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CENTRAL INTELLIGENCE AGENCY

# SCIENTIFIC INFORMATION REPORT

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PLEASE NOTE

This report presents unevaluated information extracted from recently received publications of the USSR, Eastern Europe, and China. The information selected is intended to indicate current scientific developments and activities in the countries of origin and is disseminated as an aid to research in the United States.

SCIENTIFIC INFORMATION REPORT

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# I. BIOLOGY

## Bacteriology

### 1. Czechoslovak Bacterial Insecticide Developed

"Bacteria Destroy Insects" (unsigned article); Prague, Prace 22 Nov 59, p 3

According to this article, the Biological Institute of the Czechoslovak Academy of Sciences has developed a bacterial insecticide which attacks and destroys the larvae of certain harmful agricultural insects. Production of the insecticide, which was begun on an industrial scale on the basis of the academy's research, is discussed in terms of being "the first industrial production of a bacterial warfare agent in the battle against insects, anywhere." The article states that the insecticides contains the Bacillus thuringiensis, a rod-like bacillus, and that the preparation is quite stable. Experiments and tests have shown that it has not lost its virulence for 8 years, while under study.

According to the description, the insecticide is completely harmless to humans and other "useful" insects and, for example, when used in orchards during the blossoming period, will not even destroy bees. The insecticide, which is not further identified in the article, is said to kill the insects against which it was designed in a matter of days.

### 2. Hungarians Report Revival of 3,000-Year-Old Bacteria From Antarctic Ice

"Beneath the South Pole Ice" (unsigned news item); Budapest, Nepszabadsag, 10 Dec 59, p 8

"Bacteria which are 3,000 years old have been found 30 meters beneath the South Pole ice fields. Researchers have brought the bacteria to life by using heat, and they will culture them for study purposes."

## Plant Physiology

### 3. Effect of 2,4-D on Phosphorus Metabolism in the Potato

"Data on the Effect of 2,4-Dichlorophenoxyacetic Acid on the Phosphorus Metabolism of Plants," by B. Faludi, A. F. Daniel, E. Kovacs and A. Balint, Institute of Genetics and Heredity of Eotvos Lorant University of Science; Budapest, Biologiai Kozlemnyek, Vol 7, No 1/2, 1959, pp 7-20

The effect of 2,4-dichlorophenoxyacetic acid (2,4-D) on the phosphorus metabolism of plants was studied under sterile conditions on pieces of potato tissue placed on a substratum containing a phosphorus isotope.

From analyses performed after tests lasting for 6, 12, and 24 hours, it was established that:

(1) 2,4-D inhibits the assimilation of phosphorus in potato tissue; the cells even lose a significant portion of their phosphorus content through the action of the toxic concentration;

(2) Under the effect of 2,4-D, the equilibrium of the assimilation-decomposition reaction between phosphorus compounds is shifted toward decomposition of organic phosphorus compounds rather than inorganic compounds;

(3) The phosphorus contents of organic phosphorus fractions (in relation to the weight unit of tissues) decreases under the action of 2,4-D; this phenomena is expressed most in acid-soluble and lipid-soluble fractions;

(4) The velocity of phosphorus assimilation of the various fractions is modified by 2,4-D treatment; the relative accumulation of phosphorus in the lipid fraction is especially noticeable;

(5) Phosphorus assimilation into the lipid fractions originates mainly from the inorganic phosphorus of the substratum since 2,4-D stimulates assimilation of phospholipids to a greater degree than their decomposition.

Despite the complexity of the picture obtained in connection with the action of 2,4-D upon the phosphorus circulation, it is clear that 2,4-D toxicity is reflected by a far-reaching modification in phosphorus metabolism, particularly in the lipid circulation, influencing especially the permeability conditions.

## Radiobiology

### 4. Uranium-Contaminated Water a Possible Cause of Masculinization in Fishes

"A Histological Study of the Gonads of Bleak (Alburnus alburnus L.) Subjected to the Chronic Effect of Small Doses of Uranium-238," by M. M. Telitchenko and Ye. N. Levitova, Chair of Hydrobiology; Moscow, Vestnik Moskovskogo Universiteta, Seriya Biologii, Pochvevedeniya, Geologii, Geografii, No 1, 1959, pp 45-48

The authors studied the chronic effect of small doses of uranium-238 on the gonads of Alburnus alburnus L, a type of fish which typically inhabit small rivers and lakes with a slow rate of flow.

Results of microscopic studies show that the prolonged stay (400 days) of fish in uranium-238 solutions with concentrations equalling 1, 5, 10, and 25 mg per liter leads to the degeneration of the ovaries. No marked changes were noted in the development of the testes within range of the same experimental conditions. The authors also noted that the chronic effect of small doses of uranium-238 (5 and 25 mg per liter) leads to the transformation of ovaries into testes. It is also known that in certain fishes (carp, minnows, and swordfish), masculinization of the females is noted as an effect of such factors as X-rays , increased temperature, light, and the prolonged arrest of the growth of the ovaries by keeping fish in small aquariums during the period of their fastest growth. Furthermore, the fact that males predominate in certain vertebrates which have been subjected to the effects of ionizing radiation and in their progeny should not be overlooked.

The authors conclude that the presence of uranium ions in the aqueous medium can cause masculinization of female fishes and that this may reduce the number of fishes, especially those of commercial value, within a short time.

### 5. Abnormal Developments in the Progeny of Irradiated Animals

"Abnormalities of Growth in the Progeny of Guinea Pigs Irradiated by Gamma-Rays and Their Inheritance by a Number of Generations," by A. I. Osipovskiy and G. S. Kunicheva, Chair of General Biology, Chair of Radiology, and Chair of Eye Diseases, First Moscow Order of Lenin Medical Institute imeni I. M. Sechenov; Moscow, Meditsinskaya Radiologiya, Vol 4, No 11, Nov 59, pp 37-42

Since the study of the genetic sequelae arising in the progeny of irradiated animals is one of the pressing problems of medicine at present, the authors studied the complex changes which can appear in the progeny of parents irradiated by 225 and 450 r from cobalt.

Abnormalities in the development of 250 offspring of three generations or irradiated guinea pigs included distortions in the development of the eyes (opacity of the cornea and of the crystalline lens, etc.) and teeth (bent and small), general underdevelopment and abnormalities in the development of the skeleton (dwarfism), disturbances in the development of the central nervous system, and the onset of gangrenous foci and malignancy. The fact that such abnormalities had a congenital nature should be emphasized.

The author wishes to call attention to the high percentage of deaths due to various causes among the progeny of irradiated animals.

## II. CHEMISTRY

### Adhesives

6. Chinese Research on Adhesives

"The Adhesive Property of Epoxy--Phenol-Formaldehyde Adhesives (Report No 1)," Wang Chih-lu (王 致 禄), Ch'en Tao-i (陳 道 義), and Wang Su-ai (王 素 媛), Macromolecular Institute, Kirin Branch, Academia Sinica; Peiping, Kao-fen-tsu T'ung-hsun (Macromolecular Report), Vol 3, No 3, Jun 59, pp 135-138

The authors report the results of experiments undertaken to test the shearing strength of epoxy-phenol-formaldehyde resin adhesives, which they had prepared by using epoxy resins, phenol-formaldehyde resins, and different types of fillers, plasticizers, solvents, and hardeners in varying proportions. They found that the highest shearing strength (averaging 350 kilograms/$cm^2$) was obtained by adding the following to epoxy resins and allowing the mixture to harden for 2 hours at 150 degrees centigrade: phenol formaldehyde, 10-20%; dibutyl phthalate, 10-15%; china clay, 30-50%; vinyl diamine, 7%; and acetone, 10-20%.

The authors say that adhesives of the above-mentioned type have wide application in the aviation, automobile, and shipping industries and in national defense. Their list of six references include the following two Chinese reports classified as "internal data, 1958": (1) "Adhesion Testing of Epoxy Resins," Mukden Branch, Research Institute [of the Ministry] of Chemical Industry in Peiping (北 京、工 業、研 究 院 瀋 陽 分 院); and (2) "Epoxy Resin Adhesives," Shanghai Materials Research Institute (上 海 材 料 研 究 所).

### Bactericides

7. Reaction Medium Affects Bactericidal Properties of Chlorine-Containing Substances

"The Effect of the Reaction Medium on the Bactericidal Properties of Substances Containing Active Chlorine," by E. P. Chenchikova, Central Scientific Research Disinfection Institute; Moscow Zhurnal Mikrobiologii, Epidemiologii i Immunobiologii, No 7, Jul 59, pp 109-113

The relationships existing between the reaction medium, the bactericidal effect, and the free chlorine content in solutions of different substances which contain active chlorine were demonstrated in this work.

The quantity of chlorine does not appear to be the absolute criterion of the bactericidal activity of solutions of the following chlorine-containing substances: chloramine, chlorinated lime, calcium hypochlorite, dichlorodimethylhydantoin, and trichlorocyanuric acid.

With equal amounts of active chlorine, the greatest bactericidal activity was exhibited by those substances whose solutions were more acid and contained a greater quantity of free chlorine. Increasing alkalinity, as a rule reduces the amount of free chlorine.

At equal pH values and with identical contents of active chlorine (0.01), the solutions of all the substances studied had an equal quantity of free chlorine and almost identical bactericidal activity, with the exception of chloramine solution in neutral media and dichlorodimethylhydantoin and trichlorocyanuric acid solutions in alkaline media.

## Biochemistry

### 8. Desalination of Antitoxins by Ion Exchange Resins

"The Use of Ion Exchange Resins for the Desalination of Fermented Antitoxic Sera During Their Purification and Concentration Process," by K. L. Shakhanina, Institute of Epidemiology and Microbiology imeni Gamaleya Academy of Medical Sciences USSR; Moscow, Zhurnal Mikrobiologii, Epidemiologii i Immunobiologii, No 7, Jul 59, pp 105-109

Water dialysis has been used for the removal of ammonium sulfite from antitoxic sera in their purification and concentration process. This is a long and laborious process, difficult to mechanize. In many instances, dialysis is the cause of inferior quality of the preparations undergoing purification. Synthetic ion exchange resins may serve as a means for the quick and complete removal of salts.

Effective deionization of antitoxic sera was achieved in the purification process by the use of fermentation by absorption on cation and anion exchange resins even in the presence of up to 6% ammonium sulfite in the medium.

When a high concentration of neutral salts existed in the purified sera, special attention was given to the stabilization of the medium pH within limits which exclude the inactiviation of the fermented antitoxins and which ensure the preservation of the high absorptive power of the ionites. The sorption effect of the neutral salts in combination with a high yield of the antitoxin was achieved by filtration of the purified sera through consecutively alternating cation and anion batches in a 1:4 ratio (according to weight).

## Electrochemistry

### 9. USSR Conference on the Electrochemistry of Organic Compounds

"The Electrochemistry of Organic Compounds" by L. G. Feoktistov; Moscow, Vestnik Akademii Nauk SSSR, Vol 29, No 9, Sep 59, pp 103-104

"The Second Conference on the Electrochemistry of Organic Compounds was held at Moscow on 16-17 June 1959. This conference was called by the Commission on the Coordination of Electrochemical Work at the Department of Chemical Sciences, Academy of Sciences USSR; the Institute of Electrochemistry, Academy of Sciences USSR; and the Section of Electrochemistry, All-Union Chemical Society imeni V. I. Mendeleyev. More than 100 persons from 17 cities of the USSR participated in the conference.

"The conference was opened by A. N. Frumkin, who pointed out in his introductory address the necessity of increasing the volume of research on the electrochemistry of organic compounds and also the desirability of establishing better coordination between work in the theoretical field and work of an applied nature.

"V. T. Khomyakov and A. P. Tomilov reviewed systematically the most recent progress in the USSR and abroad as far as industrial application of methods for the electrochemical synthesis of organic compounds is concerned. The report given by them discussed the prospects of industrial application of processes of electrochemical oxidation, reduction, substitution (fluorination, thiocyanation, and hydroxylation) and also of the application of electrochemical processes which involve the participation of free radicals and lead to the formation of diols, dicarboxylic acids, and furan compounds from more accessible compounds with half the molecular weight of the resulting products. They also discussed the electrochemical initiation of polymerization processes.

"Problems pertaining to electrolytic reduction and oxydation were discussed during the conference. Specifically, a new method for the industrial production of adipic acid nitrile (an intermediate product used in the production of nylon) by the cathodic reduction of acrylonitrile was described. This method makes it possible, not only to reduce the number of steps in the production process, but also to employ a cheaper and more readily accessible raw material based on acetylene. Information was given obtained in investigations on the electrolytic reduction of adipic acid nitrile to hexamethylenediamine (with the formation of chlorine as a by-product) and also on the electrochemical reduction of nitrocyclohexane to cyclohexylamine, which is an intermediate in the production of caprolactam. Problems were discussed pertaining to the polymerization of methylmetacrylate initiated by the cathodic reduction of oxygen.

"Practically feasible methods for oxydation of pyridine homologs to nicotinic and isonicotinic acids were discussed. These methods make it possible to obtain products of a high degree of purity. The problem of the electrochemical alcoxylation of furan derivatives was studied. This type of reaction results, under certain conditions, in the formation of spirocyclanes. Interest was aroused by reprots on the preparation by electrochemical methods of organic substances containing tracer atoms, specifically iodoform containing radioactive iodine and streptomyocin containing tracer atoms of phosphorus, sulfur, and chlorine.

"Several reports dealt with general problems pertaining to electrochemical synthesis and methods applied to accomplish this type of synthesis. For instance, it could be shown that application of porous electrodes produced by powder metallurgy and electrochemical methods or by the reduction of oxides makes it possible to increase the velocity of processes of industrial electrolysis by an order of 3-6. Results were obtained clarifying the effect on the intensity of the process exerted by graphite or by an external cathode made from a different metal and brought into contact with an amalgam. Results were also obtained concerning the effect of agitation on the velocity of electrochemical oxidation and reduction of organic substances.

"Theoretical problems related to the electrochemistry of organic compounds were also considered, specifically the effect of geometric isomerism of organic compounds on their polarographic behavior and the effect of the structure and crystallographic characteristics of electrodes on the electrolytic reduction of some organic acids. Results were reported that were obtained in investigations on the mechanism of the electrolytic reduction of unsaturated organic compounds on platinum, the hydrogenation of some aldehydes and acetylenic compounds at platinum and rhodium electrodes, anodic processes taking place during the electrolysis of aqueous solutions of metanitrobenzenesulfonic acid and the sodium salt of this acid, the electrolytic oxidation of aniline in acidic solutions at platinum and lead anodes, etc.

"The conference demonstrated that the volume of research in organic electrochemistry has constantly increased, particularly since the May 1958 Plenary Session of the Central Committee CPSU was held.

