Figure 3), such features as length of segments, such concepts as initial spectrum, end spectrum, etc., can be used to identify it. However, as a rule most sounds in normal continuous speech do not separate, and there are no pauses between most words in a phrase.

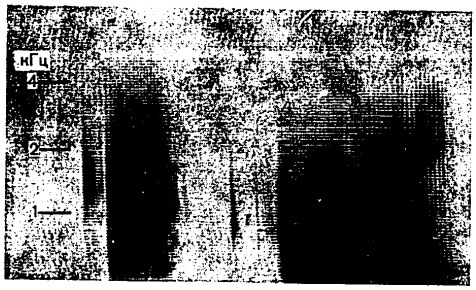

Figure 3. Image of the word "kakoy" at output of model of acoustic spectral analysis; кГц --kHz

If there is no segmentation, one must be governed by the current values of the spectrum or other parameters of the signal. A typical approach is to take spectrum samples every 10 ms and to determine each time which vowel or consonant sound this sample resembles the most. Expressly this approach is used in most systems of automatic speech identification in present use.

However, studies on man conducted in recent years established reliably that the duration of the segments--this applies to both the sounds and pauses--is a feature of paramount importance, which is used for auditory discernment of both vowels and consonants.

Neurophysiological data indicate that there is some sort of mechanism in the nervous system for singling out the ends of a sound: a significant number of neurons responds only at the start or end of a sonic message. A series of psychoacoustic studies was conducted to identify these mechanisms. It can now be asserted that drastic changes occur in the envelope of impulse density in some frequency channels of the auditory system, i.e., in the groups of neurons related to narrow segments of the cochlear membrane.

In the first approximation, the experimental data are described here by a model that consists of a band filter with central frequency of 25 Hz, to the input of which comes a rectified signal submitted to logarithmization from the output of the cochlear filter. There are devices that process the marks of auditory segmentation at the output of the band filter. Figure 4 illustrates the model's reaction to the same word, "kakoy." We see that the marks indicate the phenomena designated as the "start" of the sounds (black marks), "end" of sounds (white marks) and frequency "transitions," white oblique marks.

Interestingly enough, our model, like man, begins to demonstrate pauses in the signal when they last only 4-5 ms. Obviously, one of the flaws of most existing systems of automatic speech identification is that they do not notice brief acoustic events.

A classical question that arises when studing problems of speech identification pertains to the choice of phonetically significant spectrum parameters. This can be explained conveniently by demonstrating the acoustic spectrum of the natural stationary vowels, *u, o, a* [Russian vowels, pronounced as "ee," "o" and "ah"] (Figure 5). The spectra were obtained using the digital variant of the model of a cochlea. We see that the patterns are quite complex.

A series of studies was conducted with synthetic vowels, in order to find minimal differences in sounds (or, what is the same thing, in their spectral images), with which these sounds are referable to two different vowels and to determine the conditions under which there is maximum similarity of perception of sounds with obviously different spectral images. The results of these experiments warrant the belief that the first stage of central processing of the peripheral acoustic spectrum is singling out local heterogeneities in it (on the frequency axis). The simplest and physiologically plausible model that can do this is a procedure of so-called lateral inhibition, which makes it possible to calculate something that is close to the second derivative from the curve that describes the spectrum. The parameters of such a model have already been determined in the first approximation.

At the next stage of information processing there is integration of the image of the sonic signal over rather wide regions of the frequency scale, the range of averaging is at least an octave. At present we are considering several variants of a model of this second stage. Experiments are being conducted to choose a variant and define the quantitative parameters of the unit of the model.

The researcher is constantly confronted with contradictory requirements when working on the problem of automatic speech identification. On the one hand, he cannot lose either time-related or spectral details of images; on the other hand, the information must be amplified, both on the time axis and frequency axis. It can now be maintained that these problems are being solved concurrently for hearing. The peripheral image of the signal is reproduced in the central auditory system in several parallel versions, each of which singles out something inherent in it. But it is important that the axes of the images remain the same in all versions, axes of time and frequency. Thus, the principle followed differs substantially from the one presently used by engineers, who try, from the very beginning, to drastically reduce the amount of information processed.

The question arises as to whether there is any sense in striving to copy in a technical system the principles of signal processing by the brain. Many

specialists answer it in the affirmative. The outlay of human labor and computer time would, in this case, be directly referable to investigation and development of a model, and as soon as algorithms are developed, even if they are cumbersome, that are acceptable, they can be run by means of microprocessors.

The conclusions ensuing from the research already completed amount to the following:

As a result of experimental investigation of mechanisms of acoustic segmentation and mechanisms of central auditory processing of spectral information, a set of effects and psychoacoustic functions was found that limits drastically the number of permissible models of the phenomena and that permit evaluation of the structure and parameters of a number of units for processing sonic information.

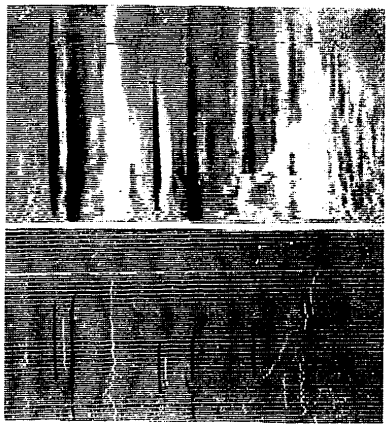

Figure 4. Image of the word "kakoy" at output of model for processing amplitude changes in "auditory channels"; top--output signals of band filters, bottom--segmentation marks.

The research on simulation of hearing made it possible to develop an operational system of processing acoustic information executed in digital and, in part, analog form. The system is so designed that it can be expanded in the future. Our immediate task is to test the possibility of reproduction

by the model of neurophysiological and psychoacoustic effects, which were not taken into consideration when it was developed, and to assess the capabilities of the model, from the standpoint of receiving signals in the presence of noise.

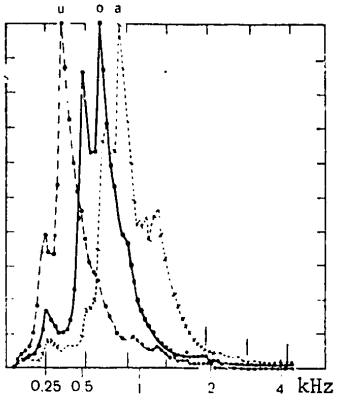

Figure 5.
"Acoustic spectra" of stationary vowels, *u*, *o*, *a*

* * *

After presentation of this paper Academician L.M. BREKHOVSKIKH asked for an update on the actual status of this research at the present time and the number of words that the computer now understands. V. A. Kozhevnikov answered that the team at the Institute of Physiology is working on the basic aspect of the problem, trying to help the engineers who, proceeding empirically, developed a system capable of perceiving speech, but the words have to be pronounced most distinctly, separating phrases with pauses, and the vocabulary is limited to slightly over 1000 words. The computer gives answers with great delay, so that it is difficult to have a dialogue with it.

Academician P. L. KAPITSA deems it important to single out, in the problem of automatic speech identification, the study of the cerebral impulse-signal, with which the process of transmission of information begins. He asked whether one should study signals by recording them directly, just as electrocardiograms are used to study cardiac function. V. A. Kozhevnikov said that this is a very difficult, if not impossible, route, since it would require insertion of electrodes in the human brain and analysis of the function of millions of receptors and ensembles thereof, the principles of action of which are not yet known.

Academician I. A. GLEBOV remarked that the process of verbal communication between man and machine consists of two parts: acoustic information--machine and machine--acoustic information. Which of them is more difficult to study? Probably the former. V. A. Kozhevnikov agreed with this and

reported that the problem of synthesizing speech has already been solved: a machine converses with an operator. As for the first part of the process, each individual has his own manner of speech and people's voices are different, as well as pronunciation; under such conditions, it is very difficult for a machine to single out what is important and meaningful, the main gist.

Academician M. A. STYRIKOVICH stated that a machine receiving ordinary human speech is, so to speak, confronted with the task of reading an illegible manuscript, rather than a printed text, and only a guess can be made about the meanings of a number of letters according to their combinations in words. The main difficulty for the machine consists of the fact that each sound is not expressed by a single signal, but a combination of hundreds of signals that have to be analyzed in order to "guess" their meaning. This is a very difficult engineering task.

In the discussions of this paper, K. P. Ivanov (acting director of the Institute of Physiology imeni I. P. Pavlov, USSR Academy of Sciences) reported that one of the most interesting projects of practical importance of the Institute of Physiology has been submitted for consideration to the Presidium of the Academy; it goes far beyond the framework of ordinary conceptions on conducting research in physiology. Even organization of this work is very complex, because the team includes not only physiologists, but acoustics specialists, mathematicians, engineers, but the physiologists are the moving force in elaborating the problem. In this regard, K. P. Ivanov stressed that the widespread opinion that physiology is related only to medicine is not quite true. The described study shows that modern physiology is involved with tasks that touch upon many very serious technical tasks.

M. A. SAPOZHKOV (Moscow Institute of Electrical Engineering of Communications) discussed the importance of team work by specialists in different fields, scientists and engineers. It is only after identifying the mechanism of speech perception that one can advance toward solving the entire problem. The speaker believes that the individual differences in human voices are so great that it is easier to recognize an individual by his voice than his fingerprints. And although the acoustic features of people differ and it is difficult to adjust the machine to this, the prospects of solving the problem are already evident. It is imperative to encourage work in the physiological aspect in order to "get down to the metal."

Academician P. G. KOSTYUK believes that the studies under discussion are of basic interest to the physiologists themselves, since it is not deemed possible to investigate the reactions of individual receptor elements, individual cells, when there are hundreds of thousands of them and they function simultaneously, using the method of electrophysiological study. At present, modeling complex systems with due consideration of direct data pertaining to their functions is the only route for physiologists. For this reason, the research conducted by the authors of the paper is included in

the complex "Brain" project (which is being worked on by the Department of Physiology, USSR Academy of Sciences), and it is being relied upon as an important element in learning about the mechanism of auditory perception.

V. I. GALUNOV (Scientific Council for the problem of "Acoustics," USSR Academy of Sciences) dwelled on the multiaspect nature of studies of speech that are being conducted concurrently in a number of directions that appear, at first glance, to be utterly unrelated: physiology, linguistics, physics, cybernetics, etc. So many aspects can be explained by the fact that, when formulating the relevant practical tasks, they cannot be expressed in a purely technical form as can be done, for example, with tasks pertaining to recognition of a limited number of commands.

If the submitted paper is considered from the point of view described above, it becomes obvious that, in the first place, it represents a certain part of a major multiaspect project and, in the second place, this is an utterly clear investigation in its scientific set-up, and it will help solve a number of applied problems.

T. K. VINTSYUK (Institute of Cybernetics, Ukrainian Academy of Sciences) stated that the problem of automatic recognition of verbal signals is also, to a significant extent, a cybernetic problem, since cybernetics is largely an applied science which is concerned with development of practical systems of identification of verbal signals referable to a number of other problems. Rather good results on recognition of a limited set of words, as well as continuous speech, have already been obtained (true, under laboratory conditions) in such institutions as the Computer Center, USSR Academy of Sciences; Institute of Mathematics, Siberian Department of the Academy, as well as the Institute of Cybernetics, Ukrainian Academy of Sciences, in Kiev.

At the present time, cyberneticists view the problem of speech identification essentially as a problem related to information processing. How should this information be processed, how should a decision be made? Unfortunately, physiology cannot answer this question. When will it be able to answer it? Apparently, not soon. Investigation of processes of verbal signal processing is a very important task, and it should be worked on from the physiological aspect; but, the speaker believes that apparently investigation thereof in the physiological and cybernetic aspects will come together on the highest level, sometime in the distant future, when we shall be able to refer to recognition of speech in a natural language, let us say Russian.

N. G. ZAGORUYKO (Institute of Mathematics, Siberian Department of the USSR Academy of Sciences) supported the studies of physiologists dealing with the problem of speech recognition. In his opinion, it is expressly the achievements of physiologists that will become the main foundation in the future for development of work in this direction, and physiologists have already obtained concrete results that are used in development systems of speech recognition. In particular, they have discovered the so-called "masking" effect, which, when simulated in a machine, makes it possible to

advance very substantially in such a difficult part of the problem as adaptation of a machine to a speaker.

As already noted, such studies must be conducted by representatives of different scientific directions. The All-Union Seminar-School on Recognition of Verbal Patterns unites different specialists and gathers together over 100 scientific organizations, both academic and sectorial, once every 2 years. One should consider the establishment of an official body that would coordinate research on this subject.

L. V. ZLATOUSTOVA (Moscow University) called the attention of the audience to the fact that the research conducted by the team at the Institute of Physiology, USSR Academy of Sciences, has a vast spin-off in linguistics, both applied and theoretical. Suffice it to state that the nomenclature of perception units developed in this laboratory is used widely by specialists in different fields. A system, in which one is able to bypass the lowest level of expression of speech, the acoustic level, will make it possible to resolve in depth and effectively the problem of automatic speech recognition.

Summing up the discussion, Academician V. A. KOTEL'NIKOV, vice-president of the USSR Academy of Sciences, characterized the problem in question as one of definite interest, from both the practical and applied, as well as theoretical points of view. The mechanisms of identification by the human brain of an image, a sound are very complex. Still, one can hope that electronic machines will soon make it possible to run identification [recognition] processes, especially if scientists will learn how this is done in nature.
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PSYCHIATRY

RECENT DIRECTIONS OF CLINICAL RESEARCH IN SOVIET PSYCHIATRY

Stuttgart FORTSCHRITTE DER NEUROLOGIE PSYCHIATRIE in German Vol 47, 1979 pp 1-23

[Article by E. Sternberg, Institute for Psychiatry of the Academy of Medical Sciences of the USSR, Moscow]

[Text] The organization of research carries fundamental importance for the planning and execution of research work in psychiatry as well as for the organization of psychiatric care, which has been developed systematically in the Soviet Union. The system of state and territorial psychiatric dispensaries assures the registration and inclusion of practically all psychiatric patients. It concentrates data on history, progress, therapy, individual personality traits of patient and family as well as of social status.