"Work has been begun on the electrochemical synthesis of initial materials for the production of high polymers. At present, it is of exceptional importance to expand research in this field and also to expand investigations on the mechanisms of electrode processes in which organic substances participate. It is necessary to disseminate a greater amount of scientific information on organic electrochemistry by publishing reviews and monographs and also by issuing an electrochemical journal.

"It is intended to hold the third conference on the electrochemistry of organic compounds at the end of 1960."

## Geochemistry

10. Uranium in Oil Shale

"Concerning the Form in Which Uranium Occurs in Some Kerogen Shales," by R. Alekperov and G. Kh. Efendiyev, Institute of Chemistry, Academy of Sciences Azerbaydzhan SSR; Baku, Doklady Akademii Nauk Azerbaydzhanskoy SSR Vol 15, No 9, Oct 59, pp 821-823

Oil shales were investigated for their uranium content. It was established that a considerable portion of the uranium contained in shales is bound to organic components, i.e., porphyrins, asphaltenes, and humic acids. Although the shales investigated did not show a heightened uranium content, the content of uranium in them (measured in clarks) was still greater than in all principal types of rocks. Furthermore, the ratio Ra: U corresponding to the radioactive decay equilibrium was found to be displaced toward higher uranium contents. This is explained by the low solubility in water of the compounds formed by uranium with the organic susbtances contained in shale.

## Growth Stimulators

11. Growth of Plants Influenced by Degranol

"The Effect of Degranol on Plant Growth," by I. Peterfi, E. Brugovitzky, J. Kozma, and F. Nagy-Toth; Budapest, Biologiai Kozlemenyek, Vol 7, No 1/2, 1959, pp 39-44

"It appears from these investigations that degranol (1,6-di-(beta-chloroethylamino)-1,6-desoxy-D-mannitol-dichlorohydrate), in certain concentrations, inhibits the growth of plant organisms. The inhibitory effect of degranol varies between 100 mg% and 100 mg%.

The plant species examined showed different degrees of sensitivity to degranol. They reacted to different quantities of this substance.

Degranol did not inhibit germination, but did hamper the growth of young seedlings. It is assumed that this apparent differentiation can be explained by the cytostatic action of degranol because, in the course of germination, a lengthening of the already existing meristematic cells occurs. Obviously, this is not hindered by degranol, but the growth processes after the appearance of sprouts are impeded; the starting point of this is the first phase of growth -- embryonal growth or cell division.

A further conclusion is that the growth-inhibiting action of degranol might be cumulative, along with other similar effects and thus be multiplied. In the present paper, the increased combined effect of degranol and X-rays was pointed out.



## Industrial Chemistry

### 12. Ageing at Elevated Temperatures of Plastics Containing Fluorine

"Application of Infrared Absorption Spectra for the Investigation of Structural Changes in Some Fluorine-Containing Plastics That Have Been Subjected to Ageing," by L. I. Tarutina: Moscow, Izvestiya Akademii Nauk SSSR-Seriya Fizicheskaya, Vol 23, No 10, Oct 59, pp 1210-1212

The changes taking place in polytrifluoroethylene, polytrifluorochloroethylene, the copolymer of tetrafluoroethylene with ethylene, and the copolymer of vinylidenefluoride with trifluorochloroethylene after ageing at the temperatures of 200-300° in air and in vacuum were investigated by the method of infrared absorption spectroscopy. It was established that the thermal ageing of polymers containing both C-Cl and C-H bonds or C-F and C-H bonds is primarily due to the scission of these bonds with the elimination of HCl and HF, respectively. When the chemical changes characteristic for this type of ageing take place in vacuum, there is formation of unsaturated bonds or cross-linking. On the other hand, ageing in air results in oxidation.

The conditions under which polymerization was carried out may have an effect on the thermal ageing of polymers. Thus, the heat stability of the copolymer of tetrafluoroethylene with ethylene depends, to a considerable extent, on the degree of branching. After this had been established by the spectroscopic method, conditions were found which improved the method of synthesis, with the result that a polymer exhibiting an improved thermal stability was obtained.

[SIR Note: This paper was presented at the 12th All-Union Conference on Spectroscopy, Moscow, 19-26 November 1958.]

13. Heat Resistant and Noncombustible Polyesters of Substituted Phosphoric Acids

"The Synthesis and Properties of Some Polyesters of Substituted Phosphoric Acids," by I. K. Rubtsova and R. D. Zhilin; Leningrad, Zhurnal Prikladnoy Khimii, Vol 32, No 11, Nov 59, pp 2604-2606

Dichlorides of phosphoric acid monoesters synthesized by reacting phosphorus oxychloride with phenol, p-tertiary butyl phenol, p-cumylphenol, o- chlorophenol, and p-chlorophenol were condensed with bifunctional phenols (hydroquinone, resorcinol, and diphenylolpropane). The resins prepared in this manner do not burn or support combustion. Furthermore, incorporation of 30% of these resins in phenol-formaldehyde, urea-formaldehyde, or polyester resins makes the latter fireproof.

14. Infrared Spectra of Isotactic Polymers

"Investigation of Isotactic Polymers by the Method of Infrared Spectroscopy," by Ye. I. Pokrovskiy and M. V. Vol'kenshteyn; Moscow, Izvestiya Akademii Nauk SSR-Seriya Fizicheskaya, Vol 23, No 10, Oct 59, pp 1208-1209

The infrared absorption spectra of isotactic polypropylene and isotactic polystyrene were compared with those of atactic polypropylene and atactic polystyrene. The results obtained are interpreted. It has been found that the absorption spectra of crystalline and molten isotactic polypropylene in the frequency range of 800-900 $cm^{-1}$ are not only unlike each other, but also differ from the spectrum of atactic polypropylene. The intensity of the 992 $cm^{-1}$ band was found to depend on the degree of crystallinity of the polypropylene. It was also established that crystalline isotactic polystyrene has a number of absorption bands in the crystalline state which disappear on melting.

[SIR Note: This paper was presented at the 12th All-Union Conference on Spectroscopy, Moscow, 19-26 November 1958.]

## Inorganic Chemistry

15. Formation of Beryllium Fluoride by the Thermal Decomposition of Ammonium Fluoroberyllate

"The Thermal Decomposition of Ammonium Fluoroberyllate $(NH_4)_2$ Be $F_4$," by O. N. Breusov, N. M. Vagurtova, A. D. Novoselova, and Yu. P. Simapov; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 4, No 10, Oct 59, pp 2213-2219

Investigation of the polythermic and isothermic decomposition of ammonium orthofluoroberyllate has shown that the decomposition process proceeds in three stages, as shown by the following formulas:

$$(NH_4)_2 \text{ Be } F_4 \longrightarrow NH_4 \text{ Be } F_3 \longrightarrow NH_4 \text{ Be}_2 F_5 \longrightarrow \text{Be } F_2$$

The compound $NH_4$ $Be_2$ $F_5$ was subjected to X-ray diffraction analysis, and the analogous salts $KBe_2$ $F_5$ and $\alpha$-Cs $Be_2$ $F_5$ were investigated by the same method. The unit cell dimensions of the crystals of these three salts were determined.

## Insecticides

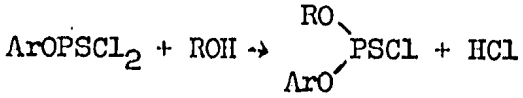
16. Alkylarylthiophosphamides: New Class of Organophosphorus Insecticides

"From the Field of Organic Insectofungicides. XLV. Synthesis of Alkylarylchlorothiophosphates and Alkylarylthiophosphamides," by N. N. Mel'nikov, Ya. A. Mandel'baum, Z. M. Bakanova and P. G. Zaks, Scientific Institute for Fertilizers and Insectofungicides; Leningrad, Zhurnal Obshchey Khimii, Vol 29, No 10, Oct 59, pp 3286-3288

The alkylarylthiophosphamides are a new class of organophosphorus insecticides. This was discovered by a study of the insecticidal properties of a series of these compounds. All of the alkyl-4-nitrophenylthiophosphamides were found to be active insecticides by P. V. Popov, who conducted the insecticidal properties study. The starting material for the synthesis of the alkylarylthiophosphamides was O-alkyl-O-arylchlorothiophosphate. The reaction of alkyldichlorothiophosphates with phenols in the presence of triethylamine gave the corresponding alkylarylchlorothiophosphates in satisfactory yields:

$$ROPSCl_2 + ArOH + (C_2H_5)_3N \rightarrow \begin{matrix} RO \\ ArO \end{matrix} \!\!> PSCl + (C_2H_5)_3N \cdot HCl$$

Alkylarylchlorothiophosphates can also be obtained by the reaction of aryldichlorothiophosphates with alcohols according to the equation:



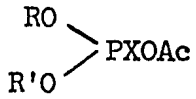
$$ArOPSCl_2 + ROH \rightarrow \begin{matrix} RO \\ ArO \end{matrix}\!\!>\!PSCl + HCl$$

By reacting alkylarylchlorothiophosphates with various amines, previously undescribed O-alkyl-O-arylthiophosphamides were prepared. The constants of the newly synthesized products are presented in two tables.

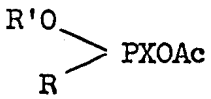
17. Strong Insecticidal Properties Exhibited by Esters of Phosphonoacetic Acid

"From the Field of Organic Insectofungicides. XLVI. The Synthesis of Several Derivatives of Phosphonoacetic Acid," by N. N. Mel'nikov, Ya. A. Mandel'baum, and V. I. Lomakina, Scientific Institute for Fertilizers and Insectofungicides; Leningrad, Zhurnal Obshchev Khimii, Vol 29, No 10, Oct 59, pp 3289-3291

The authors have noted from the works of Schrader and other investigators that compounds with the following type formulas:



$$\begin{matrix} RO \\ R'O \end{matrix}\!\!>\!PXOAc$$



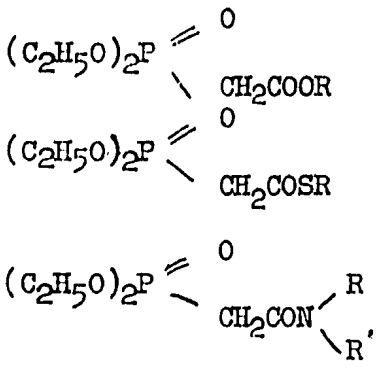
$$\begin{matrix} R'O \\ R \end{matrix}\!\!>\!PXOAc$$

easily phosphorylate vitally important enzyme systems of insects, resulting in their death.

The purpose of this research was to synthesize various compounds of this series and to gain further knowledge of the action mechanism of organophosphorus insecticides on insects. Another purpose was to study the insecticidal properties of various derivatives of phosphonoacetic acid for determining the relationship of insecticidal activity to the structure of organophosphorus compounds.

Esters of phosphonoacetic acid are easily obtained by the Arbuzov Reaction by reacting monochloroacetic acid with trialkyphosphites or sodium dialkylphosphites. Despite their ease of preparation, very few esters of phosphonoacetic acid are described in the literature, and, according to the authors, no derivative of phosphonothioacetic acid has been described. Furthermore, nothing has been published on the insecticidal activity of these compounds.

The synthesis of compounds with the following general formulas was carried out:



where R = $C_6H_5$, $C_6H_4Cl$ (4):



where R = $C_2H_5$, $C_6H_4Cl$ (4), $C_6H_2Cl_3$(2,4,5);



where R = $C_2H_5$, $C_6H_5$; R' = H, $C_2H_5$.

These compounds were synthesized by reacting triethylphosphite with esters of monochloroacetic and monochlorothioacetic acids and amides of monochloroacetic acid. Properties of the synthesized compounds are presented in one table.

The insecticidal property studies were conducted by P. V. Popov and N. S. Ukrainets. These studies showed that the esters of phosphonoacetic acid are very weak insecticides but that the esters of phosphonothioacetic acid are very strong contact and systemic insecticides. The aromatic esters of phosphonothioacetic acid are especially active. The $LC_{50}$ for triethyl ester of phosphonothioacetic acid is given as 0.003% but for diethyl-4-chlorophenyl ester of phosphonothioacetic acid, 0.001%. Amides of phosphonoacetic acid were reported as being comparatively weak insecticides.

On the basis of their studies, the authors conclude that the interaction of organic compounds of phosphorus with the enzyme systems of insects can take place along different directions.

18. Reactions of Aryldiazonium Salts With Dialkyldithiophosphates Studied

"From the Field of Organic Insectofungicides. XLVII. On the Interaction of Aryldiazonium Salts With Dialkyldithiophosphates," by N. N. Mel'nikov, A. F. Grapov, and K. D. Shvetsova-Shilovskaya; Leningrad, Zhurnal Obshchey Khimii, Vol 29, No 10, Oct 59, pp 3291-3295

The article describes the synthesis of mixed esters of dialkyldithiophosphoric acids in the continuing study of the insecticidal properties of compounds of this type.

Different aryldiazonium salts were reacted with dialkyldithio phosphates, giving a series of hitherto unknown mixed esters. The reaction takes place, forming the corresponding dialkylaryldiazodithiophosphate, which breaks down to yield the end products, 0,0-dialkylaryldithiophosphate and nitrogen:

$$ArN_2Cl + (RO)_2PSSH \rightarrow HCl + ArN_2SPS(OR)_2$$

$$ArN_2SPS(OR)_2 \rightarrow ArSPS(OR)_2 + N_2.$$

However, in the case of potassium diisopropyldithiophosphate, the reaction may proceed in two directions: in a neutral medium, the mixed esters of dithiophosphoric acid are formed, while in an acid medium, the disulfides are mainly formed:

$$(RO)_2PSSK + ArN_2X \rightarrow HX + ArSPS(OR)_2 + N_2 + KCl$$

$$2(RO)_2PSSH + ArN_2X \rightarrow [(RO)_2PSS]_2 + ArH + HX + N_2$$

## Nuclear Fuels and Reactor Construction Materials

19. Investigation of Aqueous Solutions of Uranyl Nitrate by the Method of Raman Spectroscopy

"Investigation of Aqueous Solutions of Uranyl Nitrate by the Method of Raman Spectroscopy," by S. Minc and Z. Kecki, Laboratory of Electrochemistry, Institute of Physical Chemistry, Polish Academy of Sciences; Moscow, Izvestiya Akademii Nauk SSSR-Seriya Fizicheskaya, Vol 23, No 10, Oct 59, pp 1182-1183

The effects of the concentration of uranyl nitrate on the $860^{-1}$ centimeters fully symmetric vibration, the $210^{-1}$ centimeters deformational vibration, and the $930^{-1}$ centimeters assymetric vibration of $UO_2^{2+}$ were investigated. It was established that with a reduction of the ratio of water concentration to concentration of nitrate ions, there is an increase in the molecular intensity of the $860^{-1}$ centimeters line of the Raman spectrum, which is apparently due to a displacement of electrons along the O-U-O bonds. It is possible that nitrate ions, on replacing water molecules in uranyl complexes, produce changes in the electron shell of uranyl. To obtain data which will aid in the interpretation of this phenomenon and other observations that have been made in the investigation described, further research will be carried out.

[SIR Note: This paper was presented at the 12th All-Union Conference on Spectroscopy, Moscow, 19-26 November 1958].

20. Degree of Hydration of Nitric Acid Extracted by Ethers

"Mutual Solubilities in the System $HNO_3$ - $H_2O$ -n-Dibutyl Ether at 95°", by V. M. Vdovenko, D. N. Suglobov, and A. I. Skoblo; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 4, No 10, Oct 59, pp 2376-2379

In work dealing with the distribution of nitric acid between water and organic solids, the problem in regard to the extraction of water together with the acid by the organic phase has not been considered hitherto, although it is possible that hydrates of the acid are extracted. There is only a brief reference to unpublished work in which the degree of hydration of nitric acid dissolved in three ethers has been determined (H.A.C. McKay, Journal of Inorganic and Nuclear Chemistry, Vol 4, 1957, p 375).

In the present work, mutual solubilities in the system $HNO_3$ - $H_2O$ - -n-dibutyl ether at 25° were determined. The hydration of nitric acid in the butyl ether was investigated, and the distribution of nitric acid between water and butyl ether was studied under consideration of the hydration of the acid in the ether phase. It was found that the concentration of water in the ether increases considerably with increased concentration of the acid. The dependence of the concentration of water on the concentration of acid in the ether phase has been investigated; the results obtained are presented in the form of a curve. No determinations were made at concentrations of acid in the ether exceeding 35% because at this point oxidation of the ether by the acid begins to take place at a significant rate.

21. Method of Testing Graphite for Nuclear Reactors

"A Comparative Method of Testing Graphite for Nuclear Reactors," by I. F. Zhezherun; Moscow, Atomnaya Energiya, Vol 7, No 5, Nov 59, p 424

This article describes a method for testing the suitability of graphite for nuclear reactors. The method is based on a comparison of the degree of weakening of a flux of thermal neutrons by the graphite being tested with the corresponding weakening by standard graphite. With the use of this method, one can determine the diffusion path L or the effective cross-section of neutron absorption of the graphite $\sigma$ when $L_o$ and $\sigma_o$ of the standard graphite are known. The error in the determination of $\sigma$ does not exceed 2.5%. The simplicity of the method makes it applicable for the testing of graphite on a large scale under conditions encountered during industrial production. The method has been developed in the USSR a long time ago and, with a few minor modifications, is being used successfully there under conditions of mass production.

22. Liquid Metal Coolants for Nuclear Reactors

Zhidkometallicheskiye Teploncsiteli Yadernykh Reaktorov (Liquid Metal Coolants for Nuclear Reactors), by P. A. Andreyev, A. A. Kanayev, and Ye. D. Fedorovich, Sudpromgiz (State All-Union Publishing House of the Shipbuilding Industry), Leningrad, 1959, 384 pp (unsigned review); Moscow, Atomnaya Energiya, Vol 7, No 5, Nov 59, p 500

"This book reviews non-USSR and some USSR investigations on the properties of liquid metals. Chapters 1 and 2 of the first subdivision of the book deal with the physical and chemical properties of liquid

metals and their alloys. Chapter 3 discusses the fundamental precepts of hydraulics and of heat exchange as applied to liquid metals; Chapter 4 describes the corrosion characteristics of different construction materials for nuclear reactors when these materials are immersed into liquid metals.

"The second subdivision of the book, which is entitled "Design and Operation of Liquid-Metals Systems," consists of three chapters which outline the basic principles underlying the design of liquid-metal circuits and of their individual junctions, as well as of auxiliary equipment for the operation of these circuits, including pumps, heat-exchangers, fittings, and indicators and controllers. The rules which must be observed in the operation of liquid-metal circuits are also discussed.

"The third subdivision of the book deals with USSR investigations of liquid-metal heat-transfer agents.

"The book summarizes and subjects to critical consideration a great number of theoretical and experimental investigations on liquid metals. It will undoubtedly be of use to scientific workers, engineers, and technologists who are active in the field of nuclear reactor construction and related fields of technology."



23. Constitutional Diagram of the Zirconium-Rhenium System

"The Phase Diagram of the Zirconium-Rhenium System," by Ye. M. Savitskiy, M. A. Tylkina, and I. A. Tsyganova; Moscow, Atomnaya Energiya, Vol 7, No 3, Sep 59, pp 231-235

The constitutional diagram of the system zirconium-rhenium was constructed on the basis of data obtained by the X-ray diffraction and microscopic methods, measurements of melting points, and determinations of the hardness and microhardness. It was found that in $\alpha$-zirconium at 800°C, the fraction consisting of solid solutions of rhenium comprises approximately 0.5% by weight, while at the temperature of eutectoid transformation, the relative amount of this fraction increases to 2-3% by weight.

In $\beta$-zirconium at 1,600°, 14.68% by weight of rhenium are dissolved, and at the point of eutectoid transformation at 550-600°C, 8% by weight of rhenium are dissolved. The $\beta$-phase is stabilized in alloys containing more than 4% by weight of rhenium. At 1600° and 25% by weight of rhenium, a eutectic is formed. The presence of a metastable $\omega$-phase was established in alloys rich in zirconium.

The solubility of zirconium in rhenium at 2,500°C is less than 2% by weight.

The following three chemical compounds are formed in the system by peritectic reactions:

(1) At 2500°C, $Zr_5 Re_{24}$, a compound of the type of $\alpha$-Mn with a volume-centered cubic lattice ( $a$ = 9.6-9.7 kX) and a microhardness of 1000 kg per square millimeter;

(2) At 2450°C, $Zr Re_2$, a compound with a hexagonal densely packed lattice (a = 5.21 - 5.25 Å; c = 8.5-8.56 Å; c/a = 1.63) and a microhardness of 1200 kg per square millimeter;

(3) At 1900°C, $Zr_2 Re$, a compound of the type of a $\delta$-phase with a tetragonal lattice (a = 10.12 Å; c = 5.42 A; c/a = 0.535) and a microhardness of 700-800 kg per square millimeter.

## 24. Constitutional Diagram of the System Niobium-Rhenium

"The Constitutional Diagram of the System Niobium-Rhenium," by Ye. M. Savitskiy, M. A. Tylkina, and K. B. Povarova; Moscow, Atomnaya Energiya, Vol 7, No 5, Nov 59, pp 470-472

By using the melting point, microscopic, and X-ray diffraction methods and determining the hardness and microhardness of alloys, the constitutional diagram of the niobium-rhenium system was investigated from 0 % of Re to 100 % of Re in the temperature range of 0-3200°C. The results obtained are reported in detail.

## 25. Effect of $\gamma$-Radiation on Properties of Cation-Exchange Resins

"The Effect of $\gamma$-Radiation on the Physico-chemical Properties of Some Cation-Exchange Resins," by A. M. Semushin and I. A. Kuzin, Leningrad Technological Institute imeni Lensovet; Leningrad, Zhurnal Prikladnoy Khimii, Vol 32, No 10, Oct 59, pp 2193-2197.

In the course of an investigation of the changes that take place in the physicochemical properties of some cation-exchange resins under the action of $\gamma$-radiation emitted by $Co^{60}$ it was established that the capacity of KU-2, KB-4P-2, KFU, and KMT resins is reduced as a result of irradiation, whereas the capacity of KU-1 and SBS-1 resins remains practically unchanged after exposure to the same dose of radiation. A comparison of the stabilities of three types of carboxyl resins

under the effects of radiation was carried out. It was established that cation-exchange resins derived from methacrylic acid (KB-4P-2 and KMT) are relatively less stable than KFU resin, which is produced by the polycondensation of phenoxyacetic acid with formaldehyde.

It was also established that under the action of $\gamma$-radiation, deterioration of polymer chains takes place in all of the resins investigated, so that the resins swell to a greater extent in water or in an alkali solution. It was also established that the divinylbenzene contained in the KU-2 resin affects the solubility of this resin, but does not affect the lowering of the adsorption capacity per gram of totally dry resin produced by exposure to the radiation doses that were used in the investigation described.

[For additional information on nuclear fuels and reactor construction materials, see also Geochemistry and Inorganic Chemistry.]

## Organic Chemistry

### 26. Reaction of Esters of Ethylphosphinous Acid With Acrylic and Metacrylic Acid Studied

"Addition of Complete Esters of Phosphorous and Phosphinous Acids to Conjugate Systems. VIII. Interaction of Esters of Ethylphosphinous Acid With Acrylic and Metacrylic acids," by V. A. Kukhtin and L. A. Khismatullina, Scientific-Technical Cinephotographic Institute, Kazan Branch; Leningrad, Zhurnal Obshchey Khimii, Vol 29, No 10, Oct 59, pp 3276-3278

This research involved the study of the reactions of esters of ethylphosphinous acid with acrylic and metacrylic acids. According to their mechanism, these reactions are analogous to the reactions of $\alpha,\beta$-unsaturated acids with trialkylphosphites and esters of phenylphosphinous acids. It has been established that esters of phenylphosphinous acid react more actively than trialkylphosphites, not only with alkyl halides, but also with $\pi,\pi$-conjugate systems. Hence, the authors expected that the esters of ethylphosphinous acid would also react easily with $\alpha,\beta$-unsaturated acids. In reality, the tests showed that esters of ethylphosphinous acid interact with acrylic and metacrylic acids more actively than trialkylphosphites and esters of phenylphosphinous acid.

The ethyl ester of ethylphosphinous acid reacts more energetically with acrylic and metacrylic acids than the n-propyl and n-butyl esters. Thus, the reactivity of the various esters of ethyl phosphinous acids in relation to $\alpha,\beta$-unsaturated acids also depends on the radical size, just as in other cases of the Arbuzov Rearrangement reaction. Constants of the compounds synthesized are presented in one table.

27. Synthesis of Esters of $\alpha$-Hydroxy-$\beta,\beta$-dichloroisopropylphosphinic Acid

"On the Interaction of Dialkylphosphoric Acids With Aldehydes and Ketones. XXII. Esters of $\alpha$-Hydroxy-$\beta,\beta$-dichloroisopropylphosphinic Acid," by V. S. Abramov and A. S. Kapustina, Kazan Chemicotechnological Institute imeni Kirov; Leningrad, Zhurnal Obshchey Khimii, Vol 29, No 10, Oct 59, pp 3319-3321

This article presents a further investigation by the authors on the interaction of dialkylphosphoric acids with halosubstituted ketones. The condensation of symmetrical dichloroacetone with dialkylphosphites is studied herein. The reaction occurs at both room temperature and on a steam bath without a catalyst, yielding the esters of $\alpha$-hydroxy-$\beta,\beta$-dichloroisopropylphesphinic acid. Reaction time ranges from 10 hours at 100°C to more than 4 months at room temperature. The structural formula of this series:

$$(RO)_2\overset{\overset{O}{\|}}{P} - \overset{\overset{OH}{|}}{C}(CH_2Cl)_2$$

where R = $CH_3$, $C_2H_5$, $C_3H_7$, iso-$C_3H_7$, $C_4H_9$ or iso-$C_4H_9$.

The properties of the newly synthesized substances are presented in a table.

28. Properties of Trihalomethylsulfochlorides Studied

"On the Properties of Trihalomethylsulfochlorides," by K. A. Petrov and A. A. Neymysheva; Leningrad, Zhurnal Obshchey Khimii, Vol 29, No 10, Oct 59, pp 3401-3403

One of the characteristics and important properties of sulfochlorides is their capacity to form addition products with olefins on the short bond. This capacity has been used to synthesize $\beta$-halogenated sulfides which possess high physiological activity.

This article describes the reactions of trichloromethyl- and fluorodichloromethylsulfochloride with substances which have a short bond. In contrast to other sulfochlorides, trichloromethyl- and fluorodichloromethylsulfochloride react with difficulty with olefins to form the β-halogenated sulfides containing the trihalomethylgroup. Thus, trichloromethylsulfochloride reacts with cyclohexene only after long heating at 120°C, whereas methylsulfochloride reacts energetically even during cooling. Trihalomethylsulfochlorides react with allyl chloride under more severe conditions than with cyclohexene. Addition products are obtained with propylene only at 100-110° and under a pressure of 100 atmospheres. Addition products were not obtained at all with ethylene.

Fluorodichlorosulfochloride was obtained by two methods: substitution of chlorine by fluorine in trichloromethylsulfochloride with the aid of hydrogen fluoride and by the cleavage of fluorodichloromethylsulfodiethylamide with hydrogen chloride.

## 29. Reaction of α-Oxides of Piperylene With HCl Studied

"Interaction of α-Oxides of Piperylene With Hydrogen Chloride," by A. N. Pudovik, B. Ye. Ivanov, and Z. M. Zinov'yeva, Izhevsk Mechanical Institute; Leningrad, Zhurnal Obshchey Khimii, Vol 29, No 10, Oct 59, pp 3335-37

This experiment is another in a series on the α-oxides of piperylene being conducted by the authors. In earlier experiments, they have covered the reactions of α-oxides of piperylene with water, acetic anhydride, acetyl chloride and ethyl alcohol. Later, they studied the hydration and isomerization of α-oxides of piperylene (3, 4-hydroxydopentène-1) and also its reaction with acetone, methanol, and diethylamine.

This article describes the interaction of 3,4-hydroxydopentane-1 and 1,2-hydroxydopentena-3 with hydrochloric acid and hydrogen chloride. Hydrogen chloride and 3,4-hydroxydopentene-1 form the addition product 3-chloropentene-1-ol-4.

30. Arylaminolysis of Phenyldichlorophosphazosulfonaryls

"Arylaminolysis of Phenyldichlorophosphazosulfonaryls," by V. I. Shevchenko and V. T. Stratiyenko, Dnepropetrovsk Metallurgical Institute; Leningrad, Zhurnal Obshchey Khimii, Vol 29, No 10, Oct 59, pp 3458-3462

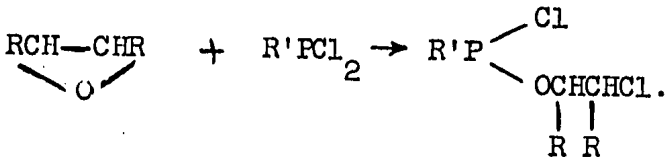
The reaction of phenyldichlorophosphazosulfonaryls with aniline was studied. Phenyldianilinophosphazosulfonaryls were synthesized: $ArSO_2N=P(C_6H_5)Cl_2 + 4C_6H_5NH_2 \rightarrow 2C_6H_5NH_3Cl + ArSO_2N=P(C_6H_5)(NHC_6H_5)_2$.