Optimal preconditions are established in this way, not only for clinical-epidemiological population surveys, but also for complete records of hospitalized as well as of ambulant patients. The existence of six special psychiatric institutes with large staffs and all the necessary equipment constitute a favorable basis for the execution of expensive programs, such as epidemiologic population surveys, extensive genetic-genealogic family examinations or the course of diseases in large series. The article discusses fundamental theories of Soviet psychiatry, its predominantly clinical-nosologic and empiric-analytical character and points out, that pathogenetically oriented research on endogenous psychoses plays a central role in ongoing studies. The following broadly developed trends of research are discussed in detail: 1) Clinical-epidemiologic population surveys, in which we describe detailed studies on about 6000 scizophrenics. We describe also special studies on ambulatory patients with senile psychiatric abnormalities and on schizophrenic patients over 60

years of age. This was complemented by a field study of over 1,000 aged persons who were known to the dispensaries. 2) Clinical-genealogical examinations of 4600 family members of schizophrenic probands. They provided considerable information on genetic determination of the disease, age of onset and degree of progression, thus viewing the problem of schizophrenia in a new light. 3) Eleven hundred patients of 60 or over, followed through several decades with disease onset at various ages. The author discusses the methods of prospective studies and the rules and dynamics of progress in various forms of schizophrenia.

I should like to precede this report on recent clinical trends of Soviet psychiatry with some introductory remarks and explanations. It should be understood, that a single person cannot positively give an exhaustive review of scientific and practical psychiatry of a vast country like the Soviet Union. The country possesses in excess of 100 teaching chairs in psychiatry, six psychiatric research institutes, a wide network of psychiatric hospitals, sections of general hospitals, policlinics and psychiatric nursing homes for chronic patients.

I restrict my report to the trends of clinical and clinical-pathologic work, not only because one article could hardly do justice to the existing wealth of material, but principally because I intend to portray those research tendencies with which I am personally familiar, thanks to my activities.

To begin with I should like to emphasize that I desist from a discussion of the numerous important and many faceted research in the subject of biologic psychiatry, which is being carried out in numerous institutes of the country. In this respect I might refer to numerous papers which were published abroad, and to chapters by K.K. Monachov and M.E. Vartanian in the monograph "Schizophrenie, Multidisziplinare Untersuchungen," which was published in German. In order to remain within the framework of this paper, I also will not refer to multiple problems of modern psychiatry therapy, particularly psychotherapy. Besides, and exhaustive report on the state of psychotherapy in the Soviet Union was recently published by the Duesseldorf psychologist W. Lauterbach (1978) who reports his personal experiences.

My present report builds on previous papers that have been published in this journal (1972, 1973) and dealt with certain aspects of the theoretic foundation as well as some concrete paths of Soviet psychiatry. In order to avoid repetition I shall deal primarily with futher developments of initiatives, which have been mentioned in previous publications. There are good reasons for discussing mainly studies in the area of endogenous psychoses. Questions concerning these types of disease still are in the center of Soviet scientists' scientific interest. This not only because of their frequent occurrance or practical and theoretical importance, but also because the pathogenetically oriented catamnestic, epidemiologic or genealogic studies of the age factor etc, proved to be fertile for clinical work in other areas of psychiatry. Thus,

the emergence of stereotypes of disease development proved to be useful in the study of chronic alcoholism and various other organic psychoses. The central role of endogenous psychoses in contemporary psychiatry also expresses recent fundamental changes in the structure of psychiatric disease. General medical progress has led to a considerable decrease not only of progressive paralysis, but also of psychoses of infection as well as those based on trauma and othe physical abnormalities. Last not least my primary choice of research trends is very naturally based on my personal participation and acquaintance with them.

Again I should point out two significant items for this discussion:
1) The important role of psychiatric care organization in the Soviet Union, and the organization of research in planning and execution of this work, and
2) certain theoritical foundations, which form the basis of clinical psychiatry and determine its course.

I also must point out the importance of psychiatric dispensaries, which have been functioning more than 50 years, in order to appreciate the characteristic organization of psychiatry in the USSR. Built on territorial principle, they offer not only free consultations, treatment and medication for psychiatric patients, but also all necessary social, economic and legal aid. The dispensaries function not only passively, like a policlinic, accessible to patients and family alike, but they practice active care in the form of regular house calls by physicians and nurses. This is particularly important for the completeness of our observations. Repeated reviews by corresponding field studies shows that practically all organic psychoses, psychopathic and neurotic abnormalities, phobias etc., are registered in the district dispensaries.

This means, that the dispensaries dispose of complete patient records. It is indispensable for the conduct of all-encompassing epidemiologic research. It is also of primary importance in studies of endogenous psychoses and of the inclusion not only of severe, but also of milder forms of disease, which are treated on an outpatient basis. No less important is the fact that it guarantees a continuous record of hospital and outpatient observations, particularly concerning general health, the way of life and domestic circumstances of patients. As a rule all observations are concentrated in the dispensaries. They include clinical course, results of examinations, patient history given by the patient himself and close associates, heredity, personality development, family interrelations, social status, work disability and work- and living conditions. Naturally this concentration of medical and social data affords a favorable climate for progress evaluation and long range catamnesis, particularly since they frequently cover decades.

Organization also is important in the planning and realization of psychiatric research. As mentioned above, the Soviet Union possesses at present six psychiatric research institutes with adequate staffs and modern laboratories. On the basis of central planning they usually work on special (monothematic) programs. The program of the Institute for Psychiatry of the Academy of Medical Sciences for instance, pursues endogenous psychoses, primarily schizophrenia. It is self-evident, that great research institutes are necessary for studies,

which require considerable manpower. This is true particularly of epidemiologic and genealogic studies. Multidisciplinary research is possible and promising only within the framework of such institutions.

In regard to our basic theoretic positions I should like to refer to a detailed account, which was published in this journal in 1973. Therefore, I shall confine myself only to summarizing remarks. In the psychiatric literature one frequently finds indications of certain similarities between Soviet psychiatry and the so-called classical one which is based on the teachings of Kraepelin. This is justified inasmuch as Soviet psychiatry like Kraepelin always have attempted to base psychiatry on a scientific basis. Soviet psychiatry always has been nosologic and tended to join general medicine and pathology in the pursuit of research. Like German, American and French psychiatry it has pursued a straight line within the past decades. Radical directions of the so-called social psychiatry, such as psychoanalysis and psychology in depth, purely mental concepts, existentialism and anthropologic psychiatry failed to influence clinical nosologic and analytic-empirical psychiatry. Still, it would be amiss to consider Soviet psychiatry simply in orthodox kraepelism. Soviet psychiatrists have shown that the original Kraepelin theory was basically prognostic and that it lacked a theoretical basis in many respects. The establishment of psychiatric entities by purely etiologic criteria was always believed to be too narrow and only to be understood in historic context.

In past decades a considerable part of the formulation of methodical and theoretic aspects of psychiatric research has been performed under the auspices of A.W. Snechnevski et al at the Institute for Psychiatry of the Academy of Medical Sciences. In their work they defined nosologic forms of disease by entities of etiology and pathogenesis.

Since we still know very little about the etiology of most psychoses, our studies concentrated on pathogenesis. Thus we could broaden the attack on biologic, genetic, epidemiologic and other studies. On the other hand our clinical studies were directed mainly at the course of disease. Thus, rules of successive changes and changes of conditions forming stereotypes of disease progress, became the subject of clinical-pathologic studies. The sequence of certain syndromes in the course of disease were viewed as the clinical expression of underlying pathogenic processes. The polymorphism of clinical manifestations was seen as expression of ramifications of the pathological process. The importance of such a model could first be demonstrated in the organic psychoses, as for instance in senile dementia or progressive paralysis. By pathogenic concepts and clinical experience we could establish three main course-types of schizophrenia, the chronic (continuous progressive), the remitting (progression in waves) and recurrent. The properties of structure of the various syndromes as well as the laws of change were established for each type by years of exacting analysis of manifestations and progress. It became necessary to separate general pathologic rule of progress forms from special ones, i.e. those characteristic for forms of specific diseases.

In spite of his categoric denial of the unity of psychoses Kraepelin examined possible evidence of general conformity of disease progress in later years. His concept then was a rough approximation of general rules of disease progress, such as the succession of melancholy, mania, irrationality and dementia. Going beyond these four stages of psychosis he developed concepts of the preponderance of general basic forms of psychic abnormalities. This found its formulation in the teachings of the 1920's. Soviet psychiatry also worked out certain general pathologic concepts of syndrome classification, i.e. arranging them into various strata. Schematically they were shown as successive syndromes reflecting increasing severity and involvement. The sequence of severity comprises asthenic-hyperaesthetic, neurotic, affective, paranoid, hallucinatory-paranoid, paraphrenic and catatonic syndromes, disturbance of consciousness as well as organic states of epilepsy and dementia. This model makes it possible to determine not only the possible range of syndromes (as for instance cyclothymia or schizophrenia), but it also accepts the various types of psychoses (endogenous, exogenous, organic etc) as important preconditions for nosologic classification. Such general psycho-pathologic concepts offered important new impulses to the studies of psychiatric syndromes. Soviet psychiatry understands a syndrome as an inseparable yet dynamic structural unity of positive and negative changes of activity. This is in contrast to earlier tendencies regarding syndromes as unique--as by Hoche and numerous French psychiatrists--and static characteristics of pathologic--productive symptoms. The peculiarities of syndromes always indicate information of disease progress. Therefore clinical psychiatry in the Soviet Union has made research on the structural entities of psychiatric syndromes the subject of intensive study. Given the unsatisfactory state of contemporaty psychiatric teaching, its prematurity and contradictions, the difference of clinical criteria for disease entities as well as the undoubted multiplicity of etiologic factors, Soviet psychiatry has come to the opinion that only multidisciplinary research can provide adequate methods for the scientific study of psychiatric diseases. For this reason we planned and carried out studies of homogenous groups, i.e. patients selected on the basis of clinical-psychopathologic, pathologic, neurophysiologic, genetic and pathophysiologic principles. Our German monograph on schizophrenia, published in 1977, conveys an idea of the planning, organization and practical execution of such a research program.

We were guided by the conviction that one of the most important and promising approaches can be seen in epidemiologic studies of certain populations or groups of psychiatric patients. Transition from selected hospitalized patients to all-inclusive epidemiologic studies should lead to further development of our knowledge. This tendency has taken a broad and in many ways original development. Its potential scientific importance is self-evident. I should like to point out some of the possibilities of this clinical- epiodemiologic approach. It is the only way to determine the true incidence of a given form of disease in various population groups. Numerical estimation of characteristic manifestations and progress, as well as the importance of etiologic factors can be obtained only by means of epidemiologic population studies. They offer a complete picture of family relations, social status, employability and adaptability. For this reason they may also be used for

objective verification of etiologic and pathogenetic hypotheses in psychiatry. This type of investigation is also important for scientifically based planning of psychiatric institutions, the organization of psychiatric care and last but not least the evaluation of treatment methods.

However, we are aware of the previously emphasized difficulties of epidemiologic population studies. They have to involve sufficiently great population samples in order to be meaningful. This in turn means expensive programs and ample staffs of qualified specialists. These obstacles were overcome by our specialized research institutes.

The problem of data gathering also presents considerable difficulties. In this respect however, we are fortunate, because we possess complete patient records in our dispensaries. They insure comprehensive pictures of at least the psychotic patients, whether they are in clinics, hospitals, other institutions or at home. Clinical-epidemiologic research of schizophrenia, which comprises the majority of our studies, can thus assume standardized comprehension of populations.

Questions of methodology naturally are of decisive importance for the validity of clinical-epidemiological research. I might mention only two questions, which play a great role in studies of national surveys*: The question of data gathering, the "instrument" used and the quest for optimal methods for identification of the patients' state of health.

In contrast to the questionnaires, self-evaluation scales etc., which are used abroad, we use standardized exhaustive examination cards. These are filled out by the examining psychistrist after examination, i.e. a semi-structured phychiatric interview, and also the utilization of all available documents. These cards contain all information on heredity, family history, education and employment, social activities, personality structure, conditions of family and domicile, prior diseases and damages, onset and progress of disease as well as the entire clinical record, such as treatment in clinics, outpatient depatments, measures for rehabilitation etc. The emerging clinical status is then reviewed by us from the viewpoint of syndromes. We believe that this method has obvious advantages. Clinical symptoms always are artificially isolated, yet they usually have many connotations and are hardly comparable because they depend to a great extent on the syndrome in which they appear. Adequate and completely characterized syndromes however completely reflect all peculiarities of a psychic disturbance at any time. The establishment of a syndrom catalogue is of special importance for classification and its diagnostic value. It lists complete and interdependent syndromes, based on theories and clinical examinations. The establishment of corresponding glossaries are another precondition for classification and diagnosis. Thus one may guarantee uniform judgment in various diseases.

*Considering numerous problems (which are less important in this work's context) that have surfaced in the attempts at international cooperation of epidemiologic studies, I should like to refer to the publication by N.M. Sharikow (1977).

Using the above described method, over 6000 schizophrenics and patients with affective endogenous psychoses have been studied epidemiologically in the district dispensaries of Moscow. Analogous studies have been initiated in other cities and several rural districts. This is important for the comparison of incidence, prevalence and the evaluation of possible local differences.

Another indispensable precondition for the evaluation of epidemiologic data is the complete characterization of the social and demographic structure of our patient population and the possibility of comparison with corresponding items within the general population of the district.

Reports of other authors have frequently ignored this aspect of epidemiology. Therefore comparisons are impossible, particularly since we have paid special attention to these aspects. In this context it is impossible to relate details of our vast epidemiologic studies. For that purpose we recommend perusal of corresponding publications (Sharikow, 1977). However, some important aspects should be emphasized. The above described methodologic and organizational principles of our studies make it possible to evaluate the relative frequency of various forms and variants of disease, because we could include all patients who were registered in our dispensaries. We could thus determine the incidence of schizophrenia at 0.6 to 0.9 percent. We learned also, that the unfavorable course in the form of dementia praecox accounted for only 6-7 percent of schizophrenics, while the majority of patients showed little progression or wave-like remitting forms of the disease. Our concept of three principal types of schizophrenia, which we had postulated on the basis of clinical studies, was fully vindicated by our comprehensive population studies, by quantitative characteristics of frequency and incidence. We were able to project successively appearing syndromes, which is important for prognosis and therapy. In this manner we were able to collect certain facts regarding time limits and periods of progress and regress in a given form of schizophrenia. These data formed the necessary framework for our clinical studies, on which we shall report at a later date.

In 1920 Kraepelin postulated the creation of "comparative psychiatry," meaning "comparison of great series of observations" in order to clarify the pathologic significance of various factors, as for instance sex or age at disease onset. Our studies provided among other items strict proof for the importance and influence of sex and onset on endogenous psychosis. Although the incidence of all forms of schizophrenia is about the same in males and femals, it could be shown that unfavorable forms of schizophrenia occurred predominantly in males (66.1 percent), compared with 33.9 percent in females. The bland type of disease prevailed in women. Slow progression was found in 53.4 percent, wave-like progression in 65.8 percent recurrent psychoses in 70.9 percent. Manic-depressive psychoses were less common in men (15.5 percent) than in women (84.5 percent) within the same urban district. An example will demonstrate the connection between onset and type of disease. Over the age of 40 years we see only 2.5 percent of schizocar nuclear forms of schizophrenia, 16 percent of continuous paranoid schizophrenia,

about 20 percent of recurrent course, but 40 percent of all manic-depressive psychoses. These studies also can give us pathogenetic correlations by sex and disease onset. The most favorable is dementia praecox, predominantly in men, the wave-like remitting form, mainly in women, beginning at a later age, and finally the prognostically favorable manic-depressive disease, occurring at a still later age, predominantly in women.

Let us now consider several specific geriatric studies, which we have done or are still performing a supplement to the described comprehensive studies.*

These unfinished studies were done in sections. We examined a population of about 770 schizophrenics over 60 years of age, who were registered in one of the municipal psychiatric dispensaries. This was undertaken to obtain a broader basis of comprehensive observations in older patients. We found that the percentage of 17 percent in persons over 60 did not differ much from the general population. Data of the last two decades seemed to indicate that the percentage of older groups of patients within the dispensaries exceeds that of the general population. From the early 1960's to 1978 the registered schizophrenics over 60 years rose from 12.7 percent to almost 20 percent. This exceeds the percentage in the general population. There are several reasons for this. The most important one can probably be found in the expansion of the diagnosis of late schizophrenia. At present it is difficult to reconcile these findings with the data of Ciompi & Mueller, Alstrom, Odegard, Niswander etc., on excessive mortality of schizophrenics. Of course, one cannot readily compare Ciompi & Mueller's data with ours. They reported on a group of patients of only certain age groups, whereas our population includes aged schizophrenics who acquired their disease rather recently. Our data can be compared only with the general population.

This epidemiologic study repeatedly showed considerable prevalence of females over 60 years (3:1). This differs from the sex distribution of the general population of schizophrenics (1-1.5 : 1), as well as from that of similar age groups of the general population. (2.1). We believe that remitting late schizophrenia, which is more common in women, is primarily responsible. Our studies also confirmed the views of several authors (Ciompi & Mueller, Huber etc.) that social adaptation of schizophrenics frequently improves at advanced age. This is corroborated by the high percentage of older schizophrenics, who live at home (90 percent). The percentage was higher not only for schizophrenics of all age groups (84 percent), but also compared to all patients of this age who registered in the same dispensary (87 percent). An investigation of the 10 percent who were institutionalized, showed that only 6.8 percent were in psychiatric hospitals, 2.2 percent in psychiatric colonies and 1.2 percent in nursing homes. The high percentage of older schizophrenics who live at home is all the more remarkable, since in the general population the percentage of institutionalized persons increases with age.

* Since I have described those studies in detail in association with Dr. S.I. Gawrilowa (Nervenarzt 1978), I shall confine muself here to a short characterization of basic questions and cite a few general aspects of the results.

Our epidemiologic studies also provided certain contributions to the problem of late schizophrenia, particularly regarding its frequency. This problem is rather controversial in the literature (according to Kraepelin schizophrenia begins in 5.8 percent after the age of 40, according to numerous other investigators in 15-18 percent and according to Meuller in 30 percent). In our geriatric material we arrived at 32 percent, which closely approximate the results of Mueller. We found the disease onset in 16.7 percent of patients over 50 and in 4 percent at age over 60. It must be emphasized however, that these numbers do not reflect the incidence of late manifestation of schizophrenia. Epidemiologic studies of the general population of schizophrenics produced low percentage figures, closer to those of Kraepelin. The frequency of late manifestations of schizophrenia also depends to a high degree on the character of the patient population. Based on repeated evaluations of the total count of hospitalized schizophrenics over 60 in a large Moscow hospital we found a considerably greater number of late schizophrenics (27-35 percent), than in comparable populations of dispensaries. Thus the contradictory data on the frequency of late schizophrenia can be explained by the dissimilarity of patient groups.

I think that we should also consider the dependency of sex distribution of late schizophrenia on the age of disease onset. At onset at ages 40-49 we found 18.3 percent men and 81.7 percent women, from 50-59 years 11.1 percent men and 88.9 percent women, and at over 60 years 23 percent men and 76.7 percent women. These data show that the manifestations of schizophrenic psychosis rises in women during the climacteric-involuntary periods. This might explain the predominance of female schizophrenia in our geriatric population.

We divided schizophrenias according to our own classification. Thus, we found, that the continuous course of the disease (simple course according to M. Bleuler, Ciompi & Meuller) was represented in small numbers. About 80 percent of the patients showed remitting (wave-like according to Bleuler) and recurrent forms (phasic according to Huber), which amount to only 56 percent in the general schizophrenic population. Predominance of the remitting course in older patients might have several causes. The youth or "Kern" forms of continuous schizophrenia is rarely encountered in older patients. Part of those patients probably dies at an early age and others may possible be not registered any more by the dispensaries. Furthermore, numerous patients, who were classified as continuous, progressive disease at an earlier date, were found later on to represent long lasting remitting waves with late remission. Some forms, that appear to be progressive at first, assume a distinct wave-like, remitting course.

Patients who underwent only one disease wave represented a spectacularly small percentage of the geriatric population (2.9 percent of all patients, 5.2 percent of men and 1.9 percent of women). This was considerably below the numbers which had been calculated for the schizophrenic population of all age groups. We have to consider that our patients may represent a "survivor population." Some patients, who underwent only one wave of

psychosis could disappear later from the dispensary records, yet the above data merit some consideration. They indicate the repeatedly observed fact, that recurrences of wave-like schizophrenia may occur at an advanced age, frequently after remissions of decades. Consequently, the long range prognosis of wave-like schizophrenia must be made with discretion. We have described late recurrences of that type in association with J.K. Moltschanowa (1972).

In epidemiologic studies of schizophrenics, extending to survival at high ages, we also observed a group with initially wave-like type, which changed to chronic progress at advanced age: 7.8 percent with early onset and 11.9 percent with late onset. This observation is of special interest in regard to the constancy of the types of schizophrenic course. We shall have to say more about this. In the past decades numerous investigators, particularly in the Soviet Union, have paid attention to relatively light schizophrenic debilities with minor clinical expression, i.e., with forms of the disease which were light and with few clinical symptoms. There are various reasons, why the interest for these forms has been increasing. On one hand the clinical picture of these forms is not as familiar as that of the "great" psychoses. On the other hand these relatively weakly progressive forms are rarely encountered in clinics. They have a special meaning for the classification of those psychic abnormalities and must be included in the family of schizophrenias. They are also important for genetic and pathogenetic studies. Some 38 percent of our patient population of schizophrenics over 60 years were ambulatory cases. We chose this disignation because these patients had never been hospitalized, or at least not within the past 20 to 30 years. This designation is only superficial and associated with various factors. This group could be equally divided between patients whose disease progressed minimally with only rudimentary but characteristic symptoms, and those patients who had distinct schizophrenic psychoses at an early age, but whose disease became "ambulatory" later on. In 158 patients we observed cessation of the disease progress within the involution period, after decades of a relatively stable course.

A summary of the gerontopsychiatric literature by Lauter contains many observations to the effect that only a small number of gerontopsychiatric disturbances are detected and treated by the psychiatrist (Juel-Nielson, Parsons, Stromgren etc.). Kay, Beamish and Roth compared this situation with an iceberg, of which only the tip is seen, while the bulk consists of unknown psychic disturbances. In our gerontopsychiatric study as well as from some random samples we gained the impression that through the dispensaries we do not reach the psychoses of older age as readily as those of younger patients. In order to gain a more meaningful study of people over 60 we undertook a field study. In it we examined a statistically representative (5 percent) sample of people believed of good health and unknown to the dispensaries. However, they lived in the same district and corresponded to the registered patients in age and sex. Organization, method and results of this field study have already been described (E. Sternberg & S. Gavrilova 1978). In it we studied 1,500 older people. I shall mention only some of the results, which appear to be important and provide directions for further clinical studies.

1) A considerable number (about 40 percent) of these seemingly well people over 60 years and unknown to the psychiatrist were found to have psychiatric disturbances of varying form and severity. 2) By severity of psychiatric disturbances we could classify a smaller portion as "psychotic." They amounted to about 5 percent of all encountered psychic disturbances and included psychoses in the strict meaning as well as definite psycho-organic changes (demntia). Milder disturbances, which were classified as "non-psychotic," were found in 34.7 percent of the studied population. This heterogeneous group included initial (pseudoneurasthenic, neurotic or psychoorganic effective) changes associated with organic, mostly cerebro-vascular processes, with endogenous psychoses which were subclinical or in remission, neuroses and non-psychotic affect changes. In view of our methods and the differences of studied populations we can compare our results with those of others (Sheldon, Essen-Moller, Nielsen, Roth, Kay et al) only with reservations. It is remarkable nevertheless, that the percentage of psychotic abnormalities (3.9-8.0 percent) corresponds to the findings of other investigators (Bremer, Gruenberg, Primrose, Svanberg et al). 3) The fact, that the proportion of psychotic to non-psychotic changes in the general population is 1:7, but in the registered dispensary patients 1:0.25. We view this as evidence that the dispensary system guarantees location, treatment and care of severe genronto-psychiatric abnormalities. 4) We have shown on the other hand, the necessity of broader participation of psychiatrists by consultation, diagnosis and therapy in geriatric centers and general medical institutions. This would enable those institutions to take proper care of the majority of mild psychic disturbances seen at advanced age within the general population.

The finding of psychic manifestations in 7.8 percent of the studied group should be understood as conditional pathologic states. We are dealing here with borderline conditions and variations between psychic aging and true disease. They are heterogeneous but difficult to qualify. We included among others a drop of intellectual faculties, which exceeded average psychic aging, and corresponds to the mild dementia or deterioration of English authors. Others were senile character changes, particularly protracted subdepressive states (grouchy, resigned, hopeless) of a taedium vitae. This type of change undoubtedly calls for a more thorough geronto-psychiatric analysis, which is not possible in the framework of an epidemiologic study. Additional catamnestic observations seem indispensable, particularly in cases of so-called mild dementia. In this connection I should remind the reader of the views of the Soviet pathologist and gerontologist I.W. Davidovski, which I discussed in an earlier publication (1975). He differentiated nosologic forms of disease from frailties of old age, i.e., clinical forms, which, however, are due to biologic and psychologic aging processes.

In a recent clinical epidemiological study which is still in progress, we have again pursued practical important questions: To what extent are psychiatrists aware of the various psychic forms of disease in patients over 60, and to what extent do these patients receive treatment and care? For this purpose we apply a repeatedly used and approved method: A comprehensive epidmiologic card of record of the patients who are registered in a

certain district, and at the same time of 5 percent of persons who are unknown to the dispensary, but compare to the patient population by distribution of sex and location. From these elaborate studies we expect not only important results for the care of older people, but also additional data concerning the incidence and particular symptoms of various disturbances at old age.

We shall mention the clinical genealogic studies only briefly. They have reached a considerable volume in recent decades of Soviet psychiatry, particularly in research on schizophrenia. I refer the reader to recently published comprehensive reports by I.W. Schakhmatova (1977). In the present paper I confine myself to the characterization of a few general facets and important results of this research. The clinical-geneological studies of schizophrenic probands and families by the staff of the Institute for Psychiatry of the Academy of Sciences may be considered exemplary. In the course of these studies we examined about 4,600 family members (among them 2,300 of direct relationship) of over 600 schizophrenic probands. This study was comprehensive and included not only possible secondary psychoses, but also structure and possible abnormalities of personality.

One need not emphasize that studies of such volume can be managed only in a specialized research institute, which disposes of the necessary means and staff. The obtained results were based on our clinical research. Since we already had arrived at the conviction that the principal courses of schizophrenia have to be considered expressions of pathogenetic entities and rules, we separated family studies and compared them in probands with different types of clinicla progress and course. We could conclude that the clinical course of schizophrenia depends on certain genetic controls, because we found significant differences in secondary psychoses which were more severe in wave-like remitting forms, than in the chronic progressive course.

This held true also in the personality structure of first degree relatives. On the whole these studies confirmed our concept of schizophrenia as a hereditary, so-called "Anlage" disease. We could show also, that the age of first manifestation or degree of progression was under the influence of certain genetic information. This emerged in additional clinical-genetic studies, which compared probands with early and late manifestations of wave-like progression and patients with polar opposite chronic continuous progression (malignant and creeping youth forms). The following aspects of this group of studies are important for the future. A considerable portion of family members were examined not only clinical-psychopathologically, but also in pathophysiologic laboratories of the institute (M. Vartajian). The biological studies were alike in probands and family members. In our pathophysiologic laboratory (J. Polgakov) they were tested for deviation of the recognition processes. There we observed that the pathophysiologic and pathopsychologic deviations that are found initially in schizophrenics, were also frequently observed in family members (significantly more frequently than in the control group). Thus, we succeeded in more complete characterization of the constitutional facets on which the psychotic process is based. The possibility of an exact and multifaceted characteristic of a "schizophrenic constitution"* which emerged from these studies, can be considered the theoretically most important aspect of the study

* The schizophrenic "pathos" according to A.W. Sneshnevski.

The third research direction, which we shall describe in greater detail, concerns systematic long range catamnesis and progressive studies of schizophrenic psychoses, that have been a subject of our clinic's efforts within past years. Research of this type has been performed in many places. We mention only the more important studies by M. Bleuler (1972), Ciomoi & Mueller (1976), Huber et al (1961-1975), as well as single publications by Angst et al, Berner et al, Hartmann, Hinterhuber, Marinow, Stromgren, Astrup, Achte, Mohs, Riemer, Lawton, Rennie etc. One would not be remiss supposing that this type of study suggested itself through numerous observations on the considerable numerical increase of schizophrenic survival from early onset into old age. In the discussion of our results I already indicated facts, that support considerable changes of age distributions in schizophrenic patients. The main reason for this would be found in demographic processes that are characteristic for our time and which affect the schizophrenic population as well as the general population. Other factors, such as greater effectiveness of modern treatment methods, improvement of psychiatric care, hospitalization and rehabilitation also should be important reasons for the increasing survival rate of schizophrenic patients. In our studies we employ catamnestic examination of patients over 60 and a retrospective reconstruction of the entire course of the disease. We believe that the solution of numerous problems of schizophrenia can be approached easier and more adequately on the basis of anamnesis, which comprises the major part of a patient's life, rather than by traditional clinical methods. In this connection I mention only the following questions: The duration and consistency of the course of disease during long periods or even the patient's entire life span; the persistence and timely limitation of periods of different intensity and progression of disease; the influence of critical periods of senescence on symptoms and progress of schizophrenia, as well as the possibility of special analysis of various developments appearing at advanced age; the question of peculiarities of psychic and somatic aging processes in schizophrenics, and many other questions. Before describing a few relevant data it seems necessary to comment on the methodologic studies. We should like to point to several methodologic differences that distinguish our studies from recent ones of other authors. Long-range progress can be studied basically in two ways--by means of the so-called cohort method or on the basis of retrospective reconstruction of the disease by means of catamnestic data. In our studies we chose the latter method. M. Bleuler, Ciompi & Mueller, Huber et al, to name the most important studies, have used the cohort method. The advantages of that method are obvious, particularly for conditions prevailing in Switzerland (little migration, good documentation) where this method provided complete data on the disease process of previously hospitalized schizophrenics. I consider the validity of that type of study of schizophrenic progress limited in the following respects: 1) Only selected, particularly severe cases can be studied, 2) continuous systematic steps of the disease are frequently missed, because complete data exist only for the period of hospitalization and immediate follow-up; 3) the problem of age factor remains problematic in most instances, because of the patients' different ages at follow-up (with the exception of the important study of the Lausanne clinic, that was conducted from that perspective) and 4) the absence of comparable populations in cohort studies

of clinic or hospital material provides an inadequate basis for the overriding question of the influence of external factors on the disease progress.