The alkaline hydrolysis of phenyldianilinochlorophosphazosulfonaryls was also studied. The monoanilides of arylsufonamidophenylphosphinic acids, $ArSO_2NH{-}PO(C_6H_5)(NHC_6H_5)$, were obtained from the hydrolysis of phenyldianilino- and phenylanilinochlorophosphazosulfonaryls.

31. Method Described for Obtaining 2-Chloroalkyl Esters of Alkylchlorophosphinous Acid

"Concerning a Method of Obtaining 2-Chloroalkyl Esters of Alkylchlorophosphinous Acid," by S. Z. Ivin and K. V. Karavanov; Leningrad, Zhurnal Obshchey Khimii, Vol 29, No 10, Oct 59, pp 3456-3458

Yields reaching 70% were obtained in the production of 2-chloroalkyl esters of alkylchlorophosphinous acid by reacting alkyldichlorophosphines with alkylene oxides:



The 2-chloroethyl and 2-chloropropyl esters of methylchlorophosphinous acid, the 2-chloroethyl, 2-chloropropyl, and 2-chlorocyclohexyl esters of ethylchlorophosphinous acid, the acid chlorides of 2-chloroethyl, and 2-chloropropyl esters of methylthiophosphinous acid were synthesized and characterized.

32. Synthesis of Diaryl Esters of N-phosphoric Acids of Aromatic Amidines

"Diaryl Esters of N-phosphoric Acids of Aromatic Amidines," by G. I. Derkach and A. V. Kirsanov, Institute of Organic Chemistry, Academy of Sciences Ukrainian SSR; Leningrad, Zhurnal Obshchey Khimii, Vol 29, No 10, Oct 59, pp 3424-3427

C-chloro-P,P-diaroxylsophosphazoaryls reacts with ammonia, diethylamine, and aniline to yield the diaryl esters of N-phosphoric acids of amidines, of N;N'-diethylamidines, of N'-phenylamidines, and of an aromatic series, according to the general equation:

$$ArCCl = NPO(OAr')_2 + 2NHRR' \rightarrow NH_2RR'Cl + ArC(NRR') = NPO(OAr')_2.$$

The diaryl esters of N-phosphoric acids of aromatic amidines possess very weak basic properties and split during thermal cleavage into the corresponding nitriles and amides of diphenylphosphates.

The physical characteristics of the newly synthesized products are presented in one table.

33. Conversion of Sodium Salts of Dialkylphosphates Described



"Reactions of Sodium Dialkylphosphites and Phosphonates," by K. A. Petrov, N. K. Bliznyuk, M. A. Korshunov, F. L. Maklyayev, and A. N. Voronkov; Leningrad, Zhurnal Obshchey Khimii, Vol 29, No 10, Oct 59, pp 3407-3411

"Sodium salts of dialkylphosphites are converted into the salts of esters of alkylphosphinic acids by the action of small quantities of dialkylphosphonates or alkyl halides."

34. Methods of Preparing Dialkylphosphates of Higher Alcohols Described

"Dialkylphosphates and Pyrophosphates," by K. A. Petrov, N. K. Bliznyuk, and F. L. Maklyayev; Leningrad, Zhurnal Obshchey Khimii, Vol 29, No 10, Oct 59, pp 3403-3407

" A method was developed for obtaining dialkylphosphates of higher alcohols by hydrolyzing chlorophosphates and by the reaction of phosphoryl chloride with water-alcohol solutions.

"It was shown that dialkylphosphates and dialkylpyrophosphates possess the capacity of alkylating aromatic amines."

35. New Esters of Phosphonosuccinic and Phosphonopropanetricarboxylic Acids Synthesized

"New Method of Synthesizing Esters of Phosphinic and Thiophosphinic Acids. XXXI. Addition of Phosphorous and Hypophosphorous Acids, Dialkylphosphorous Acids, and Esters of Phosphonoacetic Acid to Esters of Maleic Acid," by A. N. Pudovik, T. M. Moshkina, and I. V. Konovalova, Kazan Branch of the Scientific Research Cinephotographic Institute; Leningrad, Zhurnal Obshchey Khimii, Vol 29, No 10, Oct 59, pp 3338-42

"Phosphorous and hypophosphorous acids are added to esters of maleic acid after prolonged heating in the presence of catalysts.

"A number of new esters of phosphonosuccinic acids and phosphonopropanetricarboxylic acids with the butyl, isobutyl, and isoamyl radicals in the ester groups were obtained by the addition of dialkylphosphorous acids and esters of phosphonoacetic acid to esters of maleic acid."



36. Liquid-Vapor Equilibrium in Nitrogen—Helium and Helium—Methane Systems

"Liquid-Vapor Equilibrium in Nitrogen-Helium and Helium—Methane Systems," by F. F. Kharakhorin; Minsk: Inzhenerno-fizicheskiy Zhurnal, No 9, Sep 59, pp 24-29

"The volatility of helium in nitrogen-helium and helium-methane systems in the temperature range 68 to 150.3° K and at pressures from 4 to 215 atm is calculated from the data obtained in an experimental investigation of the liquid-vapor equilibrium of these mixtures.

At pressures from 40-45 to 215 atm, the solubility of helium in liquid nitrogen and methane can be calculated with sufficient accuracy by the Krichevskiy-Kazarnovskiy equation. The constants for this equation were found for the temperatures investigated.

The volatility of pure helium was calculated in the temperature range from 6 to 160°K at pressures of 300 atm."

37. USSR Research in the Field of Paramagnetic Resonance

"Investigations on Paramagnetic Resonance," by I. V. Aleksandrov and N. N. Korst; Moscow, Vestnik Akademii Nauk SSSR, Vol 29, No 10, Oct 59, pp 106-107

"On 1-5 June 1959, the Kazan' Affiliate of the Academy of Sciences USSR and Kazan' University held the current All-Union Conference on Paramagnetic Resonance. The conference was well attended. The reason for this was that electronic paramagnetic resonance and nuclear magnetic resonance, in addition to their importance in physics, have found applications in many fields of science and technology.

"Just as in former years, particular attention at the conference was paid to electronic paramagnetic resonance. However, nuclear magnetic resonance was represented this time by a much greater number of investigations than on former occasions. This circumstance is gratifying. Until recently, less attention was paid to problems of nuclear magnetic resonance in the USSR than abroad, with the result that a certain lag developed in USSR science in this respect. The conference at Kazan' demonstrated that this lag will soon be eliminated.

"The conference was opened by an introductory address given by Ye. K. Zavoyskiy, who analyzed the present-day status of work in the field of paramagnetic resonance. Then, reports were given on the investigation of the structure of organic and inorganic substances by electronic paramagnetic resonance methods. Of importance is the investigation of magnetic properties of a number of crystals. Problems in this field were discussed in papers given by representatives of Moscow, Kazan', and Tbilisi groups of physicists (A. M. Prokhorov and coworkers, S. A. Al'tshuler and coworkers, T. I. Sanadze, and B. G. Berlava). A considerable number of theoretical investigations in the field of electronic paramagnetic resonance were discussed which involved calculations of spin-lattice relaxation times, quantitative evaluation of fine structure spectra, and determination of the configuration of lines corresponding to electronic paramagnetic resonance signals. One may note a paper by N. N. Tikhomirova and V. V. Voyevodskiy, in which a simple and elegant method of analyzing the configuration of such lines was given and a method was reported for the determination of constants which characterize the lines.

"Great interest was evinced in reports on the application of electronic paramagnetic resonance in chemistry. It is known that measurements of electronic paramagnetic resonance make it possible to determine the structure of free radicals. It was emphasized at the conference that

this method may give new information on the distribution of electron density in the radical, on the type of the interaction of the radical with the environment, etc. Thus, a report by V. M. Chibrikin, S. P. Solodovnikov, and S. I. Vetchinkin brought out that the configuration of the lines corresponding to electronic paramagnetic resonance signals emitted by dibenzyl chromium and its derivatives depends principally on the structure of the radical itself, while the solvent exerts only a small effect on the configuration of the lines.

"Work by L. A. Blyumenfel'd and A. E. Kolmanson reported at the conference demonstrated that electronic paramagnetic resonance may yield much that is new in the investigation of biological objects.

"Considerable attention was paid to the technique of nuclear magnetic resonance measurements. Progress in the application of this method of investigation depends on the development of a nuclear magnetic spectroscope of sufficient resolving power. This problem was discussed in several reports (by F. I. Skripov and others, N. M. Iyevskaya and coworkers, Yu. S. Konstantinov and coworkers, L. L. Dekabrun and coworkers, and Yu. Ya. Shamonin). The discussion of this problem indicated that the principal difficulty consists in the creation of a stable magnet with a sufficiently uniform field.

"A considerable number of investigations dealt with the theory of nuclear magnetic resonance. A. A. Kokin and G. V. Skrotskiy discussed the development of the method devised by Kubo and Tomit as far as its applications to magnetically dilute solutions and solids are concerned. A lively discussion followed N. D. Sokolov's report concerning the effect of proton exchange on the width of the line representing the nuclear magnetic resonance signal. A paper by I. V. Aleksandrov concerning the computation of the magnitude of chemical shifts was also presented.

"Reports by Yu. S. Konstantinov and P. N. Borodin and F. I. Skripov on the nuclear magnetic spectroscopy of fluorine presented extensive experimental data which made it possible to establish that the relation between the magnitude of the chemical shift and the electrical negativity of neighboring atoms cannot be interpreted within the framework of present-day theories.

"A number of papers on applications of nuclear magnetic resonance in chemistry were also given. In this field, one must particularly note a report by R. A. Dautov and coworkers concerning the investigation of the structure of polymer molecules by the method of nuclear magnetic resonance and also a report by M. V. Vol'kenshteyn and coworkers.

"A paper by V. D. Korepanov on measurement of the relaxation time by means of the spin echo was received with considerable interest. Mastery of this method opens up new prospects in the field of nuclear spectroscopy. A series of reports on nuclear quadruple resonance by F. I. Skripov and coworkers must also be regarded as significant. This particular method makes it possible to investigate electric fields in crystals.

"The conference demonstrated that an increasing number of USSR scientific institutions are participating in research on paramagnetic resonance. This is shown by the fact that not only Moscow, Leningrad, and Kazan' scientific institutions were represented at the conference, but also institutions located at Perm', Krasnoyarsk, Sverdlovsk, Tbilisi, and other cities.

"At the final session of the conference, a resolution was passed which outlined a number of measures that would expedite the organization of continuous [series] production of instruments required in work on paramagnetic resonance. The resolution also recommended the publication of a number of manuals on problems of paramagnetic resonance."



38. Measurement of Electronic Paramagnetic Resonance at Low Temperatures

"Resonators for the Determination of Electronic Paramagnetic Resonance at Low Temperatures," by S. D. Kaytmazov and A. M. Prokhorov, Physics Institute, Academy of Sciences USSR; Moscow, Pribory i Tekhnika Eksperimenta, No 5, Sep/Oct 59, pp 107-110

A description is given of the design of resonators, by means of which one can determine the electronic paramagnetic resonance at low temperatures in the centimeter ( $\lambda$ = 2.5 and 3.2 centimeters) and decimeter ranges of wave lengths. The design is such that the sample can be placed into the resonator after the temperature of the latter has been lowered. The centimeter resonator range can be regulated for different wave lengths. The dimensions of the resonator are such that it can be immersed into a standard Dewar flank with a capacity of one liter.

## Radiation Chemistry

### 39. Hungarian Plastics Research Described

"Successful Experiments by Plastics Industry Researchers", by Erzsebet Toth; Budapest; Magyar Nemzet, 18 Nov 59, p 5.

The Organic Chemical Industry and Plastics Industry Research Institute in Budapest maintains contact with 40 enterprises, including the Pearl Button Factory (Gyongygombgyar); Ikarausz [a vehicle factory]; the Medical Sciences University, which uses polyester resins for anatomical preparations; the Leather Industry's Wooden Equipment Enterprise (Boripari Fakellekterme1o Vallalat); and the Audio and Film Technology Enterprise (Hang- es Kinotechnikai Vallalat)

At the institute, Gyozo Ferenczi designed a polyethylene acid pump. Its frame is of cast iron and weighs 20 kilograms; all other parts are of polyethylene and weigh a total of one kilogram.

One of the doors [in the laboratory] was marked with a "death's head." It leads to the control chamber for the "cobalt cannon." Janos Dobos, director of the department, said: "We recently placed into operation, together with the Central Chemical Research Institute of the Hungarian Academy of Sciences, the largest radiation source in Hungary to be used for chemical purposes." Using isotope radiation, new, special types of very pure synthetic materials can be produced -- for example, blood plasma substitutes. Polyethylene stable at 180 degrees centigrade can be produced here by applying radiation, whereas, without radiation, polyethylene can resist exposure to only 100 degrees centigrade.

[For information on radiochemistry, see Nuclear Fuels and Reactor Construction Materials.]

## Synthetic Fibers

### 40. Chinese Research on the Synthesis of Acrylonitrile Copolymer Fiber

"Copolymerization of Acrylonitrile and Polarized Vinyl Chloride," by Wang Hsiu-kang (王秀崗), Ko Tseng-p'ei (葛增培), and Hu Ya-tung (胡亞東), Institute of Chemistry, Academia Sinica; Peiping, Kao-fen-tzu T'ung-hsun (Macromolecular Report), Vol 3, No 2, Apr 59, pp 32-33

The authors state that the development [in China?] of polyacrylonitrile fibers has been hindered by the fact that polyacrylonitrile is difficult to dye and requires a special solvent for spinning.

Their investigation of the copolymerization of acrylonitrile and oriented vinyl chloride monomers, a project which is currently in the expanded experimentation stage, was undertaken for the purpose of preparing a relatively low-cost acrylonitrile copolymer fiber.

This article presents the conditions necessary for a good copolymerization reaction and for the spinning of the copolymer. The conditions were established by the authors after numerous experiments, they say.

## III. EARTH SCIENCES

41. Qualitative and Quantitative Characteristics of the Distribution Process of a Polydispersed Aerosol Described

"The Distribution of a Polydispersed Aerosol in a Turbulent Atmosphere at a Long Distance From an Instantaneous Point Source," by I. L. Karol' and A. Ya. Pressman, Institute of Applied Geophysics, Academy of Sciences USSR; Minsk, Inzhenerno-Fizicheskiy Zhurnal, No 9, Sep 59, pp 83-91

The article describes the qualitative and quantitative characteristics of the distribution process of a polydispersed aerosol at a long distance downwind from the source.