Our decision to embark on a long-range study in an unselected population of over 60 years of age, was based on the system of psychiatric dispensaries, as explained previously. The workup of dispensary records, which included decades, as well as the additional study of histories and other documentations, made for a more or less complete reconstruction of the disease progress. It was supplemented by intensive catamnestic data and questioning of family and associates at work. Based on dispensary populations we had the considerable advantage of locating and examining nearly all schizophrenic patients, i.e., not only the hospitalized, more severe cases, but also the milder "ambulatory" forms.

Still, any study on older patients has to contend with the unavoidable problem of selection. The associated limitation of validity of such studies surfaces in the above mentioned studies. We too could study only those patients who were still alive. Mueller emphasized correctly that psychiatry of old age always is the "psychiatry of survivors." The selection of schizophrenics who can be examined at an advanced age, is largely determined by two factors--the number of early deceased and those patients who are not examined for other reasons. Mortality rate plays a prime role in cohort studies of previously hospitalized patients. We have to assume also, that a certain cases with favorable progress are lost by the dispensaries. For this reason we tried to locate those patients who were previously treated by the dispensaries but were not registered later on, because of favorable progress. As much as they were known by our records and still alive, they also were studied. The selection factor was limited mostly by our clinical-catamnestic studies which were based on an ongoing epidemiologic study of all patients of 60 years or over. We studied all of these older patients uniformly, no matter whether they were in hospital, in nursing homes or lived at home. We analyzed schizophrenia not as an entity, but studied it separately by types and progress forms, as could be assumed from the above mentioned details.

Following the previously described methods we have to date carried out catamnestic long term studies of more that 1100 schizophrenics, who had reached or exceeded the age of 60. Six hundred of these patients had a continuous course, 500 had wave-like and remitting forms of the disease. Within these two large groups we could distinguish several subgroups distinguishable by the degree of progress. Cases in whom the progress of waves or attacks of disease was limted during the entire course, i.e., through old age, cases where the initially wave-like progress changed to chronic-progressive psychosis, and finally those cases in whom the disease ended at advanced age, were classified as wave-like progress. Within the large group of continuous (progressive) schizophrenias we also recognize some variants, based on the difference of progress: 1) Strongly progressive forms, 2) forms of moderate progression (medium), which essentially correspond to the old paranoid schizophrenia, 3) weakly progressive and 4) so-called marginal forms, as for instance those akin to paranoia and possibly latent schizophrenia. Both groups contained forms of early and late schizophrenia.

A more detailed presentation and discussion of the results emerging from this research program will be reserved for a monographic publication. A detailed comparison of our results with those of similar large studies (Huber, M. Bleuler, Ciompi & Mueller etc) would exceed the limits of this publication. Therefore I shall confine myself to a brief description of several principally important results of this research. By way of introduction I should like to say that the above described classification has proven itself, because we were enabled to formulate general rules as well as single data correlating with those parameters.

Although we agree with other authors, that long range observation has improved the general prognosis of schizophrenia beyond expectation, we think that this general judgment needs qualification. So, for instance, we cannot agree with M. Bleuler, who confines the active-progressive phase of the disease to 5 years. This on the basis of hospitalized and ambulatory patients. Even the generally correct statement by Huber, that the progress of schizophrenia is not constant, should be limited. We derive all these reservations from the results of our differential analysis of disease forms. Here are some examples.

In regard to the wave-like schizophrenic progress we could establish that the development of negative symptoms, i.e., signs of progressive schizophrenic personality change, usually occur early. This reaches its maximum after the 1-3rd wave, but remains stable thereafter independently of the appearance of more or less frequent recurrances. Early personality changes and later stabilization could be observed in 86 percent of 146 patients. in whom the schizophrenic process lasted for decades in distinct psychotic waves. Population studies of the epidemiologic section of our institute showed the same results (L.M. Shmaonova, J.J. Liebermann).

In those patients whose progress remained wave-like throughout advanced age, we could observe another facet of this course, which extends to the distribution at different ages. These patients underwent a total of 1,351 waves. Up to the age of 40 the waves accounted for 24.1 percent of the total occurrence, from 40-49 years 18.8 percent, from 50-59 years 26.2 percent and over 60 years 30.9 percent. In this type as well as in recurrent courses of schizophrenia we see more frequent attacks as age advances, but this does not result in aggravation of personality changes. This dynamism of progress shares much with that of long range maniac-depressive disease. The increasing and in a certain sense contradictory tendency of pathogenic mechanisms, i.e., the stability of early observed defects in the presence of increased recurrences represents one of the most important results of our progressive observations. Diametrically opposed clinical progress, such as stopping of the waves, or contrarywise the development of unusually long lasting ones, can be relatively independent of the dynamism of personality changes. This phenomenon of dissociation of disease progress and pathogenic mechanisms appear to be based on etiology, frequency of duration of psychotic waves. Observations on remissions at an advanced age have shown no influence on earlier personality changes. We pursued the modifying influence of age factors on the wave-like progress of schizophrenia in a series of studies,

which we shall not cite in detail. It became clear that the influence of age factors manifested itself primarily by increasing frequency of waves of illness, which may appear in series during the so-called involution period (50-60 years of age). However, it did not lead to increases of personality deficit. Viewing our observations on the long range course of 600 continuous (chronic) schizophrenias, that were studied recently by our associates (T.A. Drushinina, J.K. Moltschanoawa, A.A. Sukhovski, A.W. Medvedev et al.) we might summarize these observations briefly: 1) Progress of chronic schizophrenia is not constant or unlimited. This was also formualted by other investigators (M. Bleuler, Ciompi & Mueller, Huber etc) and holds true for the overwhelming majority of cases, although not for all. 2) As we shall demonstrate shortly, this formula is too general and simple. The clinical reality possesses more variations and can be explained only through the influences of different pathologic parameters.

In the course of chronic schizophrenia one may observe indeed varying steps of progress: An initial period, a period of maximal activity of disease progress, then transition to increasing stabilization, followed by gradual reduction of symptoms. This type of progress is found to be most distinct in "moderately" progressive courses, similar to paranoid schizophrenia. Numerous clinical-psychopathologic questions arose from these observations. Among them the task of descriptive-analytical characteristics of those changes, which occur in different periods of the illness and in psychopathologic symptoms (paranoid, hallucinatory, catatonic etc). Observations of this type have been published previously. As an example we might mention the work of Glatzel on the hallucination of chronic schizophrenics. At present we are engaged in the classification of our relevant clinical-psychopathological observations. Nevertheless I should like to emphasize the importance of such studies for the correction of purely statistic symptomatologic concepts (as for instance the concept of primary symptoms, the symptoms of first order etc). The limitation of progressive development of illness in time and extent should be considered proven by numerous studies, even in continuous-progressive course, which closely resembles Kraeplin's model of schizophrenia as progressive disease. Since the above named publications, including our own, belong to recent decades, we must inquire into the possible importance of modern active methods of treatment. This question cannot be dismissed lightly and requires careful study. I may be permitted to state that the facts at our disposal indicate, that energetic active therapy only reinforce existing tendencies of disease progress. This is borne out by numerous observations on patients who had not been treated for years or never.

As already mentioned, we do not believe, contrary to Bleuler, that certain time schedules can be set for the defervescence or stabilization of illness. We compared three groups of chronic schizophrenia--strongly progressive (malignant, schizocar, catastrophic similar to youth forms), moderately progressive, such as paranoid schizophrenia, and weakly progressive (bland, creeping, simple in Bleuler's sense). In doing so we found significant differences in the temporal extent of the various stages. They correlated primarily with the speed and degree of progression, but to a certain extent

also with the age of disease onset. One may express the thus found rules in a general way: The more severe the progression, the speedier the development of chronic schzophrenia and the more frequent the change of stages. This can be illustrated by two numerical examples: The "active-progressive" period of paranoid schizophrenic psychoses was more prolonged (in 9.5 percent of patients up to ten years, in 30 percent more than 10 years) than in unfavorably progressing forms (paranoid-catatonic) in which 40 percent extended to 10 years and only 6 percent to 30 years. We found similar differences concerning age illness stabilization and symptom reduction: Up to the age of 49 only 11 percent of paranoid schizophrenics had these types of change, whereas 63 percent had a less favorable course.

Since we dealt not only with clinic patients, but also with registered patient populations, we were able to follow a group of 190 patients with weakly progressive, creeping but definitely chronic schizophrenic processes to advanced age. We found that the rules which are valid for the majority of patients with chronic course, namely the gradual alleviation of productive symptoms, also are valid for these ages. These correlations between speed and degree of progress and changes of stablilizing and decreasing progression were even more extended in time.

The correction of temporarally and qualitatively limited progression of schizophrenic processes is as follows. The course of chronic (continuous) schizophrenia forms a cycle with stages of increasing stability and decreasing activity. It is different however in its dependence on the degree of progress and time period of illness. In unfavorable youth forms for instance, this cycle is maximally limited in time and has its transition to a residual stage after a few years. In creeping (bland) forms this cycle is maximally extended, whereas the paranoid forms occupy the middle ground.

In closing we shall mention a problem that we encountered during our comparative studies of various groups of continuous schizophrenic psychoses. Their interpretation poses certain difficulties. Among the 600 cases which could be considered part of this form of schizophrenia, we found 60 patients with hallucinatory psychoses. A detailed clinical characterization of these forms is neither necessary nor possible in the frame of this discussion. I should like to emphasize only, that we are convinced as is Huber, that these forms belong to the group of schizophrenia, independently of the fact, that one characterizes these forms as marginal or slow, relatively little progressive chronic schizophrenias. Although the systematic monothematic paranoid psychoses occupied the foreground through many years, even decades, one could find them in other types of schizophrenia. [passage missing]

We are then dealing with chronic hallucinatory psychoses with changes characteristic of chronic schizophrenia, with increasing stability and decreasing progression. Attempting to interpret these observations we might consider the possibility that these cases progress so slowly, that the particular periods are extended to the degree that the patients remain

in the active stage to the end of their lives. On the other hand one must consider that we are dealing with chronic hallucinatory psychoses, the position of which has always been unsettled within the schizophrenia group, and which apparently assume a special marginal position.

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PUBLICATIONS

BOOK ANALYZES ACTION OF NEUTRON RADIATION ON ANIMAL EPITHELIUM

Leningrad RANNYYE EFFEKTY DEYSTVIYA NEYTRONOV NA KLETKI EPITELIYA ZHIVOTNYKH (Early Effects of Neutrons on Animal Epithelial Cells) in Russian 1978 signed to press 31 Oct 78 pp 2, 3, 127-128

[Annotation, Table of Contents, and Foreword from book by B. I. Monastyrskaya, V. A. Simonenkova, and Ts. P. Medvedovskaya, Izdatel'stvo Nauka, 1,000 copies, 128 pages]

[Text] Annotation

This monograph presents the results of functional-morphological research on epithelium of the anterior lobe of the hypophysis, the mucous membrane of small intestine, and the lens of the eye at different times following general irradiation by fast neutrons in doses close to the minimum absolutely lethal dose. Histological, histochemical and ophthalmological methods, autoradiography, and electron microscopy were employed. Quantitative and qualitative descriptions were obtained of reactive changes occurring in cells of the anterior lobe of the hypophysis, and of changes in cell populations in the cryptae and villi of the small intestine, and the lens. It is demonstrated that early reactive changes occurring in epithelial elements manifest themselves as intensification of cell vital activities coupled with activation of synthesis and especially of secretion in a number of functional forms. The physiological processes behind cell migration persist. DNA synthesis and mitosis, which are suppressed in the first hours following irradiation, begin to recover toward the end of the day. Some of the cells undergo dystrophic alteration. Interphasal cell death was not detected. A comparison of early changes observed in response to the action of neutrons with experiments conducted by the authors in which animals were irradiated with equivalent doses of roentgen rays established that neutrons have a stronger direct action on nuclear and cytoplasmic processes occurring in irradiated cells. Bibliography--425 references, 23 figures, 5 tables.

Contents Page

Foreword 3

Chapter I. Changes in Glandular Cells of the Anterior Lobe of the Hypophysis in the First Days Following General Neutron Irradiation . . . 4

Early Reactions of the Body's Cells to Irradiation, and Their Morphological Revelation 4

Early Changes in the Hypophysis of Irradiated Animals 8

Diurnual Rhythm of the Vital Activities of Hypophyseal Cells . . . 9

Changes in Glandular Cells of the Hypophysis in the First Days Following Roentgen and Neutron Irradiation 12

Changes in Endothelium of Hypophyseal Sinusoids 28

Conclusions 30

Chapter II. Early Changes in the Epithelium of the Small Intestine Following General Neutron Irradiation 32

The Objectives of Research on Irradiated Intestinal Epithelium . . 32
The Radiosensitivity of Intestinal Epithelium 32
Early Reactions by Cells to Irradiation 33
The Biological Action of Neutrons 33

The Intestinal Syndrome 35
A Short Historic Review 35
The Mechanisms of the Intestinal Syndrome's Development 37

The Initial Reaction of Proliferative Intestinal Cells to Irradiation 38

Secondary Postradiational Changes in the Epithelium of the Cryptae 43

The Kinetics of the Epithelial Population of Intestinal Cryptae . 45

The Epithelia of Intestinal Villi in Response to Radiation 51
Morphological Changes in the Epithelium of Villi 51
Functional Changes in the Epithelium of Villi 56

Bacterial Invasion of Irradiated Intestinal Epithelium 60

The Mucopolysaccharide Complex of Erythrocytes Following Irradiation 62

Conclusions 66

Chapter III. Changes in Epithelial Elements of the Lens Following General Neutron Irradiation 67

Some Present Ideas Concerning an Experimental Cataract Produced by the Action of Neutrons and Other Forms of Radiation 67
Clinical and Histomorphological Manifestations of Radiation Injury to the Lens 68
Development of Postradiational Changes in the Lens 72

Biophysical Aspects of the Influence of Radiation According to the "Cataract Genesis" Test 75
Threshold Radiation Doses and the Latent Time of Development of Radiation-Caused Changes in the Lens 75

Relative Biological Effectiveness of Neutrons of Different Energy Levels According to the "Cataract Genesis" Test and the Dose Fractionation Effect 79

Clinical-Morphological Analysis of Radiation-Caused Effects in the Rabbit Lens Following General Neutron Irradiation 84

Experiments With Roentgen Rays 90

Quantitative Description of Radiation-Caused Effects in the Germinative Zone of the Lens 91

Relative Biological Effectiveness Factors in Relation to Cataract Genesis, Depending on Irradiation Dose 96

Conclusions 98

Conclusion 100

Bibliography 106

Foreword

The action ionizing radiation has on cells in a complex organism depends to a significant extent on the unique features of the object--the species of the animal, the histological type of tissue, and its individual modifications. Differences in radiosensitivity within the system of mammalian epithelial tissues are attracting serious attention in connection with their important significance to the local and general consequences of irradiation. If we are to understand the essence of changes caused by radiation, we would first have to study, on a particular object, the early direct and indirect phenomena, their reversibility, and their relationship to interphasal and genetic death of cells. Morphological research on these effects must include a description of the functional state of cellular elements, and of intercellular relationships. It is important to compare data on early postradiational changes occurring in epithelium typified by relatively low radiosensitivity--glandular cells in the anterior lobe of the hypophysis for example--with one of the most radiosensitive forms of epithelium, the mucosa of the small intestine. The results of research on successively developing changes in the endothelium of sinusoids in the anterior lobe of the hypophysis of animals irradiated by roentgen rays and neutrons are communicated incidentally. Changes developing in the lens in response to different doses have important significance among the postradiational processes produced in epithelial tissue by neutron irradiation.

The epithelia of the organs indicated above were studied in animals subjected to general external exposure to fast neutrons. These observations are compared with the results of research conducted by the authors and with the latest literature on the consequences of irradiation by roentgen and gamma-rays, which ionize the medium to a lesser degree. The obtained data are examined in light of today's information on the essence and mechanism of development of early changes in the cells of an irradiated organism, ideas about which have

been forming in recent years. Materials from research on different types of epithelium are used in this book in an attempt to clarify some general laws governing early changes typical of the epithelial tissue of irradiated animals.
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PUBLICATIONS

BOOK ANALYZES SOCIAL PSYCHOLOGY IN THE USA

Moscow SOVREMENNAYA SOTSIAL'NAYA PSIKHOLOGIYA SShA (Social Psychology Today in the USA) in Russian 1979 signed to press 1 Jun 79 pp 2-8, 229

[Annotation, Table of Contents, and Introduction from book by P. N. Shikhirev, Izdatel'stvo "Nauka", 6,500 copies, 229 pages]

[Text] Annotation

This monograph analyzes the state and developmental trends of social psychology in the USA. The author demonstrates with a large amount of facts that the dominant methodological principles (positivism and empiricism) are leading social psychology into a dead end in relation to the pressing problems of science.

The monograph is intended for a broad range of scientists interested in social psychology.

CONTENTS Page

Introduction 3

Chapter One. Theoretical Problems 9

1. General Characteristics of the State of Theory Today . . 9
2. The Object of Social Psychology 18
3. Evolution of Human Models 26
4. The Positivism Phenomenon 68
5. Analysis of a Concrete Object (The Social Set) 86

Chapter Two. Critical Analysis of the Principal Areas of Research 104

1. Social Perception and Common Sense 104
2. The Individual Within the Group: Group Influence, the Relationships of Authority and Subordination 133
3. Intergroup Relationships 161

Chapter Three. Theoretical Science and Social Problems 171

1. The Fate of the Laboratory Experiment 171
2. The Problem of Social Relevance 185

Conclusion 206

Bibliography 209

Introduction

Social psychology has enjoyed a special status among the ruling classes of capitalist countries in recent years. Thus government institutions and organizations in the USA spend about half a million dollars on psychosocial research each year, and more than 8 million students take courses in psychology dominated by the problems of social psychology. Journals regularly publishing articles and materials on behavioral and social psychology have more than 600,000 subscribers. Research in this area is being carried on by about 40,000 professional psychologists.

Nor is the place of social psychology any less prominent in other capitalist countries. As an example out of 35 national centers in France dealing with the social sciences, nine are involved in research in social psychology. Even in countries such as Japan and India, which have traditionally been thought of as the "outposts" of psychological science, in the opinion of experts social psychology has been climbing to one of the leading places in relation to pace of development in recent years (106).

The USA plays the dominant role among capitalist countries in relation to social psychology. There are fully objective reasons for this, explained by the acute demand this largest capitalist country has for knowledge in social psychology. Such reasons include aggravation of class, ethnic, and other social conflicts, growth in the role of the human factor in the scientific-technical revolution, and a number of others. There is tremendous significance to the social order of ruling classes, which are trying with all of their effort to hold onto their position, to arrive at and optimize, through psychological resources, effective operation of the production sphere and the entire sociopolitical system of the society, and to utilize all possibilities to maintain the status quo. The data of social psychology are acquiring great and ever-increasing significance to the conduct of effective domestic and foreign political propaganda. This circumstance is extremely important considering the acute ideological struggle occurring between the world's two sociopolitical systems.

Thus social psychology is faced by a fully definite instrumental task--that of revealing and assisting in the use, for the stated goals, of the psychological mechanisms behind the control of people. Both theoreticians and practical workers are laboring on this task in academic laboratories, at enterprises, in schools, in the army, in the propaganda system, and so on.

This book will discuss not all of social psychology but only its academic aspect--that is, research having the objective of developing social psychology as an area of scientific, theoretical knowledge. This monograph consciously neglects the tremendous amount of material acquired by applied social psychology. Analysis of its numerous areas is a separate and important task.

Academic social psychology in the USA is itself a heterogeneous entity. In the opinion of a number of authors we can break it down into psychological social psychology, psychological sociology, and symbolic interactionism (214,106). However, most researchers prefer to subdivide it into psychological and social, each of these areas being developed correspondingly by psychologists and sociologists.

Another opinion that is just as commonly accepted is that the "countenance" of social psychology in the USA is defined by psychological social psychology, which is responsible for 70 to 80 percent of all research done (106,291). It is to an examination of this area that we will limit ourselves in the present study.

Academic science was selected as the object of analysis for the following considerations. Development of general theory is a pressing task of Soviet social psychology. In this aspect we can use the mistakes made by the Americans in their research attempts as lessons for ourselves.

There is yet another circumstance of no small importance. The tremendous amount of experience acquired, the abundance of procedures and techniques, the use of the latest achievements of data recording and processing technology, and the high level of scientific research have all made American social psychology the standard for the world for a long period of time. Thus it is not surprising that our social psychology has been guilty of "uncritical acceptance of methods, approaches, and even individual theoretical premises offered by social psychology in the USA" ((92), p 13). Hence follows the need for critically analyzing (from the standpoints of theory and methods) modern American social psychology.

If we consider furthermore that as with all social sciences, social psychology interacts with ideology, perhaps the most important task today is to reveal and criticize the ideological premises resting beneath the supposedly ideologically neutral position of the academic scientist.

This task has been posed to Soviet science and to Soviet social sciences in decisions of our party congresses and in CPSU decrees on the social sciences. "There can be no room for neutrality and compromises in the struggle between the two philosophies," state documents of the 25th CPSU Congress ((12), p 74).

Obviously the task of critically analyzing American social psychology could be completed only by a collective of researchers, considering that the volume of information accumulated in the USA over a period of many decades is so great.

Here are a few facts. The fundamental five-volume "Handbook of Social Psychology" was published in 1968. This is essentially an encyclopedia of this science, having a total volume of 7,500 pages (217). The 10-volume "Experimental Social Psychology" was published in 1977 (102). One book and 10-15 articles are published on this subject on a daily average.

Thus we will examine only some of what we believe to be the key problems in the development of social psychology in the USA today.* Their choice is dictated in part by the situation that evolved in American social psychology in the 1970's, when an acute need for reinterpreting past experience arose and the debate on subsequent development began. Under these conditions the main emphasis was distinctly laid on development of the theory and practice of research, and on the role of social psychology and the social psychologist in society. Most of these problems are examined in this book.

The position taken by the authors in this regard is as follows. In American social psychology, philosophical notions concerning the essence of man, the nature of interaction between man and society, and so on were rejected as "fruitless" speculation from the very beginning. The science was rested on the principles of positivism and neopositivism, elevated to the rank of a general methodological foundation. Here lies the first fundamental cause of today's stagnation in American social psychology.

The second cause lies in the fact that despite the declared intent to acquire positive knowledge independent of the influence of ideology, social psychology, which is a social science, naturally could not avoid the influence of ideology** or the values dominating the society; nor could it avoid the direct influence imposed by its immediate clients, be they private capital or the government.

As long as these two causes remain in effect, American social psychology will never be able to solve any problems facing it today. Demonstration of this thesis is the basis for the content of this book. It is presented according to the following plan: Analysis of the general status of modern American social psychology and the debates, both in the USA and abroad, on its subsequent fate attest to the need for creating a general, integrative theory of social psychology. But it is fundamentally impossible to build such a theory on the basis of the methodological principles of positivism. As a way to support this thesis the book examines different particular conceptions grouped about the principal conceptual models of man which are used today in American social

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* To the extent possible, we will omit data (primarily concerning methods) already known to the Soviet reader from previously published works (31,52, 54, 66).

** We emphasize that we are talking not about the influence of ideology in general but about the concrete ideology of capitalist society, oriented toward protecting an obsolete social structure.

psychology as a substitute for a unified philosophical conception. We believe that this approach would permit us to gain a clearer idea of the present situation in psychosocial theory. It is in this regard that the monograph examines ideas about the object of social psychology and the concept of what is social. It analyzes the results of the influence of positivism and neopositivism on social psychology and, finally, it uses works on social set as an example with which to follow the "production" chain of concrete research in social psychology, leading from a model of man to a method to an interpretation. The prospects for possible integration of the obtained facts and the existing theories are discussed.

The second chapter analyzes work done in two large areas of research--common sense and group processes. The former deals wtih the psychological laws of man's perception by man, formation of the social stereotype, and attributive processes. The second area deals with the relationship between authority and subordination, as well as with intergroup relationships. A thesis concerning the ideological nature of academic research is grounded in these sections.

An isolated abstract individual in an isolated group, yielding blindly to the pressure of the majority--this is picture created by this research. At the same time it is clearly evident from this research that American social psychologists, speaking in the words of V. I. Lenin, are fleeing "disgracefully from...the problems of life, together with its struggle of those that have against those that have not, into the area of innocent utopias ((9), p 192). This flight is precisely what hinders adequate solution of the problems of social relevance. "Depersonalized psychology of homogeneous individuals" (M. Deutsch) can tell us little about the complexity of real life. Arisal of such a psychology was predetermined to a significant extent by the search for "immutable laws" of behavior in laboratory experiments, the principal method of research in American social psychology. One of the sections of this book analyzes the unique features of this method.

Finally, the conclusion discusses the reinterpretation made by many American social psychologists of their real place in society. This section demonstrates that a socialist psychologist in the capitalist structure can play no role other than that of a social engineer at the service of the bourgeoisie, which is striving for a relevance of social sciences advantageous to it.

Throughout the entire book the author strives to reveal the prospects for development of social psychology in the USA, and to make Soviet scientific society aware of various concepts containing kernels of truth or facts deserving of attention.

It stands to reason that the fact that the problems and the levels of their examination are diverse could not but have an effect on the structure of the book and the style of its presentation.

This diversity is apparently an unavoidable price of analyzing modern American social psychology, which is such a complex field.

The author extends his deep gratefulness to all who have helped him with the manuscript, and mainly the workers of the social psychology sector of the USSR Academy of Sciences Institute of Psychology, where this book was written.
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PUBLICATIONS

PSYCHOLOGICAL PROBLEMS RELATED TO SPACE FLIGHTS

Moscow PSIKHOLOGICHESKIYE PROBLEMY KOSMICHESKIKH POLETOV (Psychological Problems of Space Flights) in Russian 1979 signed to press 12 Dec 79, pp 2, 3-4, 237-239

[Annotation, foreword and table of contents from book edited by L. G. Rodionova, Izdatel'stvo Nauka, 3100 copies, 240 pages]

[Text] Annotation

This collection of articles sheds light on a range of problems of general and engineering psychology, which arise in the course of space flights. The results of research and observations made by cosmonauts during flights are submitted. Much attention is devoted to problems of psychological preparation and conditioning of cosmonauts.

Foreword (by B. N. Petrov, B. F. Lomov and N. D. Samsonov)

This book deals with problems referable to one of the youngest branches of psychology, space psychology, which is only now beginning to develop actively as an independent area of research, as well as its object, a new form of human endeavor, the work of cosmonauts.

The inception of space psychology is attributable to the fact that manned space flights made it necessary to investigate the influence of such specific space flight factors as weightlessness, accelerations, sensory isolation, hypokinesia, etc., on mental functions, processes and states of cosmonauts, their performance and behavior as a whole.

Investigation of psychological problems that arise in connection with manned space flights is a mandatory prerequisite for improving the effectiveness and reliability of such flights.

At the present time, space psychology is at a stage of scientific search; its range of problems is being defined and investigate methods are being developed.

This book was compiled on the basis of papers delivered at the first seminar on psychological problems of space flights, which was organized by the Institute of Psychology, USSR Academy of Sciences. What is of particular value is that cosmonauts participated actively in the writing of this book.

The direct experience acquired by cosmonauts during their flights is one of the most important sources of information about the psychological distinctions of their activities, which makes it possible to single out the most pressing problems and outline the routes for working on them. Since it is unique, this experience constitutes substantial supplementation to the data obtained from scientific research.

Unquestionably, the success of a space flight and space experiments is largely determined by the effectiveness of cosmonaut work aboard a spacecraft or orbital station. To assure efficient work by a cosmonaut under such unusual conditions, it is imperative to investigate all of the distinctions of interaction between man and such a complex apparatus as a spacecraft under these extreme conditions.

It is possible to resolve psychological problems of space flights only with the broad use of the advances in the entire system of psychological sciences, particularly experimental, engineering, social and pedagogic psychology, psychophysics, psychophysiology, etc.