The relationship between the expressions for volume concentration and surface concentration of a polydispersed aerosol deposited from the atmosphere and boundary conditions on the surface of the earth is derived. Thus, formulas for the volume and surface concentrations are shown to be essentially different, depending on whether or not the "weightless" component of a polydispersed aerosol is reflected by the surface of the earth.

# IV. ELECTRONICS

## Communications

### 42. Method for increasing Range of Panoramic Receivers

"Automatically Adjustable Filters Using Reactance Tubes for Panoramic Reception," by N. I. Svetlov; Moscow, Radiotekhnika, No 9, 1959, pp 45-56

An effective method for increasing the dynamic range of a panoramic radio receiver is the use of automatically adjustable filters in the stages of the first i.f. amplifier of the wide-band channel. Electrically adjustable reactance tube filters with two phase-shifting circuits are considered in this article. Appropriate formulas are given, and a method for engineering computation of the filters is described.

Exploitation of a two-cycle band filter of this type in a panoramic receiver showed that the dynamic range of the receiver increases several times.

## Components

### 43. Cold-Cathode Tubes

"Tubes Weighing One Gram," by T. Fetisov; Moscow, Izvestiya, 4 Dec 59

Cold-cathode tubes, in many cases, successfully replace more expensive conventional electronic tubes, electromagnetic relays, and even transistors. Such tubes are about the size of a flashlight bulb, but have no filaments. The weight of a cold-cathode tube is from 0.5 to 1.0 g, and the service life is about 100,000 hours, as contrasted with only 1,000 hours for a conventional vacuum tube.

It was in the USSR that cold-cathode tubes were incorporated for the first time in various industrial electronic apparatus. Some of the Soviet electronic apparatus contain as many as 1,500 cold-cathode tubes. About one fourth of all the tubes in the series manufactured universal computer "Ural" are cold-cathode tubes.

It is probable that the cold-cathode tubes will, in the future, replace about one half of all vacuum tubes, relays, and transistors. L. N. Korablev, who suggested a better method for utilization of cold-cathode tubes, and a number of other organizations and enterprises using such tubes have urgently

requested a manifold increase in their production. At the present time, in the USSR, the demand for cold-cathode tubes is at several million units, and it is expected that the demand will soon increase by several times.

44. Hungarian Laboratory Produces Ferrite Memory Units

"A Visit to the Iron Industry Research Institute," by Valeria Bozsik; Budapest, Napszabadsag, 10 Nov 59, p 6

"According to Endre Nagy, Kossuth Prize winning mechanical engineer and chief of the powder metallurgy department of the Iron Industry Research Institute. "Some of the most important parts for modern signal equipment, electric brains, and various control devices are the ferrite rings used in memory units. These little rings, 2-7 millimeters in outside diameter, store the data.

Photographs in source show the rings, about half the size of a match head, and the "almost square" hysteresis loop, on a cathode ray tube screen, for a "satisfactory ring."

Nagy continues by saying that "the Central Physics Research Institute and the Beloiannisz Signal Technology Factory use ferrite rings in building various pieces of equipment. At this moment, we are the only ones in the country making them; we are using small-scale methods, but we completely satisfy the domestic demand."

"The rings are made of powdered manganese, magnesium, zinc, and iron oxide, mixed with materials which facilitate pressing, and formed into rings. The rings are then fired at a temperature of about 1,300 degrees centigrade...."

"We produced the primary materials with our own laboratory methods and had a relatively easy job because we got complete manufacturing documentation on a trip to the Soviet Union...."



45. Hungarian Researchers Produce High Purity Tungsten Filaments

"Semiconductors Transform Technology," by Gyorgy Szigeti, Academician and First Secretary of the Lorand Eotvos Physics Society; Budapest, Nepszabadsag, 22 Oct 59, p 6.

In September, 100 Hungarian physicists and 120 foreign physicists from nine countries participated in the colloquium at Balatonfured on solid state physics. The presidium of the Lorand Eotvos Physics Society has now evaluated the results of the meeting.

In the article, the author speaks in general terms about transistors, silicon rectifiers, etc. Hungarian researchers, he says, have succeeded in producing tungsten wire thinner than one hundredth of a millimeter which does not change form during 1,000 hours in an incadescent lamp at a temperature above 2,500 degrees centigrade.

## Instruments and Equipment

### 46. Two-Degree of Freedom Vectormeter

"Vectormeter With Two Degrees of Freedom," by L. F. Kulikovskiy and P. P. Kemeshis; Moscow, Izmeritel'naya Tekhnika, No 10, Oct 59, pp 28-32

Measuring instruments which determine the voltage and current vectors directly are becoming more widely used. With the voltage and current vectors obtained with the aid of this instrument, it is rather simple to reconstruct the vector diagrams for various ac devices, as well as to obtain directly the geometric locations of current and voltage vectors for a circuit with variable parameters.

A vectormeter with two degrees of freedom was developed and built at the Chair of Automation and Telemechanical Devices of the Kuybyshev Industrial Institute. The main components of this vectormeter are: annular magnetic circuit, toroidal 3-phase winding, round loop, mirror, elastic rod, screen with coordinate graph, light source, compensating circuit, illuminator winding, winding with a center tap, and phase-shifting winding. The electric compensator corrects the initial emf induced in the loop by the residual magnetic-flux coupling. A beam of light, after reflection from a mirror mounted on the loop, strikes a screen from which the radius-vector can be read. This vectormeter has the following operating characteristics: it draws power from a 220-v source; the maximum current measured is 5 milliamperes; maximum voltage measured is 1.1 volts; resistance of the loop is 200 ohms; current constant is $3 \cdot 10^{-5}$ a/mm; distance between scale and mirror is 220 mm; and induction in the gap is 620 gauss.

This vectormeter is intended for recording the current-vector hodograph, and the geometric locations of the current vectors can be recorded on film.

## Materials

### 47. Research in Electrographic Methods

"Great Possibilities in the Field of Electrography," by I. Zhilevich, Scientific Research Institute of Electrography; Moscow, Pravda, 13 Nov 59

The young Scientific Research Institute of Electrography at Vil'nyus has proven, through extensive research, that electrographic methods of image reproduction are applicable to many fields of science and engineering. The institute has designed an electrographic device for reproduction of documents in large number from transparent originals, blueprints, or photographs.

The institute, in cooperation with the Institute of Physics of the Earth, Academy of Sciences USSR, has designed an electrographic attachment to conventional oscilloscopes for recording low-frequency processes on semiconductor coated photographic tape. A special machine designed by the institute has been installed at the Paper Plant imeni Yu. Yanonis of the Lithuanian Sovnarkhoz for industrial-scale production of semiconductor coated photographic paper.

The author stresses the fact that the experimental facilities at the Scientific Research Institute of Electrography, which is the only research establishment of its kind in the country, are far from being satisfactory. Therefore, there is an urgent need for expansion of experimental facilities at the institute and the need for establishment of a specialized enterprise to manufacture electrographic equipment within the borders of the Lithuanian economic region.

### 48. Recent USSR Work on Semiconductors

"Investigation of Semiconductor Materials," by B. T. Kolomiyets, Doctor of Technical Sciences; Moscow, Vestnik Akademii Nauk SSSR, Vol 29, No 10, Oct 59, pp 107-108

"The Institute of Metallurgy imeni A. A. Baykov and the Physico-Technical Institute held, on 22-26 June 1959 in Moscow, the Fourth Conference on Semiconductor Materials, which was concerned principally with compounds and solid solutions. More than 60 institutions were represented at the conference.

"A considerable number of reports dealt with compounds of the $A^{III}B^{V}$ type. Among these materials, particular attention was paid to indium antimonide, aluminum antimonide, gallium antimonide, and gallium arsenide. Considerable progress has been made in preparing these materials in a state

of high purity. Specifically, indium antimonide with a concentration of carriers derived from impurities amounting to $10^{12}$ - $10^{13}$ $cm^{-3}$ and a mobility of current carriers amounting to $10^6$ $cm^2$/ volt.sec at 77°K has been obtained. In addition to work done on the preparation of materials in a state of ultimate purity, investigations have been conducted with the aim of clarifying the role played by impurities.

"Another group of papers, which reported work done by chemists, dealt with the results of investigations of different semiconductor systems and phases. These investigations were concerned mainly with materials produced on the basis of elements belonging to the VI group of the periodic system, namely, sulfur, selenium, and tellurium.

"The majority of reports were on the preparation and properties of solid solutions of the substitution type and of materials of complex composition. The interest evinced toward this type of semiconductor materials is due to the possibility opened up for controlling the properties of materials by changing their composition. Considerable interest was aroused by reports dealing with materials which have the structure of zinc blende (sphalerite) and with vitreous semiconductors.

"Much attention was paid at the conference to problems involved in the preparation and investigation of two-element compounds, a class of substances which has been investigated to only a minor extent hitherto. Among compounds of this type, antimony selenide appears to be particularly promising from the standpoint of practical applications.

"Problems related to the thermodynamics of semiconductors were discussed in some detail. One may note that progress has been made in work on the determination of thermodynamic constants of semiconductors.

"A number of reports dealt with the technology of the production of semiconductors of simple, as well as complex, composition.

"The conference demonstrated that definite progress has been made in research on semiconductors: the range of materials being investigated has expanded, the volume of work being done has increased, and the quality of the investigations being carried out has been raised.

"The conference made a number of important decisions with regard to future development of research in this field and outlined the principal lines to be followed in formulating the theory of semiconductor materials and also in developing new substances for technical applications.

"It is planned to hold the next regular conference on semiconductors at Leningrad in 1961."

49. New USSR Research on Ferrites

"Ferromagnetic Semiconductors," by Prof K. A. Belov; Moscow, Vestnik Akademii Nauk SSSR, Vol 29, No 10, Oct 59, pp 108-109

"During recent years, there has been a greatly increased interest in the new magnetic materials called 'ferrites,' which represent compounds of ferric oxide with oxides of different other metals (divalent metals in the majority of cases). Because they combine ferromagnetic properties with semiconductor characteristics, these materials soon found extensive application in radio engineering, computers, automatic control, etc.

"Investigation of ferrites is also very important from the scientific standpoint. Research on correlations between their magnetic and crystal-chemical properties will contribute much that is new in the development of the solid state theory.

"The Third All-Union Conference, dealing with the physics, physico-chemical properties, and physical aspects of the application of ferrites, was held at Minsk on 1-7 June 1959.

"As distinguished from previous conferences, the program of this conference was the first to include reports dealing with the investigation of magnetic and electrical properties of single crystals of ferrites. Until quite recently, only polycrystalline ferrites (produced by the methods of ceramic technology) were subjected to study in the USSR. However, to obtain an adequate understanding of the nature of the properties of ferrites, investigations must be conducted on single crystals.

"At the Institute of Crystallography, Academy of Sciences USSR, large single crystals of ferrites with a spinel structure are now being grown. Magnetic anisotropy, galvanomagnetic phenomena, ferromagnetic resonance, and rotation of the plane of polarization of electromagnetic waves are being studied on these crystals. It was established that some single crystals of the manganese-magnesium ferrite exhibit a very narrow line of ferromagnetic resonance absorption (12-15 oersted) and a sufficiently high saturation magnetization. Single crystals of the manganese ferrite show a high specific rotation of the plane of polarization of electromagnetic waves in relatively weak fields.

"Research on single crystals of ferrites is also being expanded at other USSR scientific institutions. The Institute of Crystallography has supplied these institutions with the necessary equipment and drawings and conducts consultations with them. Particular interest is being evinced in the investigation of the ferromagnetic resonance characteristics

of single crystals of yttrium ferrite with a garnet structure. The Institute of Semiconductors, Academy of Sciences USSR, and the Institute of Crystallography, Academy of Sciences USSR, grow crystals of this ferrite with a width of the resonance line amounting to 5-6 oersteds. This makes it possible to approach the solution of the problem in regard to the creation of a amplifier and generator of super-high frequencies on the basis of materials of this type.

"A considerable number of reports were concerned with the investigation of the properties of ferrites of rare-earth elements (gadolinium and others) which have a structure of the garnet or perovskite type. These ferrites have very unusual magnetic properties. Experiments have shown that these properties change to a considerable degree when a very small number of iron ions are replaced by ions of other elements in the lattice of rare-earth ferrites (Institute of Semiconductors and Physics Faculty of Moscow University). It is quite obvious that in order to understand the phenomena which take place in these ferrites, one must investigate thoroughly their crystal-chemical structure.

"The conference paid much attention to problems pertaining to the chemistry and technology of the preparation of polycrystalline ferrites, a class of materials which is of great technical importance. The principal problem here is assuring the reproducibility and uniformity of the properties of the ferrites that are produced. This is a very complex problem because the properties of ferrites depend on many factors (the purity of the initial oxides, the conditions under which the material has been sintered, the pressure that has been applied, etc.). In connection with this problem, one must regard as noteworthy work done at the Chair of General Chemistry, Moscow State University, on the production of ferrites by a new, 'nonceramic' method.

"A special subject of discussion was formed by the information given in a large number of papers that dealt with the investigation of ferrites with a rectangular hysteresis loop. These ferrites are used for the magnetic elements of computers. One must note the extensive work on the behavior of ferrites in pulsating magnetic fields that has been done by a group of investigators at the Moscow Power Institute. Investigation of the remagnitization of ferrites under the effect of pulsating fields is of importance from the standpoint of application of the results in work on the improvement of rapidly acting computers of small dimensions and the development of new computers of this type. Solution of problems in this area is also of importance in connection with developments in other technical fields.

"Reports on the investigation of static magnetic characteristics of ferrites with a rectangular hysteresis loop (Academy of Sciences, Belorussian SSR) and also on the investigation of magnetic viscosity (Physics Faculty, Moscow State University) attracted considerable attention.

Discussions were held on results obtained in the investigation of ferrites with a high coercitivity, which at present are receiving increased recognition in technology as cheap and effective materials for permanent magnets. In connection with this, one must note work on the investigation of the domain structure of barium ferrites, which contributes to an understanding of the mechanism of remagnetization of ferrites with a high coercitivity (Institute of Metal Physics, Academy of Sciences USSR).

"Many papers were concerned with the investigation of electric and galvanomagnetic properties of ferrites. Knowledge of these properties is of great importance from the theoretical standpoint. Many ferromagnetic anomalies of electrical characteristics exhibited by materials of this type may not be subject to relationships established for metals and alloys. Investigation of the dependence of the specific conductivity and of the galvanomagnetic effects (primarily, the Hall effect) on the temperature and correlation of the data obtained with the temperature course of the spontaneous magnetization in single crystals and polycrystalline materials will aid in the solution of problems pertaining to the state of the energy spectrum of electrons in the materials in question. The most interesting temperature range in this respect corresponds to the region of magnetic transformation (Curie point), in which the effects of the ferromagnetic and antiferromagnetic states of matter on the electrical properties must be clearly expressed.