At the same time, research in the field of space psychology could enrich substantially psychological science as a whole. A space flight is a natural experiment, which makes it possible to study many mental phenomena in a specific, critical situation. The range of psychological problems turns out to be rather broad. It covers various "levels" of the psyche, from relatively elementary phenomena (for example, changes in sensitivity of the analyzers and, accordingly, in sensations) to the most complex ones (for example, sociopsychological elements of the personality, group performance). Space flight conditions enable us to obtain the most valuable data, for example, about the role of different analyzers and their interaction in man's spatial orientation, as well as to investigate the role of motivation in man's activities, a feeling of duty, will, wisdom, self-control and restraint as factors in man's activities.

There is no laboratory experiment that could reproduce the complex conditions that arise during space flights.

The activities of cosmonauts are diverse during flights: control of the spacecraft and its systems, fulfilling the flight mission and many others. These activities are particularly complex from the psychological point of view. We would state that the role of psychological factors is not manifested as distinctly as in cosmonaut activities anywhere else. For expressly this reaosn, psychological studies of cosmonaut performance are of exceptional value to psychology as a whole.

No doubts, the findings of studies of distinctions of mental phenomena during space flights will be quite useful to development not only of special, but general theoretical problems of psychology, such as the problem of correlation between biological and social elements, the problem of activity and the problem of social intercourse.

There are four sections in the book. The first one offers a general description of psychological problems of space flights. The second deals with psychological analysis of cosmonaut activity. The third pertains to questions of cosmonaut training. The fourth section deals with problems of engineering psychology, which are very important to development of spacecraft.

Of course, the problems discussed in this book are still far from being entirely solved, and the proposed approaches to their solution are debatable.

Continued development of space psychology requires broad deployment of research.

Contents Page

Foreword 3

1. General Description of Problems of Space Psychology
Lomov, B. F. "Psychological Problems of Space Flights" 5
Beregovoy, G. T. "The Role of the Human Factor in Space Flights" 17
Leonov, A. A. "Prospects of Space Exploration and Psychology" 25
Sevast'yanov, V. I. "Manifestation of Some Psychophysiological Distinctions of Man During Space Flights" 29
Popovich, P. R., and Artyukhin, Yu. P. "Some Distinctions of Crew Performance During Space Flights" 38

2. Psychological Analysis of Cosmonaut Performance
Kolesnikov, G. M. "Modeling Man's Performance During Space Flights" 42
Volynov, B. V.; Sukhanov, E. D.; Smirichevskiy, L. D.; and Yakovlev, A. I. "Investigation of Effects of Space Flight Conditions on Statistical Characteristics of Operator Performance" 47
Smirichevskiy, L. D. "Investigation of Operator Performance of Standard Functions Under Simulated Long-Term Space Flight Conditions" 53
Krylova, N. V., and Krylov, V. Yu. "Possible Means of Improving Effectiveness of Cosmonaut Performance" 61
Shibanov, G. P. "Evaluation of Effectiveness of Crew Performance Under Stress" 69
Pavlov, V. L. "Some Aspects of Interaction Between Spacecraft Crew Members in Emergency Situations" 84
Zamaletdinov, I. S.; Krylova, N. V.; Kiselev, S. A.; and Trufanova, Ye. V. "Possibility of Identifying Levels of Emotional Stress According to Verbal Indices in Aviation and Space Activities" 91

Litsov, A. N., and Sarayev, I. F. "Problems of Assuring Stable Work Fitness During Long-Term Space Flights" 101
Pozdnyakov, V. V. "Investigation of Operator Work Fitness in the Case of Continuous Activity" 106
Zamaletdinov, I. S., and Zhdanov, O. I. "Determination of Individual and Group Performance and Behavior by Distinctions of Individual Cognitive Styles" 110
Zhdanov, O. I. "Possible Approaches to Investigation of the Style of Cognitive Behavior of Cosmonauts in the Case of Individual and Group Variants of Activity" 115
Zotov, V. S. "A Method of Expert Evaluation of Space Research Programs" 119
Popov, V. A., and Popov, A. K. "Retention of Spacecraft Control Skill in the Course of Long-Term Flights" 123

3. Psychological Problems of Cosmonaut Training
Novikov, M. A. "Psychophysiological Screening, Manning Crews and Preparation for Space Flights" 130
Kitayev-Smyk, L. A. "The Question of Adaptation to Weightlessness" 135
Stupnitskiy, V. P. "Methodological and Organizational Principles of Psychological Training of Cosmonauts" 152
Bogdashevskiy, R. B.; Vorob'yev, G. I.; Usov, V. M.; and Yaropolov, V. I. "Objectivization of Main Elements in the Process of Preparing Crew for Space Flights" 160
Solov'yeva, I. B. "Psychological Training of Cosmonaut Operators Under Emotional Stress" 164
Zaval'nyuk, V. P.; Anakhov, N. P.; and Singatulin, Ye. G. "Physiological Aspects of Psychophysiological Cosmonaut Training on a Simulator" 169
Usov, V. M.; Bogdashevskiy, R. B.; and Belozerov, A. V. "Psychological Training of Cosmonauts on Professional Simulators" 172
Dyatlov, Ye. G., and Dmitrov, V. A. "The Role and Significance of Crew Instructor in Cosmonaut Training" 178
Varenov, B. P.; Shibanov, G. P.; Ryabinin, L. V.; Lobanov, Ye. F.; and Rodchenko, V. V. "The Variance Method of Objective Evaluation of the Training Process and Degree of Operator Training in Modes of Aircraft Control" 181

4. Problems of Engineering Psychology in Space Psychology
Stepanov, V. N., and Stepanov, E. N. "Engineering Psychology of Technical Maintenance in Space" 188
Glazkov, Yu. N. "Design of Devices for Cosmonaut Movement in Space Without Supports and Requirements of Engineering Psychology" 194
Kazachkov, V. M.; Metlik, V. I.; Khludeyev, Ye. N.; and Khrunov, Ye. V. "Engineering Psychological Aspects of Optimizing Visual Fitness of Man During Space Flights" 203

Trunin-Donskoy, V. N. "Possibilities and Psychological Aspects of Verbal Communication Between Man and an Automatic System" 210
Nikonov, A. V. "Reflection of Dynamics of Psychophysiological State of an Operator in Radio Communications" 214
Minayev, S. A., and Meshcheryakov, I. P. "Construction of a Model Simulating Operator Activity During Manual Control of Spacecraft at the Approach Stage" 219
Volkov, A. M. "Use of General Psychological Principles to Solve Problems of Operating 'Man-Machine' Systems" 231

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CSO: 1840

PUBLICATIONS

BOOK ANALYZES EFFECTS OF HYPERBARIC ENVIRONMENT ON HUMAN BODY

Leningrad OSNOVY GIPERBARICHESKOY FIZIOLOGII (Fundamentals of Hyperbaric Physiology) in Russian 1979 signed to press 18 Apr 79 pp 2-6, 316-319

[Annotation, Table of Contents, Foreword, Introduction, and List of Abbreviations from book by G. L. Zal'tsman, G. A. Kuchuk, and A. G. Gurgenidze, Izdatel'stvo "Meditsina", 5,000 copies, 320 pages]

[Text] Annotation

This monograph generalizes the world's basic achievements in the physiology of man and animals subjected to high-pressure gas and water environments, and the results of many years of research in this area by Prof G. L. Zal'tsman and his students, Cand Med Sci A. G. Gurgenidze and Cand Biol Sci G. A. Kuchuk. An attempt is made for the first time to describe and systematize all known factors of a hyperbaric environment which may become extreme factors to man, and the responses of the body, both adaptive and pathological. A detailed examination is made of the state of the human and animal body experiencing short-term and lengthy exposure to an oxygen environment and to environments containing oxygen mixed with indifferent diluent gases of the nitrogen group and of the helium group, in corresponding ranges of low, moderate, high, and superhigh pressures. The resulting changes and disturbances are examined at the general organismic, organic, and cellular levels, and their mechanisms are discussed. Problems concerning practical use of various pressurized respiratory gas mixtures and the prospects for further assimilation of a hyperbaric habitat by man are presented.

The monograph is intended for a broad range of biologists, physiologists, and physicians, as well as specialists dealing with pressurized mediums for therapeutic purposes and in diving operations.

The book contains 61 figures, 14 tables, and 3 diagrams. There are 344 bibliographic references.

CONTENTS

Page

Foreword 3

Introduction 4

List of Abbreviations 6

PART I. PHYSIOLOGICAL DESCRIPTION OF A HYPERBARIC HABITAT . 7

Chapter 1. Extreme Factors of a Hyperbaric Habitat Associated with Gas Physical Properties 15

1.1 The State of the Body's Mechanical Structures in a Hyperbaric Gas Medium 20
Action of a Hyperbaric Gas Medium on Physical Bodies 20
General Uniform Three-Dimensional Compression of the Body 21
Three-Dimensional Compression of the Body's Gas-Filled Cavities 26

1.2 The Body's Sensory Functions in a Hyperbaric Gas Medium . . . 29
Propagation of Acoustic Waves in a Hyperbaric Gas Medium 29
Worsening of Acoustic Perception in a Hyperbaric Gas Medium . . 30

1.3 The Body's Motor Functions in a Hyperbaric Gas Medium (Breathing Biomechanics) 32
Gas Currents in a Hyperbaric Medium 32
Growth in Resistance to Gas Currents in the Respiratory Tract . 34
Change in Articulation in a Hyperbaric Gas Medium 41

1.4 Gas Exchange of the Body in a Hyperbaric Medium 42
Mass Transfer Phenomena Associated with Movement of Molecules of a Gas Medium Through the Body Surface 42
Excessive Penetration of Indifferent Gases into the Body's Internal Environment 46
Excessive Penetration of Oxygen into the Body's Internal Environment 58

1.5 The Body's Heat Exchange in a Hyperbaric Gas Medium 63
Phenomena Associated with Transfer of the Thermal Energy of a Gas Medium on the Surfaces of Bodies 63
Heightened Heat Removal From the Body by a Gas Medium 64

1.6 Integrated Interactions Between the Body and a Hyperbaric Gas Medium 69
Phenomena Associated with Oversaturation of Bodies by an Indifferent Gas 69
Decompression-Caused Gas Formation in the Body, and Gas Embolism 74

Chapter 2. Extreme Factors of Hyperbaric Habitat Associated with the Properties of a Sealed Gas Environment Created with Hyperbaric Equipment 80

2.1 The State of the Body's Mechanical Structures in a Sealed Gas Environment 88

The Conditions Under Which Local Nonuniform Pressure Arises in a Sealed Gas Environment 88
Local Nonuniform Compression of the Body by Rigid Surfaces Delimiting a Sealed Gas Environment 89

2.2 The Body's Sensory Functions in a Sealed Gas Environment . . . 90
Restriction of Communication Between a Sealed Gas Environment Created with Hyperbaric Equipment, and the Outside World . . 90
External Limitations on the Sensory Field of the Body in a Sealed Gas Environment 91

2.3 The Body's Motor Functions in a Sealed Gas Environment 93
Limitation of the Dimensions of a Sealed Gas Environment Created with Hyperbaric Equipment 93
External Limitation of the Body's Motor Field in a Sealed Gas Environment 93

2.4 The Body's Gas Exchange with the Medium in a Sealed Gas Environment 95
The Gas Medium of Sealed Environments and the Body's Vital Activities. 95
Reduction of the Oxygen Concentration in a Sealed Gas Environment 100
Increase of the Concentration of Carbon Dioxide in a Sealed Gas Environment 104
Increase of Humidity in a Sealed Gas Environment 108
Increase of the Content of Toxic Microimpurities in a Sealed Gas Environment 110

2.5 The Body's Heat Exchange in a Sealed Gas Environment 111
Thermal Processes in a Sealed Gas Environment Created with Hyperbaric Equipment 111
Heightened Heat Removal From the Body in a Sealed Gas Environment 113
Reduced Heat Removal From the Body in a Sealed Gas Environment 113

2.6 Interaction of the Body with the Biological Components of the Medium in a Sealed Gas Environment 114
Accumulation and Activation of Microflora in a Sealed Gas Environment Created with Hyperbaric Equipment 114
Infection of the Body 114

Chapter 3. Extreme Factors of a Hyperbaric Habitat Associated with the Physical Properties of Water 118

3.1 The State of the Body's Mechanical Structures in an Aquatic Medium 122
Water Pressure upon Submerged Bodies 122
General Vertically Nonuniform Compression of the Body in an Aquatic Medium 124

3.2 The Body's Sensory Functions in an Aquatic Medium 125
Unique Features of the Propagation of Light and Sound in an Aquatic Medium 125
Change in Visual Perception in an Aquatic Medium 126

Change in Auditory Perception in an Aquatic Medium 128

3.3 The Body's Motor Functions in an Aquatic Medium 129
Hydrostatic and Hydrodynamic Forces 129
Hypogravitation of the Body in an Aquatic Medium 130
Resistance Experienced by a Moving Body in Water 132
Dynamic Effect of Water Masses Upon the Body 133

3.4 The Body's Gas Exchange in an Aquatic Medium 133
Utilization of Oxygen Dissolved in Water for Respiration 133
Disturbance of Gas Exchange in Response to Entry of Water into the Human Respiratory Tract 135

3.5 The Body's Heat Exchange in an Aquatic Medium 135
Transfer of the Aquatic Medium's Thermal Energy to Submerged Bodies 135
Heightened Heat Removal From the Body in an Aquatic Medium 135

3.6 Interaction of the Human Body with the Biological Components of an Aquatic Medium 137
Dangerous Marine Animals 137
The Consequences of Encountering Dangerous Marine Animals 137

PART II. THE STATE OF THE BODY IN THE CONDITIONS OF A HYPERBARIC ENVIRONMENT 139

Chapter 4. The State of the Body in a Hyperbaric Oxygen Environment (Low-Pressure Range) 140

4.1 The State of the Body in an Oxygen Environment at Pressures Above 2 kg/cm^2 ("P.(Ber's) Effect") 140
Action of High Oxygen Partial Pressures on the Human Body 140
Action of High Oxygen Partial Pressures on the Animal Body 150

4.2 The State of the Body in an Oxygen Environment at Pressures Below 1 kg/cm^2 ("L. Smith's Effect") 165
Action of High Oxygen Partial Pressures on the Human Body 165
Action of High Oxygen Partial Pressures on the Animal Body 168

4.3 Use of Oxygen to Create a Hyperbaric Medium 170
Use of a Hyperbaric Oxygen Medium for Diving Operations 170
Use of a Hyperbaric Oxygen Medium to Treat Diseases 174

Chapter 5. The State of the Body in a Hyperbaric Environment Consisting of Indifferent Gases of the Nitrogen Group (Medium Pressure Range) 179

5.1 The State of the Body in a Hyperbaric Nitrogen-Oxygen Environment 179
Action of High Nitrogen Partial Pressures on the Human Body . . . 179
Action of High Nitrogen Partial Pressures on the Animal Body . . . 190

5.2 The State of the Body in a Hyperbaric Argon-Oxygen Environment . 197
Action of High Argon Partial Pressures on the Human Body 197
Action of High Argon Partial Pressures on the Animal Body 204

5.3 The State of the Body in a Normobaric Krypton-Oxygen Environment 211

5.4 The State of the Body in a Normobaric and a Hyperbaric Xenon-Oxygen Environment 212

5.5 The Mechanism of Action of Indifferent Gases in the Nitrogen Group 214

5.6 Use of Indifferent Gases in the Nitrogen Group to Create Hyperbaric Environments 218

Chapter 6. The State of the Body in a Hyperbaric Environment Consisting of Indifferent Gases in the Helium Group (High and Superhigh Pressure Range) 219

6.1 The State of the Body in a Hyperbaric Helium-Oxygen Environment 220
Action of High (Up to 20 kg/cm^2) Helium Pressures on the Human Body 220
Action of Superhigh (Above 20-30 kg/cm^2) Helium Pressures on the Human Body 227
Action of High and Superhigh Helium Pressures on the Animal Body 237

6.2 The State of the Body in a Hyperbaric Neon-Oxygen Environment 247
Action of High Neon Pressures on the Human Body 247
Action of High Neon Pressures on the Animal Body 248

6.3 The State of the Body in a Hyperbaric Hydrogen-Oxygen Environment 249
Action of High Hydrogen Pressures on the Human Body 249
Action of High Hydrogen Pressures on the Animal Body 251

6.4 The State of the Body in a Hyperbaric Aquatic Medium When Breathing Dissolved Oxygen 252

6.5 The Mechanism of Action of Indifferent Gases in the Helium Group 259
Comparative Analysis of the Action of Hyperbaric Gas and Water Mediums on the Body 259
Analysis of the Action of a Hyperbaric Helium-Oxygen Environment on the Body with the Help of Pharmacological Models 260
The Central Mechanisms of the Physiological Action of Indifferent Gases in the Helium Group 263
Possible Neuron Mechanisms Associated with the Action of Indifferent Gases in the Helium Group 265

6.6 Use of Indifferent Gases in the Helium Group to Create Hyperbaric Environments 268

6.7 General Results 270

Chapter 7. The State of the Body in Prolonged Hyperbaric Conditions . . 272

7.1 The State of the Human Body Subjected to Prolonged Hyperbaric Conditions in the Low and Moderate Pressure Range 274

7.2 The State of the Human Body in Prolonged Hyperbaric Conditions in the High and Superhigh Pressure Range 277

7.3 The State of the Animal Body in Prolonged Hyperbaric Conditions 284

7.4 General Results 293
Conclusion 297
Bibliography 301

Foreword, by Academician Ye. M. Kreps

This monograph generalizes the basic achievements of world human and animal physiology in relation to hyperbaric conditions, and the results of many years of research conducted in this area by Prof G. L. Zal'tsman and his students, Cand Med Sci A. G. Gurgenidze and Cand Biol Sci G. A. Kuchuk.

G. L. Zal'tsman's first monograph, "Fiziologicheskiye osnovy prebyvaniya cheloveka v usloviyakh povyshennykh davleniy gazovoy sredy" (Physiological Principles of Man's Presence in a High-Pressure Gas Environment) was published by our editorial board back in 1961. It was followed by physiological research on test subjects, and by extensive experiments on animals. The research results were generalized in the books "Giperbaricheskiye epilepsiya i narkoz" (Hyperbaric Epilepsy and Anesthesia) (1968) and "Organism v usloviyakh dlitel'noy giperbarii" (The Body in Prolonged Hyperbaric Conditions) (1977), which enjoyed a favorable evaluation from domestic and foreign specialists.

The present work deals with the experimental research of the authors associated with the action of hyperbaric oxygen, aerial, helium-oxygen, and argon-oxygen environments upon the human and animal body in short-term and lengthy exposures. The monograph makes an attempt, successful from my point of view, at describing and systematizing all known factors of the hyperbaric environment which may become extreme, and the responses of the body, both adaptive and pathological. It is with this purpose that different physical factors of the hyperbaric environment are examined in relation to their influence upon the structures and functions of the body responsible for metabolism, energy exchange, and information exchange with the outside environment, in concrete conditions created by technical devices and in different pressure ranges. Thus the interaction between the body and a hyperbaric environment is presented in all of its diversity and in all of its complexity, which is especially important to an understanding of the state of the body in extreme conditions, and to the planning of further research.

The book is a summary of the latest scientific results in hyperbaric physiology, and it is concurrently a systematic presentation of its fundamental principles.

Introduction

The natural gas environment in which man and terrestrial animals live is a normobaric aerial environment. A hyperbaric gas environment arising in response to high pressure is something new, unusual, and extreme to our

bodies. Man's professional activities necessitate his presence in hyperbaric environments--diving operations, caisson operations, and so on. In this case human beings may find themselves in high-pressure chambers and within submarine habitats and vehicles. Moreover high-pressure gas environments are also used for therapeutic purposes.

The use of hyperbaric environments for practical purposes, which have a history of a little less than 2 centuries, has been progressing especially swiftly in the last few years. This pertains primarily to diving. The human foot has already touched the ground at a depth of 500 meters, and the human body has been subjected to pressures above 60 kg/cm^2 in recompression chambers used for dive simulation. The method of so-called saturated dives, which is associated with man's habitation of submarine or deck pressurized complexes containing a hyperbaric gas environment, has been undergoing intense development with the purpose of raising the effectiveness of diving operations. The environmental pressure is made equal to that outside, and therefore decompression is not required following work beneath the water. As a result man's labor under water comes to resemble labor in terrestrial conditions.

Use of the hyperbaric environment for therapeutic purposes has enjoyed significant development in recent decades. Hyperbaric oxygenation of the body, which makes it possible to increase the concentration of oxygen in blood and tissues by several orders of magnitude, has turned out to be a unique and effective method for treating patients suffering various forms of hypoxic disorders and ischemia, anaerobic infections, and neoplasms, and it has found use in other areas, such as heart surgery.

From a physiologist's standpoint a hyperbaric environment is a complex, extreme environment affected by many factors eliciting development of diverse adaptive and pathological responses. Hyperbaric physiology is the name given to that special subdivision of physiology which studied the influence of a hyperbaric environment on the human and animal body.

This book is an attempt at outlining the range of problems that should make up the content of hyperbaric physiology viewed as an internally cohesive area of knowledge, and at presenting its fundamentals.

Other subdivisions of physiology and medicine are tied in closely with hyperbaric physiology--underwater physiology and medicine, diving physiology and medicine, and hyperbaric medicine. Underwater physiology and medicine is a broader area. It includes the problems of the habitability of submarine craft, but it does not examine the physiological aspects of using hyperbaric environments for therapeutic purposes (hyperbaric medicine); nor does diving physiology and medicine deal with these problems. In distinction from hyperbaric, diving, and underwater medicine, hyperbaric physiology should obviously refrain from examining problems such as the diagnosis and clinical pattern of specific diseases, and their treatment and prevention. However, all of the disciplines mentioned here still have an extremely significant "zone" of overlap with hyperbaric physiology, inasmuch as when man places

himself in an aquatic environment in soft gear and in some diving apparatus, a hyperbaric gas environment is a component acting directly upon the body.

Hyperbaric physiology is also closely associated with biophysics, and it may be interpreted as one of its subdivisions, inasmuch as the principal object of research--extreme influences upon the body--is governed by the physical properties of the gas and water environment. Hyperbaric physiology may also be interpreted as one of the subdivisions of "environmental physiology," having in mind its influence upon the body. And, finally, formation of adaptive (compensatory) and pathological reactions in the body is nothing more than transition from the normal to the pathological, and therefore hyperbaric physiology may be associated with the physiology of transitory or premorbid states.

Determining the range of problems and the content of the basic concepts and terms inherent to a particular young area of knowledge is always a difficult thing, always debatable, requiring time to establish many of the premises. This pertains fully to hyperbaric physiology--a subdivision of physiological science that has been developing swiftly in recent years.

The authors feel it their pleasant duty to express their deep gratefulness to Academician Ye. M. Kreps, Academician V. N. Chernigovskiy, Corresponding Member S. N. Yefun, Prof V. Z. Akesl'-Rubinshteyn, Associate Professor Yu. S. Vayl', senior scientists V. A. Ivanov, V. R. Rabkin, and G. M. Sokolov, and Prof O. M. Todes for their valuable remarks concerning this work.

List of Abbreviations

H_2, O_2, N_2, He, Ne, Ar, Kr, Xe-- Chemical elements.

CO, CO_2, NH_3, H_2S--Chemical compounds

pO_2, pCO_2, pN_2--Partial pressures of oxygen, carbon dioxide, and nitrogen.

PAO_2, $PACO_2$--Tension of gases in alveolar air.

PaO_2, $PaCO_2$--Tension of gases in arterial blood.

PvO_2, $PvCO_2$--Tension of gases in venous blood.

АКС, АрКС, ГКС--Respiratory mixtures--nitrogen-oxygen, argon-oxygen, helium-oxygen.

ГБО--Hyperbaric oxygenation.

НСВД--High-pressure nervous syndrome.

ЭКГ, ЭЭГ, ЭМГ--Electrocardiogram, electroencephalogram, electromyogram.

ЦНС--Central nervous system.

ВП, ВПСП, ТПСП--Evoked potential, postsynaptic arousal potential, postsynaptic inhibitory potential.

ГАМК--Gamma-aminobutyric acid.

17-КС--17-Ketosteroids.

17-ОКС--17-Oxycorticosteroids.
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RADIOBIOLOGY

CHEMICAL PROPHYLAXIS OF RADIATION INJURY

Moscow KHIMICHESKAYA PROFILAKTIKA RADIATSIONNYKH PORAZHENIY (Chemical Prophylaxis of Radiation Injury) in Russian 1979 signed to press 24 Jan 79 pp 2, 3-4, 190

[Annotation, introduction and table of contents from book by Aleksandr Sergeyevich Mozzhukhin and Foma Yur'yevich Rachinskiy, Atomizdat, 190 pp]

[Text] Annotation. This book (the first edition of which was published in 1964) deals with drug therapy for acute radiation disease, caused by external gamma-ray and neutron radiation in lethal doses. The book considers the problems involved with the search, testing and mechanism of action of radioprotectors. Although special consideration is given to the sulfur-containing compounds, all classes of adequately effective radioprotective chemical compounds are discussed. The book is intended for radiobiologists, pharmacologists, and specialists in medical radiology, radiation hygiene and medical protection.

Introduction

At the present time, chemical prophylaxis of radiation injury (chemical protection) is an accepted field of radiobiology and radiation medicine, and is not considered on unique grounds as it was ten-fifteen years ago (141).

The terms "chemical prophylaxis," and "chemical protection" should not be taken literally. So far, no pharmacological agents have been identified which, if introduced before irradiation, are able to completely prevent the appearance of the characteristic changes identified with radiation sickness. The terms "chemical prophylaxis" and "chemical protection" more accurately denote an increase in resistance or a lowering of sensitivity of the body of animals and man to injurious action of ionizing radiation. Which of the two descriptions better describes the exact process, remains to be elucidated in future research. At this time, both terms are arbitrarily judged to mean the same thing.

Historically, the first research to show the possible existence of chemical prophylaxis in radiation injury to mammals was done by Patt (385) and Cronkite (295, 298) in 1949-51, who showed that cysteine and glutathione, introduced into mice and rats prior to a lethal dose of radiation, prevented death in

a significant fraction of the animals. However, the effect was temporary and thus evoked skepticism with respect to the actual possibility of protection. The final decision on the question of chemical prophylaxis is due to the research of Bacq (279), who in 1951 showed that cysteamine and cystamine, introduced into mice before irradiation, conferred 100% survival as against 100% fatality in controls.

Radioprotective compounds were found in a variety of classes of chemical substances, although the most promising were the aminothiols and their analogues (18, 141). At the same time, the relatively high toxicity and low therapeutic latitude of aminothiols and most of their analogues shed doubts on the possibility of their use in humans as protectors from the action of ionizing radiation (230). In recent years, thousands of new compounds have been synthesized and tested on mice, among which there have been found effective radioprotectors possessing a high therapeutic latitude compared to cystamine and cysteamine. This has renewed interest in the problem (181, 204, 263).

The best studied radioprotectors are finding their way into use in radiotherapeutic and oncological practice.

Since the publication of the first edition, there has been much research done on new radioprotectors, their mechanisms of action and of their pharmacological and protective action (18, 70, 173, 183, 184, 256). This allows the authors of this book to omit material on the systematic presentation of the problem of prophylaxis in radiation sickness. As in the previous edition, the aminothiols and their analogues are discussed because of their advantageous radioprotective action, their transformation in man and animals and their influence on the functional well-being of the body--the authors are most experienced in the synthesis and study of these compounds. In addition, the authors have considered it necessary to compare the effects of the radioprotective character of aminothiols with other radioprotective compounds and, also, to present new data on the effectiveness of radioprotectors under various conditions, not only with X and gamma ray, but with neutron and proton radiation and the use of combinations of radioprotectors. At the same time, the authors have condensed or deleted chapters and sections, the content of which was outside the scope of the search, testing and evaluation of radioprotectors.