"In connection with this, one must note the results obtained at the Chair of General Physics, Moscow State University, in the investigation conducted there on the Hall effect in ferrites close to the Curie point. In the report on the work in question, a method is described for the determination of the so-called ordinary or classical Hall constant, on the basis of which the concentration of current carriers in ferrites can be calculated. Investigations of the anisotropy of galvanomagnetic phenomena in single crystals of ferrites and of the dispersion of electrical conductivity and of the dielectric constant are also of importance for the understanding of the mechanism of conduction in ferrites.

"A number of reports dealt with problems of magnetic spectroscopy, magneto-optics, and the behavior of ferrites at super-high frequencies. Investigation of these problems is of great technical importance because it furnishes information that is of value in connection with the application of ferromagnetic semiconductors in high-frequency radio engineering.

"Several papers were concerned with the theory of antiferromagnetism and of the magnetic anisotropy of ferrites (Institute of Metal Physics and Institute of Crystallography); unfortunately, there were very few theoretical reports, which is a serious shortcoming.

"On the whole, the conference demonstrated that both qualitatively and quantitatively the scope of research on ferromagnetic semiconductors in the USSR has widened considerably. However, a great amount of work still remains to be done in this important field of knowledge because many problems of the theory of ferrites have not been solved as yet. It is necessary to establish the nature of the rectangular characteristic exhibited by hysteresis loops of manganese-magnesium ferrites, to formulate an adequate theory interpreting the width of the ferromagnetic resonance absorption line, and to expand research on the domain structure. One must also greatly expand the application of neutronographic methods for the investigation of the atomic and magnetic structure of materials exhibiting the properties of ferrites and antiferromagnetics."



50. Crystal Chemistry of Piezoelectrics

"Some Problems of the Crystal Chemistry of Piezoelectrics," by I. S. Rez, TsNILP. [Central Sci-Res Lab of Piezotechnics, Ministry of Radio Engineering Industry USSR), Moscow; Leningrad, Zapiski Vsesoyuznogo Mineralogicheskogo Obshchestva, Vol 88, No 5, Sep/Oct 59, p 624

The author of the report discussed some problems pertaining to the crystal chemistry of piezoelectrics. Starting from experimental data and general crystal-chemical considerations based on the concept of structural types, the author formulated the following "genetic" principle: it is advisable to search for new piezoelectrics among substances of a family at least one representative of which exhibits a pronounced piezoelectric effect. In doing this, principal attention must be paid to the investigation of different modifications of the typical structure, first, those modifications which tend to increase the degree of assymetry, increase the dipole moment of the molecule, eliminate antiparallel packing of structural dipoles, reduce the density of packing, and increase structural strains by reason of structural dipoles, reduce the density of packing, and increase structural strains by reason of the deformation of valency angles and shortening of bonds. The use of the genetic criterion enabled the author and his co-workers to discover more than 425 new piezoelectrics by investigating substances in specially developed highly sensitive equipment designed for the testing of small samples. The results obtained confirm the validity of the proposed criterion as a means of predicting the suitability of substances as piezoelectrics. Critical consideration of data obtained in the investigation of inorganic and coordination compounds has indicated the following:

(a) Compounds of a type exhibiting a piezoelectric effect contain easily deformable atomic structures (pyramids, tetraheders, and octaheders and combinations of these structures); difficulty deformable atomic structures of the type of linear chains and plane triangles are not conducive to the development of piezoelectric effect;

(b) Piezoelectric properties are apparently exhibited by substances with predominantly covalent bonds;

(c) In cases of isomorphous substitution, the piezoelectric effect which is due to the skeleton of the structure is preserved, being modified, depending on the nature of the atom or the radical functioning as the substituent;

(d) The relationships outlined above also apply to organic compounds.

By applying the methods mentioned above, more than 20 types of piezoelectrically active compounds were found which have a high percentage of piezoelectrics in the "genetic series" derived from them.

[SIR note: This is an abstract of a paper presented at the International Session on Crystallography Commemorating the 40th Anniversary of the Death of Ye. S. Fedorov (Leningrad, 21-27 May 1959).]

51. New Method of Growing Single Crystals of Germanium

"Growing of Single Crystals of Germanium in Salt and Oxide Melts," by V. N. Maslov, Yu. V. Granovskiy, and V. D. Samygin; Leningrad, Zhurnal Prikladnoy Khimii, Vol 32, No 11, Nov 59, pp 2571-2574

It has been established that it is possible to grow from melts consisting of $B_2O_3$ and KCl single crystals of germanium with a specific resistance approaching 10-15 ohms X cm and a length of diffusion paths of secondary carriers up to 0.5 mm. It was found that the fused salt phase is capable of suppressing the effect exerted by extraneous crystallization nuclei and of protecting the molten germanium, as well as the growing crystal, from oxidation.

52. Procedure for Growing Single Crystals in Vacuum or an Inert Gas by Verneuil's Method

"Equipment for Growing Single Crystals of High-Melting Substances in Vacuum or an Inert Gas Without a Crucible," by V. V. Dobrovenskiy, Institute of Crystallography, Academy of Sciences USSR; Moscow, Pribory i Tekhnika Experimenta, No 5, Sep/Oct 59, pp 134-137

Growing of single crystals by direct melting of a highly disperse powder in the flame of an oxygen-hydrogen burner and subsequent crystallization were already applied by Verneuil in 1902 for the preparation of synthetic ruby crystals from aluminum oxide. At present, by applying this method, single crystals of ferrites, spinels, mullite, corundum, and a number of other materials are produced. However, the method in question is not suitable for growing single crystals of substances which interact readily with the gas phase during the process of crystallization and subsequent cooling. The difficulties inherent in this method can be overcome only by letting the substances in question crystallize in vacuum or in the atmosphere of an inert gas after a melt containing them has been produced by subjecting an appropriate mixture to electric heating. Equipment of this type that is heated by an induction current has been described. By using this equipment, polycrystalline silicon could be obtained, which was subsequently purified by vertical zone refining. For the purpose of growing single crystals of silicon and of barium titanate directly from powder in vacuum or in the atmosphere of an inert gas, the author has designed and constructed special equipment which is heated by means of a graphite resistance heater. Temperatures up to 2,000°C are employed in the operation of the equipment described. A new appliance for the uniform feeding of powder has been designed and forms a part of this equipment.

53. Production of Plastic Scintillators With a Large Volume

"Preparation and Properties of Plastic Scintillators With a Large Volume," by G. A. Kirdina and N. K. Pereyaslova, Institute of Applied Geophysics, Academy of Sciences USSR; Moscow, Pribory i Tekhnika Eksperimenta, No 5, Sep/Oct 59, pp 47-51

Scintillator plastics exhibit a number of specific characteristics, among which is a relatively short time of de-excitation amounting to approximately $10^{-9}$ - $10^{-8}$ seconds, a high degree of transparency, high mechanical strength, stability at elevated temperatures, and good workability. Because they have these characteristics, plastic scintillators can be used in experiments on the investigation of cosmic rays, the investigation of properties of particles that form in accelerators, and in the dosimetry of ionizing radiation. Scintillators with a large volume can be used to advantage in highly sensitive intensimeters for $\gamma$-rays.

Thus, the development of methods for the production of plastic scintillators with a large volume is of considerable importance. In the present work, a method is described for "growing" scintillator polystyrene blocks with a volume up to 10,000 cubic centimeters. The result of the determination of some characteristics of the scintillator phosphors prepared in this manner are described, and details are given on the method of preparation. Before the purified styrene was subjected to polymerization by the method described, 2% of p-terphenyl and 0.02% by weight of POPOP has been added to it. The time of de-excitation of the polystyrene prepared in the manner described was compared with that of polyvinyltoluene scintillators prepared at the Joint Institute of Nuclear Research and that of liquid scintillators representing a solution of terphenyl in toluene to which POPOP had been added.

## Miscellaneous

### 54. Fourth Conference on Radioelectronics To Be Held in 1960

"Third All-Union Conference on Radioelectronics" (unsigned article); Gor'kiy, Izvestiya Vysshikh Uchebnykh Zavedeniy - Radiofizika, Vol 2, No 4, 1959, p 666

Among the recommendations made at the Third All-Union Conference on Radioelectronics in Kiev was the proposal that the regular fourth conference of the Ministry of Higher Education USSR on radio engineering and electronics be called in November 1960 in Khar'kov.

### 55. International Conference on Microwave Links, Budapest

"International Scientific Conference on Microwave Links" (unsigned news item); Budapest, Magyar Nemzet, 11 Nov 59, p 5

A 4-day colloquium on establishing microwave links began Tuesday, 10 November 1959, at the Hungarian Academy of Sciences; it was organized by the Technical Sciences Department of the Hungarian Academy of Sciences and by the Signal Technology Association (Hiradastechnikai Egyesulet). Twenty-five foreign guests from the US, England, France, and Austria are participating, in addition to those from the Soviet Union and the People's Democracies.

Geza Bognar, Kossuth Prize-winning academician, read the opening address Tuesday before an audience of about 300. Papers were then read by L. Lewin (London), H. Dobesch (Berlin), and Sandor Csibi and Peter Rona of the Telecommunications Research Institute (Tavkozlesi Kutato Intezet).

H. Schulanke (Berlin) opened the afternoon session. Papers were then read by Gyorgy Pribelszky, Tibor Hoffmann, Andor Budincsevics, Andras Dallos, Tibor Horvath, Janos Nagy, Janos Erdelyi, and Gyorgy Gellen of the Telecommunications Research Institute.

"International Conference on Microwave Links" (unsigned news item); Budapest; Nepszabadsag, 24 Nov 59, p 9

At the recent Budapest International Microwave Conference, Soviet Academician V. I. Siforov reported on his theoretical research aimed at eliminating conditions which disturb radio reception. Lewin of England, De Castel of France, Prosin of the Soviet Union, and Beckman of Czechoslovakia read papers dealing with problems of atmospheric scattering of radio waves, thus contributing to a technical solution of relay stations far removed from one another. The paper of the absent Simon (France) read at the conference also dealt with this problem. The Germans Dobesch and Schulanke discussed mathematical problems pertaining to signal technology. There were 10 foreign papers and 21 domestic ones. Tibor Hoffmann (Hungary) read a paper on molecular amplifiers.

## V. ENGINEERING

### Automatic Control Engineering and Computers

56. Application of Computers to Automation

"With the Aid of Computers," by B. Bukiya, Tbilisi Scientific Research Institute of Instrument Building and Automation Equipment; Moscow, Promyshlenno-Ekonomicheskaya Gazeta, 29 Nov 59

Various electronic computers for the control of industrial processes are now in the process of design at the Tbilisi Scientific Research Institute of Instrument Building and Automation Equipment. Such special electronic computers are now being designed for the control of blast-furnace operation, for cupola furnace operation, for the regulation of electric power distribution in power networks, and for automation of oil refining and other chemical processes.

It is planned to design more than 100 such special control devices during the current Seven-Year Plan.

57. Application of Computers in Rail-Transport Automation

"To New Victories on the Labor Front" (unsigned article); Moscow, Avtomatika, Telemekhanika i Svyaz', No 11, Nov 59, pp 1-3

The article contains the following passages:

"In conjunction with the introduction of new 127-ton rollerbearing cars to rail transport, the retarding efficiency of the gravity classification yards must also be increased. The use of new braking devices will increase this efficiency without necessitating any changes in the length or grade of the tracks.

"The TsNII (Central Scientific Research Institute of Rail Transport) and Giprotranssignalsvyaz' have developed methods for automatic retarding of cars on mechanized gravity classification yards by utilizing computers and radar-type car speedometers. The TsNII system is now being tested at the Losinoostrovskaya station's mechanized gravity classification yard, and the Giprotranssignalsvyaz' system is being tested at the mechanized gravity classification yard of the Leningrad-Sortirovochnaya station.

"At present, the signalization and communication administration employs 2,570 engineers and 7,240 technicians. This year, the schools of the Ministry of Communications will graduate 413 engineers and 1,656 technicians for signal, centralization, blocking, and communications services. The number of such graduates will increase each year. In addition to the departments at the Leningrad and Tomsk institutes, new departments of automation, telemechanics and communications will be established at the Institutes of Rail Transport in Moscow, Sverdlovsk, Tashkent, and Khar'kov."



58. Hungarians Use Analogue Computer to Solve Power Net Problems

"A Visit to VILLENKI," by Geza Simonffy; Budapest, Muszaki Elet, 29 Oct 59, p 13

For the past 6 years, the Electric Energetics Research Institute (VILLENKI) has operated a model of an alternating-current power net. This apparatus, which is essentially an analogue computer, has been used for several examinations in connection with international cooperation in power distribution.

## Electrical Engineering

59. Low-Frequency Electronic Converters

"2-0.5 Cycle Electronic Frequency Converters for Electromagnetic Stirring Installations of Arc Furnaces," by N. S. Siunov, M. G. Rezin, Ya. I. Drobinin, and Ye. M. Glukh; Moscow, Elektrichestvo, No 11, Nov 59, pp 41-43

The first experimental-industrial arc furnace with electromagnetic stirring of molten metal was installed in 1956. A low-frequency (2-0.5 cycle) two-phase current was fed to a stator winding mounted under the bottom of the furnace. The bottom jacket of the furnace was made from nonmagnetic steel. The rotating magnetic field created by the stator induces an eddy current in the molten metal, which, in turn, creates a dynamic moment sufficient to stir effectively the molten metal in the furnace.

A very effective low-frequency electronic converter was designed at the Ural Polytechnic Institute imeni S. M. Kirov in cooperation with the "Uralelektroapparat" plant. This electronic frequency converter incorporates 12 rectifiers assembled in two groups of 6 each and interconnected into a three-phase counter-parallel circuit. Each of the group of three rectifiers conducts current during one half of the cycle, while the group

of other three is cut out by the grid bias. An independent grid control for each three rectifiers is achieved with the aid of a static phas regulator. A group of six rectifiers feeds one phase of the two-phase winding of the stator. A selsyn-rheostat, which supplies power to the magnetizing winding of the phase-regulator, acts as a transducer for obtaining a low-frequency sinusoidal current. The selsyn-rheostat is driven by a 20-w-dc motor through a reduction gear. One mercury-arc rectifier of RMNV-1,000 X 12 type with 12 insulated anodes and 4 independently controlled grid circuits was used in one industrial installation carrying 2,000 ampere current per phase of the stator at a frequency of 2-0.5 cycles. An electronic frequency converter of this type will be installed at the Verkh-Isetsk metallurgical plant for electromagnetic stirring of metal in a 25-ton furnace. This type of frequency converter can be applied to furnaces up to 180 tons capacity.