Table of Contents

	Page
Introduction	3
I. Chemical Characteristics of Radioprotectors	6
1. Characteristics of radioprotective compounds	6
2. Mechanisms in the chemical protection of living organisms	24
3. Selection of radioprotectors in model experiments	40

II. Chemical Protection of Mice From the Action of Roentgen and Gamma Rays Using the Minimal Absolute Lethal Dose 48

1. Protection of mice using radioprotectors belonging to various classes of chemical compounds 49
2. Protection of mice using different combinations of radioprotectors 75

III. Chemical Protection of Various Classes of Mammals 78

1. The protective action of radioprotectors depending on the method of introduction 78
2. Action of radioprotectors in sublethal, intermittent and prolonged whole body, as well as local, gamma irradiation 87
3. The protective action of radioprotectors under neutron and proton irradiation 93

IV. The Behavior of Sulfur-Containing Radioprotectors in Animals and Man 101

1. Absorption of radioprotectors 103
2. Distribution of radioprotectors in the body 106
3. Conversion of radioprotectors in man and animals 118
4. Isolation of radioprotectors and their decomposition products from the body 124

V. The Action of Radioprotectors Upon the Functional Well-Being of Higher Animals and Man 128

1. Action of radioprotectors on metabolic processes 129
2. Changes in the basic physiological functions of the body under the action of radioprotectors 134
3. Action of radioprotectors on the nervous and humoral regulation of physiological functions 148

VI. Conclusion. Possible Mechanisms in the Protective Action of Compounds in Chemical Prophylaxis of Radiation Injury 154

Bibliography 169

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SCIENTISTS AND SCIENTIFIC ORGANIZATIONS

FIRST CONFERENCE OF URAL HYDROBIOLOGISTS

Kiev GIDROBIOLOGICHESKIY ZHURNAL in Russian No 5, 1979 pp 127-129

[Article by I. V. Kozlova and Yu. G. Andreyashkin]

[Text] A conference of Ural hydrobiologists was convened in Sverdlovsk on 13-16 February 1979 at the initiative of the Sverdlovsk department of the VGBO [All-Union Hydrobiological Society], Institute of Plant and Animal Ecology, UNTS [Ural Research Center?], USSR Academy of Sciences, Ural department of GosNIORKH [State Scientific Research Institute of Lake and River Fisheries] and UralNIIVKH [Ural Scientific Research Institute of Water Management]. A total of 93 specialists from 19 institutions of the USSR Academy of Sciences, USSR and RSFSR Ministry of the Fish Industry, USSR and RSFSR MMiVKH [ministries of land reclamation and water resources], as well as employees of some VUZ's of the Ural region participated in this conference. A total of 67 papers was delivered dealing with the structure and functions of marine ecosystems, hydrochemistry, radioecology, hydrobotany, production hydrobiology, use of mathematical methods in hydrobiology, ichthyology and pisciculture, helminthology, protection and wise use of reservoirs.*

The water resources of the Ural area are significant and diverse. On the whole, there are over 50,000 small and medium-sized lakes in this region over a total area of more than 3 million hectares. The space they occupy includes tundra, tayga, forest-steppe, steppe and mountain regions. The hydrochemistry of the lakes is very diverse: ultrafresh water and salt, and even lakes with deposited salt. Flowing bodies of water are referable to four large river basins. The overall area occupied by water is in excess of 600,000 ha.

Intensive fishing and pisciculture are being pursued in all waters. The results thereof were discussed in several papers. For example, it was noted (M. L. Grandilevskaya-Deksbakh, Yu. A. Koz'min) piscicultural work is based on the conception of free ecological niches, without consideration of

*The proceedings of this conference have been published in a collected entitled "Struktura i funktsii vodnykh biotsenozov, ikh ratsional'noye ispol'zovaniye i okhrana na Urale" [Structure and Functions of Marine Biocenoses, Wise Use and Protection Thereof in the Ural Region], Sverdlovsk, 1979.

interaction between introduced fish and the local hydrofauna. After seeding with new species, there was an improvement in quality of the catch; there was a decrease in catch of local fish with increase in catch of introduced species. There was a decrease in zooplankton mass with high density of seeding. The question has been raised of setting standards for removal of biological production transformed by the fish without detriment to the production properties of the body of water as a whole. There is a question that requires a definitive answer: is it necessary to completely replace the aboriginal ichthyofauna with new species. It is stressed (N. V. Nesterenko, G. M. Lopatyshkina, N. M. Podkina) that seeding with whitefish of most roach and perch lakes did not result in a substantial increase in the catches; commercial breeding in carp lakes was more successful. It is imperative to conduct more in-depth studies of correlations between seeded and aboriginal fish, as well as the influence of introduced species on ecosystems as a whole. There were also two papers dealing with pond pisciculture.

Several papers submitted data on nutrition, dynamics of population size and distribution of young fish. An analysis was made of some biological distinctions of pelyad from Ural lakes related to reproduction (Ye. L. Galaktionova, A. I. Leont'yev). There was a discussion of the ichthyofauna of bodies of water, morphological variability of fish in these reservoirs (including coolants of state regional electric power plants), as well as lakes and rivers. There was a survey of considerable material pertaining to variability of Eurasian graylings (Ye. A. Zinov'yev), special attention being devoted to the parallel between form-producing processes within species and subspecies having an extensive range. Similar ecotypes appeared in different regions, and their ecological features were found to be the most similar; there was less frequent coincidence of morphological features. It was reported that there is a severe worsening of ecological conditions in the Ural tributaries of the Ob' River related to anthropogenic factors (V. R. Krokhalevskiy, V. I. Polymskiy). There are spawning grounds of the pelyad, broad whitefish, Siberian powan in the Severnaya Sos'va, Sunya, Voykar and Sob' rivers; there too, these fish find shelter during the annual period of mass destruction in the Ob' River. It was suggested that immediate steps be taken for biological and technical amelioration of these rivers, organizing protection of spawning grounds and particularly against increasing poaching.

Macrophytes occupy extensive parts of Ural bodies of water, but they have been studied very little. For this reason, one should welcome the appearance of works shedding light on the composition and productivity of collections of macrophytes in Ural waters. Several papers submitted the results of studies of phytoplankton in reservoirs and lakes (M. I. Yarushina, A. P. Vasil'chikova and others).

Several papers contained information about the composition and production of zoobenthos and zooplankton in lakes, their role in the biotic cycle of matter. There was discussion of the taxonomic composition of midges

[Chironomidae family] in the central Ural region (G. A. Sokolova), Oligochaetae in the northern Urals (V. M. Popchenko), effects of anthropogenic factors on the zoobenthos, zooplankton and fish (N. S. Solov'yeva, V. M. Gol'din, M. B. Stepanova and others). It was noted (L. A. Sherstneva) that the absence of penticides from water cannot serve as an indication of a good toxicological situation in fishery-involved waters, since DNOK [dinitro-o-cresol], Sevin and GKhTsG [hexachlorocyclohexane] settle at the bottom very rapidly and remain virtually unremoved from debris and silt. All pesticides are toxic for marine animals at all stages of their development. Pesticides of the GKhTsG type are particularly dangerous, and the possibility of presence thereof must be totally exluded. The results were submitted of a study of composition and productivity of zooplankton in a small, but interesting mountain lake, Arakul', which is used as a whitefish stock pond (T. S. Lyubimova). There was a summary of results of studies of species-related diversity, level of development and rate of zooplankton production in six typical lakes in the southern and central Ural region (I. V. Kozlova). The species-related diversity and composition of zooplankton there are determined by mineral content of the water, pH, extent of overgrowth, level of development and rate of production of zooplankton as a whole and of different groups thereof, differences in temperature conditions, as well as relative profusion of highly productive species and age structure of populations. There was a report on changes in the feed base of Lake Duvankul' related to raising whitefish there (I. V. Kozlova, M. P. Koval'kova). Long-term observations of the feed base in the case of dense seeding are urgently needed and should be planned; unfortunately, they are most often conducted on the basis of individual initiative (as in the above-mentioned case).

An effort was made to discuss the correlations between species-related, morphological, energy and other aspects of structure, on the one hand, and the system of control in biogeocenoses on the other (Yu. G. Andreyashkin, N. I. Andreyashkina). The biocenosis that regulates the flow of matter and energy is considered to be the controlling subsystem. The controllable parameter is the correlation between chemicals in the cycle and the output signal is appearance of superfulous biogenous elements in the inanimate part of the biogeocenosis. Control is implemented by altering the structure of increment or even species-related structure, primarily in the phytocenosis.

Z. M. Balabanova summarized extensive material pertaining to Ural lakes, where mass destruction phenomena are observed annually. Other papers gave information about the effects of anthropogenic factors (mainly regulation) on hydrochemical conditions of the rivers in Chelyabinskaya Oblast (A. F. Krivopalova). In connection with the change at electric power plants to atomic fuel, there is a particularly acute question of investigating the effects of dumping excess heat and waste from atomic power plants on hydrobionts and the need to speedily elaborate the principles of ecological standard setting for levels of radioactive substances in reservoirs (N. V. Kulikov); a mathematical model has been proposed for the process of bacterial oxidation of bottoms (A. J. Zatsepin); there was a report on the trial of automatic classification in a study of size and age structure of mollusk populations (I. M. Khokhutkin, Yu. A. El'kin); the results were submitted of

a classification of lakes according to composition of zoobenthos, using a method that took into consideration the Euclidean distance between benthonic biocenoses in multidimensional space (K. Ye. Sherman); a link was traced between the cyclic fluctuations of fish catches and level of solar activity, consideration of which makes it possible to predict catches with fair accuracy (V. I. Medvedev).

The conference participants heard and approved of the program entitled "Productivity and Protection of Inland Waters of the Soviet Union," which was prepared at the initiative of G. G. Vinberg, corresponding member of the USSR Academy of Sciences and president of the VGBO, and they appealed to all researchers to participate in its implementation.

In the decision that they adopted, it was noted that some positive results have been obtained from studies and development of biological resources of Ural waters. Research is being conducted with success in the field of production hydrobiology, hydrology, radioecology and hydrochemistry of bodies of water.

Advances have been made in breeding and raising valuable fish species (with special mention of the fish industry enterprises of Chelyabinskaya and Tyumenskaya oblasts).

Poor coordination of hydrobiological research and virtual isolation of researchers working on Ural waters constitute a substantial flaw. As a result, not all types of bodies of water are investigated, joint analytic work is not being done to evaluate the condition of the reservoirs, interaction between seeded and local fish has not been adequately studied, small lakes (up to 100 ha in size), the importance of which has increased in recent years due to use thereof as hatcheries, have not been submitted to hydrobiological investigation; questions of marine toxicology and a number of others have not been sufficiently investigated.

The following most pressing directions of hydrobiological work in the Ural region were defined at the conference: joint studies of the structure and function of the main types of marine ecosystems; hydrobiological studies of small lakes suitable for use as hatcheries; determination of correlations between newly seeded and aboriginal fish; investigations pertaining to more rational use of liquid waste from heat and atomic power plants for fishery purposes.

It was agreed that the question of expanding toxicological studies due to the increasing pollution of water by industrial enterprise waste is an extremely pressing one. The participants at the conference also deemed it timely to summarize the significant material on hand dealing with hydrology and hydrochemistry, flora and fauna of Ural waters in the form of a monographic description of the best studied bodies of water, as well as a retrospective bibliography pertaining to hydrobiological and ichthyological studies of the region in question.

This conference was instrumental in uniting the efforts of researchers concerned with Ural waters. It was decided to convene regular conferences for the purpose of continued coordination of studies.
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SCIENTISTS AND SCIENTIFIC ORGANIZATIONS

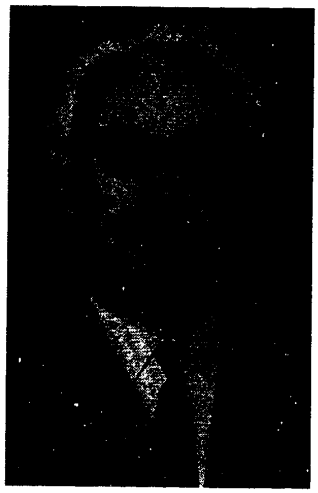
UDC 616.89:929 Frumkin

OBITUARY NOTICE: YAKOV PAVLOVICH FRUMKIN

Moscow ZHURNAL NEVROPATOLOGII I PSIKHIATRII in Russian Vol 79 No 9, 1979 pp 1428-1429

[Obituary]

[Text] On 29 September 1978 at the age of 76 the distinguished Soviet psychiatrist, Honored Scientist of the Ukrainian SSR, and Doctor of Medical Sciences Professor Ya. P. Frumkin passed away.



Yakov Pavlovich Frumkin was born 17 August 1902 in Smolensk. In 1924 he graduated from the Medical Faculty of Moscow University after which he worked for some time at the Department of Psychiatry of the university as an ordinator and assistant under the direction of P. B. Gannushkin. From 1932 through 1974 Yakov Pavlovich headed the Department of Psychiatry of the Kiev Medical Institute imeni A. A. Bogomolets, and then, till the end of his days, he was scientific consultant of the department.

Ya. P. Frumkin successfully developed questions of clinical psychiatry and was one of those who developed the ideas of the Moscow school of psychiatry of S. S. Korsakov and P. B. Gannushkin.

Yakov Pavlovich was a widely educated and talented clinician. He was distinguished by a rare ability to observe. Following the principles of his teacher, P. B. Gannushkin, Y. P. Frumkin carried out clinical investigations, penetrating deeply into the essence of psychopathological phenomena. His differential-diagnostic and prognostic opinions were characterized by exactitude and depth.

The greater part of 150 works published by Yakov Pavlovich are devoted to the study of clinical manifestations, diagnosis, differential diagnosis, and treatment of psychical illnesses. He worked out topical areas in epilepsy, its clinical forms and types of course of the disease; he described the typological characteristics of epileptoid and arteriosclerotic dementia and of the psychoses accompanying these diseases. To the pen of Ya. P. Frumkin belong a number of publications on the history of psychiatry, the organization of psychiatric assistance, psychotherapy, psychiatric deontology and a method of teaching psychiatry. In collaboration with Academician A. A. Bogomolets, Yakov Pavlovich participated in studying the questions of geriatric psychiatry and reactivity during psychical illnesses.

Ya. P. Frumkin wrote monographs and school text books widely known in our [USSR] country: "Psychiatric Terminology" (1939), "A Short Differential Diagnosis of Several Mental Illnesses" (1951), the first native "Educational Atlas of Psychiatry" (1963), "Psychiatry: Tables and Diagrams" (1977).

Under the direction of Ya. P. Frumkin more than 40 candidates' and doctoral dissertations were completed and defended. A number of his students were at the head of departments of psychiatry in medical VUZes [i.e., institute of higher learning] of the Ukrainian SSR, many are successfully continuing their scientific and pedagogical activity and are organizers of psychiatric help.

Yakov Pavlovich was a brilliant pedagogue. His brilliant and profound lectures invariably attracted a wide audience not only of students, but also of practicing physicians. He was distinguished by the valuable gift of a teacher, was always simple in communication; he loved his patients, enjoyed great authority and respect among students, physicians and scientists.

Yakov Pavlovich Frumkin was a member of the CPSU since 1943. Many times he was chosen as a member of the party bureau of the Faculty of Medicine, and performed active social work. Over the course of many years Yakov Pavlovich was on the board of the All-Union and Ukrainian Societies of Neuropathologists and Psychiatrists; in 1974 he was chosen Honorary Member of the All-Union Society of Neuropathologists and Psychiatrists.

For his fruitful pedagogical, scientific, practical and social activities Prof Ya. P. Frumkin was awarded the title of Honored Scientist of the Ukrainian SSR.

The blessed memory of Yakov Pavlovich Frumkin--pedagogue, scientist and human being will remain forever in our hearts.

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END