## 60. Revision of Design Methods and Specifications for Dam Construction

"For Further Progress in Hydroelectric Construction," by V. S. Eristov, Ministry for Construction of Electric Power Stations; Moscow, Gidrotekhnicheskoye Stroitel'stvo, No 11, Nov 59, pp 1-4

The Ministry for Construction of Electric Stations, in cooperation with its design, scientific-research, and construction organizations, has reviewed the blueprints and estimates for the 22 hydroelectric stations now in construction and concluded that a reduction from 47 to 39 billion rubles, i.e., about 17%, of the original estimates, can be secured by applying more progressive engineering principles.

The suggested progressive measures are of the following nature: lowering the presently accepted unjustifiably high design safety factors; reduction in the volume of gravity-concrete dams by incorporating wider joints which help to lower the back-pressure (Bratskaya, Krasnoyarskaya, and Bukhtarminskaya stations); switching from gravity type dams to arch types (Ladzhanuri) which require only about one third of the concrete; replacement of some of the concrete members of the dam by other locally available materials; an increased water discharge per unit length of the spillway section of the dam, thus reducing the total length of the concrete section of the spillway; elimination of the conventional generator room (Kremenchugskaya and Dneprodzerzhinskaya); increasing the size of individual hydraulic turbogenerators, which permits and increase in total capacity of the station without additional investment (Krasnoyarskaya and Bratskaya); elimination of some dispensable work in preparation of water reservoir (Stalingradskaya, Bratskaya, Kremenchugskaya, and Votkinskaya); and a decrease in the capacity of concrete mixing and other auxiliary facilities (Bratskaya and others).

## Surveying, Prospecting

### 61. Book on Interpretation of Dimensions of Aerial Photographs

Izmeritel'noye Deshifirivovaniye Aerosnimkov v Polevykh Usloviyakh (Dimension Interpretation of Aerial Photographs in Field Conditions), by N. G. Kell', Laboratory of Aeromethods of the Academy of Sciences USSR, Publishing House of the Academy of Sciences USSR, Moscow, 1959, 124 pp

The book acquaints the reader with the geometric and geodesic properties of aerial photographs and the most efficient methods of utilizing these properties in field conditions.

The principal protion of the book is given to dimension interpretation of aerial photographs used in different geological-geomorphological operations.

The book is intended for a wide group of specialists and researchers, topographers, geologists, geomorphologists, etc.

### 62. Earth's Magnetic Field Utilized by New Method of Geophysical Prospecting

"Geophysical Prospecting Improved", (unsigned item); Moscow, Izvestiya, 1 Dec 59

A new method of geophysical prospecting is reported as having been developed in the L'vov Institute of the Geology of Useful Minerals of the Academy of Sciences, Ukrainian SSR. The new method is based on the use of the natural pulsations of the Earth's electromagnetic field. The advantage of this method consists in the fact that it dispenses with the need for cumbersome power apparatus. This will reduce the cost of prospecting many times in comparison with existing methods requiring the creation of artificial electromagnetic fields.

## Miscellaneous

63. New Instrument and Machine Building Standards

"Important Problems in Development of National Standards and Specifications" (unsigned article); Moscow, Izmeritel'naya Tekhnika, No 11, Nov 59, pp 1-3

The article contains the following passages:

"During the next 2 years, machine building specifications covering the whole range of instruments, attachments, dies, and other technical equipment of general use should be worked out; and during the next 3-4 years, the machine building standards and specifications to cover common machine units and parts and the most important mass-produced equipment for mechanization and automation should be worked out.

"During the first half of November 1959, the Committee on Standards, Measures, and Measuring Instruments at the Council of Ministers USSR has approved the standardization program for 1960.

"In 1960, for the first time, the standards for radio-engineering measuring instruments, such as tube voltmeters, standard signal generators, heterodyne and resonance frequency meters, pulse generators, and meters for percentage of amplitude modulation, were worked out."



64. Rocket Drills Rocks

"Rocket for Drilling Rocks," TASS' Kishinev, Sovetskaya Moldaviya, 11 Sep 59

"This automatic rocket is intended, not for interplanetary flight, but for use on earth, for sinking shafts into solid rock with the aid of a flaming jet at supersonic velocity. The motor of this rocket, in which liquid fuel is used as in jet aircraft, does not lift the rocket into space. The powerful high-temperature gas torch, which is ejected from the nozzle of the rocket at a velocity of 2,000 meters per second, strikes the rock and breaks it into tiny pieces. Drills can be made which were unattainable with drilling equipment available before in mining practice The self-propelled, thermal-drilling device was designed by Kazakhstan scientists in cooperation with engineers. As distinguished from existing thermal drills, the new machine is completely automatic."

65. Hungarians Report Soviet Development of New Structural Glass

"Sital" (unsigned news item); Budapest; Muszaki Elet, 29 Oct 59, p 10

A new material named "Sital" (Szital) has been developed in the glass laboratory of the State Glass Industry Scientific Research Institute of the Soviet Union. The primary material is a glass of a peculiar structure; it is microcrystalline, the particles being approximately one micron in size. This microcrystalline structure, which is responsible for the properties of the glassy material, is produced through heat treating.

Sital is four times stronger than glass; it is harder than high carbon tempered steel; it is not brittle; and it is lighter than aluminum. Its electrical characteristics are better than those of ceramic materials. It has very high heat resistance and does not soften even at 1,400 degrees centigrade.

Ball bearings made of this material have proved long lasting, even in aggressive media at high temperatures. Sital is used for containers, machine parts, pipes, and fireproof walls.

## VI. MATHEMATICS

### 66. Soviet Cyberneticists Visit Hungary

"Soviet Cyberneticists Visit Hungary" (unsigned article); Budapest; Magyar Nemzet, 25 Nov 59, p 3

According to an announcement in source, M. A. Gavrilov, head of a laboratory of the Institute of Automatics and Telemechanics of the Academy of Sciences USSR; V. P. Smiryagin," chief of the electronic computer utilization department" of the Computer Center of the Soviet Academy; T. I. Milchenko, chief engineer of the department; and D. I. Golenko, scientific worker, arrived in Budapest for a 3-week visit at the invitation of the Hungarian Academy of Sciences.

The guests will study the work of the Szeged Mathematical Research Institute of the Hungarian Academy of Sciences and will discuss plans for joint work in the coming year. The Soviet cyberneticists will also visit the Mathematical Research Institute of the Academy, the Cybernetics Research Institute, the Technical University, and several institutions and plants.

# VII. MEDICINE

## Antibiotics

### 67. Review of Book on Antibiotics

Puti Izyskaniya Novykh Antibiotikov (Methods of Searching for New Antibiotics), by G. F. Gauze, reviewed by M. M. Mayevskiy; Moscow, Antibiotiki, Vol IV, No 5, Sep/Oct 59, pp 110-111

Guaze's book provides data on the methods of searching for antibacterial, antiviral, and antitumorous antibiotics. It contains five chapters, each followed by a bibliography on the subject discussed in the chapter. Chapter 1 contains information on the different soil microbe-antagonists, and on the ecological significance of antibiotics. Data on the classification of the microbes which form the antibiotics is provided in Chapter 2. Proper classification of these microbes, the author states, is essential to the success of the search for new antibiotics. Chapter 3 deals with methods of isolating antibiotics from cultural fluids and methods for determining the chemotherapeutical properties of the antibiotics. Methods of searching for and developing antiviral antibiotics are discussed in Chapter 4. Considerable space is given to the problem of utilizing bacteriophages in the search for antiviral antibiotics. The fifth and final chapter of the book deals with the problem of the search for antitumorous or "anticancerous" antibiotics. Research work done by the author is described in this chapter.

## Aviation Medicine

### 68. Possibilities of Human Space Flight Discussed

"A Human Being in Outer Space" (unsigned article); Moscow; Meditsinskiy Rabotnik, No 80 (1828), 6 Oct 59, p 2

Laboratories of many scientific research institutes are concentrating their attention on developing conditions which will be tolerable for a human being traveling through outer space in a rocket. There are many researchers in the Soviet Union who are busy trying to develop an in-flight feeding system. This statement was given by G. A. Arutyunov, the director of a laboratory working on this problem.

Scientists are familiar with the use of concentrated food in flights of short duration, lasting from 2-3 hours to several days. A food prepared from products that have high food value and a lower fat content than that required by people on earth is recommended. It must contain normal amounts of protein, carbohydrates, and vitamins. The bulk and weight of a human astronaut's food must be kept at a minimum and it must not spoil easily (concentrates, canned food).

Feeding may be achieved in a satisfactory manner by the intake (every 3-4 hours) of smaller quantities of food than are required on earth. The intake of food under condition of weightlessness is particularly complicated. A human being cannot drink water from a glass while he is in a state of weightlessness, because "weightless" water acquires spherical shape. Poured out of the glass, it will hover in the rocket in the form of one or several ellipsoids. Water must therefore be drunk through a special dispensing container with a tube attachment.

Since food particles may fall "down," float through the air, and enter human nostrils, mouth, eyes, and ears under condition of weightlessness, it is advisable that food placed in the cabin consist of solid, compact pieces.

Food intake will have to be different when an oxygen mask is worn. The food must be in liquid form and must be prepared from highly nourishing products. Concentrated soup in puree form and made of highest quality meat, chocolate, fruit, and cream is recommended. Equipment should include a jar with a tube attachment; food passes through the tube and through a special valve in the oxygen mask and enters the mouth without interfering with respiration. The equipment used to feed the dog Layka operated on this principle.

The assimilation of food is very important. Researchers outside the Soviet Union have suggested 100% assimilation can be attained by compounding synthetic mixtures consisting of amino acids and carbohydrates. The Soviet scientists, however, prefer to use natural products enriched with amino acids.

How can a man survive in outer space if his flight should last several months? The rocket can hold only a limited supply of water and food. There are two ways to solve this problem. (1) resorting to chemicals in supplying the necessary food -- proteins, fats, carbohydrates, and vitamins can be formed from products of nitrogen metabolism, and oxygen can be separated from carbon dioxide; and (2) using microorganisms and algae as food for humans. Fifteen varieties of algae which can serve as food for humans are known to scientists. Chlorella is believed to be the most valuable; it not only can serve as food, but also possesses the exceptional capability of transforming carbon dioxide into oxygen. The fact that the

Japanese have used algae as part of their normal diet is sufficient proof that they do not disrupt digestive functions and do not harm the human organism.

All that can be said about satisfying the human organism with water is that water can be obtained from the air in the cabin. Water in the cabin precipitates on chilled surfaces and can be used for drinking. Drinking water can also be obtained by the use of chemicals.

## Contagious Diseases

### 69. Tick-Borne Encephalitis and Polio in Slovakia and Attempts to Combat Them

"Invisible Carnivores," by Helena Libikova, Institute of Virology of the Czechoslovak Academy of Sciences; Prague Priroda a Spolocnost, No 18, Sep 59, pp 8-11

The Institute of Virology of the Czechoslovak Academy of Sciences in Bratislava, which studies virus diseases affecting man and possibilities of combating these viruses, has a section for research on neuroviral infections. Presently, 11 scientific workers, five of whom hold a degree of candidate of medical sciences or of biological sciences, work here.

The research work of this group has concentrated its efforts for the most economical and fastest progress. Therefore, the section has selected only one project -- research on tick-borne encephalitis virus, which has a rather high incidence in Slovakia. The virus is found in natural foci in small forested or forest-steppe areas in Slovakia.

In 1951, Roznava and its surroundings experienced an epidemic of tick-borne encephalitis. Information obtained in research on this disease determined the basic direction for the section's research on neuroviral infections. Up to this time, it was the dominant opinion that the disease might develop in man only after the bite of an infected tick. But since several hundreds persons in Roznava and the surroundings were affected with the disease who had not come into contact with ticks showed that this opinion was untenable.

The Roznava epidemic brought about large scale research work. The Institute of Virology brought in specialists from the Czech lands and from Slovakia, and within 3 years it was determined that a natural focus of tick-borne encephalitis exists in the Roznava vicinity. The virus was isolated from the ticks and antibodies were discovered in the blood of roe bucks, rabbits, foxes, wild boars, and in small mouselike rodents,

and also in the serum of birds, cows, goats, and sheep, which means that all these animals had been hosts to the virus for some time. In determining how the virus was transferred from the natural focus to the several hundred persons who were ill, detailed epidemiological study showed that most of the patients drank poorly pasteurized milk in which goat milk was also mixed. It was further determined that the goat milk carried the virus.

Dr. Gresikova has shown that both sheep and goats eliminate the tick-borne encephalitis virus in their milk whether they are infected by subcutaneous injection or by experimentally infected ticks. The milk of these animals shows a higher concentration of virus than their blood. This is not true in cows, where only small amounts of the virus get into the milk. The virus will live in milk for a considerable number of days and will also live for some time in soured milk; it will be active up to 2 months in butter and cream when these products are stored at 4 degrees centigrade. It can withstand temperatures of about 50-60 degrees centigrade, but is quickly destroyed by boiling. Dr Malkova has determined that chlorine preparations can destroy the virus.

Doctors Macicek, Nosek, and Ernek of the institute have studied the relationship of the encephalitis-carrying tick to wild animals. It has been shown that roe bucks, rabbits, and mouselike animals can receive large quantities of virus subcutaneously or intracerebrally without becoming infected since theyhave natural immunity. However, the virus circulates in the blood and lives in the brain for some time without producing any signs of disease. In experimentally infected chicks the virus sometimes causes a chronic preliminary brain inflammation, while in ducklings the virus circulates in the blood after infection, and in lizards it can lead to serious illness following subcutaneous infection. Since slices of brains and other organs are a source of information, the section's histologist, Dr Albrecht, constantly assists all the other members of the collective.

In working on the problem of tick-borne encephalitis, the section discovered a virus in eastern Slovakia responsible for inflammation of the brain and spinal marrow of horses. This virus was hitherto unknown in Europe. New information on antibodies of the virus, found in humans and animals, is being obtained constantly.

Much attention was also given to the virus-tick relationship. New methods of feeding ticks on infected mice and of carrying the virus from animal to animal via ticks were introduced. The first successful attempts of Dr Rehacek to grow tick tissues as a basis for research, since the viruses multiply in tick cells, are pioneering.

Since the use of white mice for experimentation is expensive and space-consuming, the work of the last half year has been concentrated on trying to find the best method of growing tissue cultures. The first results look very promising. It is hoped that this procedure will soon replace the use of mice. Only then will it be possible to expand the research to the extent required. This use would also simplify the virological diagnosis of tick-borne encephalitis in kraj and okres hygenic-epidemiological stations.

Protective inoculations against polio were begun in 1957 in Czechoslovakia. In the research on serums, Dr Pesek devised a simplified test on plastic trays with small depressions; the results were identified according to the color reaction caused by the effect of the viruses on the cells. From this it was known that small children in Slovakia came into contact with all three types of polio sooner than those in the Czech lands /Bohemia and Moravia/ and, overcoming an inapparent infection, form antibodies. This information made it possible to select the age groups most suitalbe for inoculations.

During the polio research, the problem of Coxsackie and ECHO viruses was also investigated. Dr Mayer, working for several years, demonstrated some types of these viruses among patients. Before this it was not known that such viruses occur in Czechoslovakia.

Dr Zemla heads the new biochemical laboratory which was established in the last 2 years in the section for research on virus infections of the nervous system. The biochemical laboratory has already taken its first steps: the glucose consumption of growing cells in relation to time and to various medium conditions was determined for HeLa cells, where polio and tick-borne encephalitis virus is known to multiply. The present attempts devote attention to other components, e.g., phosphorous compounds, which are important in the material change of cells. These components are an important structural unit of virus particles.

## Hematology

### 70. Bulgarians Develop Blood Expander

"Hydrolysate," (unsigned article); Prague, Ceskoslovensky Cerveny Kriz, Nov 59, p 8

According to the above source, the Institute of Hematology and Blood Transfusion is Sofia has produced a hydrolysate by chemically and thermally processing the beef cattle blood. The new product is suitable for use in all cases where the intake of food through the mouth is impossible and when it is essential that the patient's strength be restored, such as prior to

surgery or in post operative situations. The hydrolysate is said to cost only 1/100 that of human blood and in many cases can actually replace the use of human blood completely.

The institute is also working on a protein blood substitute. Work has been in progress on this product for the past 4 years. The blood substitute has biological characteristics which correspond to the Soviet BKZ blood substitute.

Another aspect of the work conducted at the institute is the acceleration of the work leading to blood preservation techniques, and particularly the preservation of red blood corpuscles through the use of hydrolysate.

## Immunology and Therapy

### 71. Immunogenicity of Inhalation Vaccination

"The Problem of the Effectiveness of Inhalation Vaccination," Report I. The Effect of the Inhalation Method of Vaccination on General Immune Reconstruction of the Organism," by A. I. Maslov, District Hospital and Military Medical Order of Lenin Academy imeni Kirov; Moscow, Zhurnal Mikrobiologii, Epidemiologii i Immunobiologii, Vol 30, No 11, Nov 59, pp 15-18

In introducing this article, the author states that recent achievements in the study of aerosols in general and medical aerosols in particular have revealed new possibilities for more intensive study of the inhalation method of vaccination. In the research described, the depth of penetration and fate of particles ranging in size from 5 to 30 microns in various branches of the respiratory tract were studied. In the first series of experiments, white mice were vaccinated aerogenically with a live B. prodigiosum aerosol produced by a special sprayer; a table shows the dimensions of the particles delivered, the quantity of particles (in percent), and the weight of particles (in percent according to the weight of the solution used). The mice were exposed for 5 minutes in an aerosol charber in which the density of the aerosol was 50 million microbial cells per liter. The effectiveness of the method was then tested by seeding ling sections from the mice on meat-peptone agar and calculating the number of colonies produced. Several other experiments were performed; the extent of general immune reconstruction in the experimental animals was determined by immunization and subsequent challenge with Gertner's bacillus.

Comparison of the results of the inhalation method with those of the subcutaneous and intranasal-oral methods are presented in a table. The author concludes that the inhalation method of vaccination guarantees intensive, general immune reconstruction of the organism to which it is administered, but that a high concentration of vaccine and rather prolonged exposure of the animal to the aerosol are required.

72. Lithium Therapy of Psychic Disturbances

"On the Therapy of Maniacal States of Different Origin and of Certain Psychic Disturbances in Organic Cerebral Affections With Lithium Salts," by M. I. Botvinnikova, Hospital imeni Skvortsov-Stepanov; Moscow, Zhurnal Nevropatologii i Psikhiatrii imeni S. S. Korsakov, Vol 59, No 10, Oct 59, pp 1222-1223

Lithium carbonate in doses of 0.5-1.0 gram two or three times per day was administered to ten patients suffering from different forms of psychoses: three of the patients suffered from manic-depressive psychosis, one from infectious psychosis with maniacal syndrome, one from vascular affection of the cerebrum with psychic disturbances, five from organic affections of the cerebrum with psychic disturbances. A calmer state was observed in all of the patients at the end of the first week after therapy was begun. Irritability decreased, the behavior of the patients became more normal, they became interested in their surroundings, and their sleep improved. Five of the patients were discharged. No adverse effects were noted in any of the treated patients.

73. Contraindications to Use of Rauwolfia serpentina Preparations

"On the Problem of Indications and Contraindications in the Therapy of Patients Suffering From Hypertension With Rauwolfia serpentina Preparations," by N. N. Kolotova, Ye. M. Kucherenko and T. P. Chuberkis, Chair of Hospital Therapy, Vinnitsa Medical Institute; Moscow, Sovetskaya Meditsina, Vol 23, No 10, Oct 59, pp 112-115

Reserpine was administered to 42 patients suffering from hypertension. Serious complications developed in three of the patients: two developed myocardial infarction, and the third developed a disturbance in cerebral circulation. The author considers three possibilities: (1) reserpine had no relation to the development of the complications; (2) reserpine was the direct cause of their development; and (3) under certain conditions reserpine was the contributing factor. Further experimental research is needed to ascertain whether reserpine may cause complications when used in hypertension. On the basis of the data obtained, however, the author recommends that care be exercised before reserpine and other

Rauwolfia serpentina preparations are used in cases with expressed coronary sclerosis or chronic coronary insufficiency; expressed sclerosis of the cerebral vessels with chronic insufficiency of the cerebral circulation; and increased tonus of the vagus nerve.

74. Diphtheria Toxin Exposed to Ultrasound

"The Effecto of Ultrasonic Waves on Diphtheria Toxin," by G. I. Stepanchenok-Rudnik, Ye. I. Nekhotenova, V. A. Blagoveshchenskiy, and P. V. Pavlov, Institute of Epidemiology and Microbiology imeni Gamaleya; Moscow, Zhurnal Mikrobiologii, Epidemiologii i Immunobiologii, Vol 30, No 11, Nov 59, pp 118-119

"An investigation was undertaken to explain the action of ultrasound of varying frequency and amplitude on diphtheria toxin and the effect of purifying the toxin on its sensitivity to ultrasonic waves. The following diphtheria toxins were selected for the investigation: (1) natural toxin which had been kept for some time (18 Lf/ml, Kf--1 hour and 15 minutes, MLD--0.0028 ml); (2) fresh natural toxin (30Lf/ml, Kf--one hour and 20 minutes, MLD--0.0006 ml); (3) toxin which had been purified by ammonium sulfate precipitation (30Lf/ml, Kf--30 minutes, MLD--0.02 ml); (4) toxin purified by the precipitation of the natural toxin at the iso-electric point (pH 4.0) with 30% trichloroacetic acid (38 Lf/ml, Kf--120 minutes, MLD--0.008 ml). A Soviet UL-1 apparatus in which a barium titanate piezoceramic disk served as a source of sound waves was used for the research. Exposure to sound was carried out in special trays with nylon bottoms. The apparatus was provided with a cooling system, which made it possible to keep the temperature of the toxin being exposed to ultrasound around 25°C.

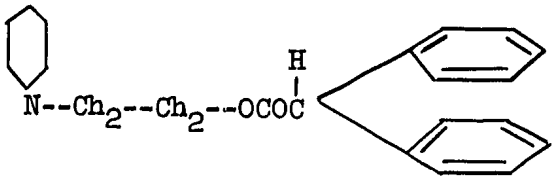
"The action of ultrasonic waves at a frequency of 400 and 2,400 kc and a sonic pressure of 5 vt/cm$^2$, and also at frequencies of 800 and 1,200 kc and pressure of 10 vt/cm$^2$ for 30 minutes (in certain cases for 90 minutes) had no effect on the toxic properties of the diphtheria toxins investigated; the values of the Lf, Kf, and MLD of the toxins exposed to ultrasound were not changed. Purification of natural toxin by precipitation with ammonium sulfate or trichloroacetic acid did not affect the sensitivity of the toxin to ultrasound."

## Pharmacology and Toxicology

### 75. Effect of Cholinolytics on Suprarenals

"Effect of Certain New Cholinolytic Substances on the Function of the Suprarenal Cortex (Clinical-Experimental Investigation)," by T. A. Mel'nikova, O. P. Zaplatina, and N. M. Kostygov (Leningrad), Chair of Pharmacology Leningrad Chemicopharmaceutical Institute and Surgical Section of the Oktiabr Railway Hospital; Moscow, Problemy Endokrinologii i Gormonoterapii, Vol V, No 5, Sep/Oct 59, pp 14-19

A report on the results of research work conducted to determine the effect of anicaine and tropacine, new cholinolytic preparations on the hypophysial-adrenal system is presented. Anicaine is the diphenyl acetic ester of piperidyl ethanol and has the following structural formula:




Tropacine is the hydrochloride of the tropic ester of diphenyl acetic acid. Pharmacological investigations have established that both preparations stimulate the secretion of cortical hormones. The application of the preparations is recommended in cases in which the use of the adrenocortiotropic hormone is indicated.

### 76. Papaverine Therapy of Disturbed Cerebral Circulation

"On the Intravenous Application of Papaverine in Acute Disturbances of Cerebral Circulation," by R. A. Tkachev, L. I. Aleksandrova, and E. S. Prokhorova, Institute of Neurology, Academy of Medical Sciences USSR; Moscow, Sovetskaya Meditsina, Vol XXIII, No 10, Oct 59, pp 106-109

Papaverine was administered to 60 patients suffering from acute disturbed cerebral circulation. The patients arrived at the Institute of Neurology from half an hour to 2 hours after the appearance of the disease symptoms. All were afflicted with hypertonia in the sclerotic phase. Papaverine was administered in doses of 2 milliliters of a 2-percent solution intravenously together with 10 milliliters of a 40-percent solution of glucose once a day. In all cases the drug produced a rapid therapeutic effect. On the basis of the data obtained, the authors recommend the application of papaverine in hypertonic cerebral crises.

77. Neuroleptic Drugs in Therapy of Neuroses

"Experiment of the Application of Neuroloptic Drugs in the Therapy of Neuroses," by L. I. Maricheva, Psychoneurological Hospital imeni I. P. Pavlov, Leningrad; Moscow, Zhurnal Nevropatologii i Psikhiatrii imeni S. S. Korsakov, Vol LIX, No 10, Oct 59, pp 1198-1200

A report on the results obtained in the application of aminazine in combination with psychotherapy in the therapy of patients suffering from different types of neuroses is presented. Aminazine administered in the initial stages of the psychotherapeutic treatment relaxed tension, fear and alarm and helped to normalize sleep and the appetite. It made the patients more amenable to psychotherapy. Small doses of the drug, 0.025-0.075 gram two or three times a day, are recommended.

78. Rhodanine and Its Derivatives

"Pharmacology and Toxicology of Rhodanine and Its Derivatives," by Wieslawa Zlakowska, Acta Polon Pharmac. (Poland), 1958, 15, No 6, 471-480 (from Referativnyy Zhurnal -- Khimiya, Biologicheskaya Khimiya, No 22, 25 Nov 59, Abstract No 30384, by R. Khaunina)

"Investigations were conducted of 12 rhodanine derivatives. Rhodanine itself and its methyl and ethyl derivatives, its closest analogues, were found to possess greatest toxicity ($LD_{50}$ 162-228 milligrams per kilogram of body weight); its phenol and acetate derivatives were found to be considerably less toxic ($LD_{50}$ 3,520-1,853 /sic/ milligrams per kilogram of body weight in experiments on mice). Most of the investigated compounds produced functional and histological hepatic and renal modifications. Some of the preparations were found to be capable of producing hyperglycemia."



79. Derivation of Quarternary Ammonium Salts

"Derivation of Quarternary Ammonium Salts From New Types of Initial Materials," by V. P. Erekayev; Moscow, Institute of National Economy imeni G. V. Plekhanov; Moscow, Meditsinskaya Promyshlennost' USSR, Vol XIII, No 10, Oct 59, pp 20-26

The article describes a new technical method of deriving quarternary ammonium salts from synthetic high molecular alcohols produced at the Shebenskiy combinat of synthetic alphalitic acids by the oxidation of petroleum hydrocarbons, and from phenol and phenol mixtures. The quarternary ammonium slats thus obtained have a bacteriostatic and fungistatic

effect on 17 species of microorganisms; they are also bactericidal to staphylococci, Bacillus coli, Proteus vulgaris, and have a fungicidal effect on yeastlike fungi.

80. Better Use of Medicinal Plants Urged

"Better Use of Medicinal Raw Material Resources," by Prof V. Asatiani, Corresponding Member of the Academy of Sciences Georgian SSR; Moscow, Meditsinskiy Rabotnik, No 80 (1828), 6 Oct 59, p 3

The author of this article states that scientists of the Tbilisi Chemicopharmaceutical Scientific Research Institute have taken into consideration the decisions of the June Plenum of the Central Committee CPSU and have outlined more clearly the tasks with which they are confronted: the development of new preparations against cancer and hypertension, the search for effective cardiac, styptic, and astringent drugs, cost reduction and improvement in production of a number of medicaments, the promotion of effective supervision over production, and the evaluation of medical preparations, etc.

The primary effort is being channeled toward the exploration of wild flora of the USSR. There are many regions in the USSR where the medicinal plants and resources have not yet been explored. An expedition sent in 1959 to Makharadze Rayon returned with rich herbariums of medicinal plants. Much material has been collected by the institute as result of numerous other expeditions. The personnel of the institute made 5,000 analyses under field conditions, and 15,000 plants were collected. About 40 rayons were explored; thickets of medicinal plants in these rayons were charted and their approximate supply was indicated. Since thickets marked on the chart no longer exist, the institute is endeavoring to take measures to preserve plants that have medicinal value.

The institute is giving considerable attention to collecting and examining folk remedies used in the Georgian SSR. These remedies have been used for centuries and handed down from generation to generation. Some remedies used by various racial groups have been tested in various departments of the institute, and their effectiveness has been tried out in clinical practice. These remedies will soon be in production.

The department of pharmacobotany at the institute has accelerated its efforts to examine those plants which are important as raw material for new drugs. Results of these efforts will be turned over to the pharmaceutical industry so that production of new drugs can begin in 1959.

Decisions of the June plenum also served to encourage the biochemical, chemical, and analytical departments of the institute to intensify their study of the chemical composition and properties of various plants.

The coffee factory in Batum and the chemicopharmaceutical factory in Tbilisi are important segments of the chemical industry of the USSR. The Batum factory was established after I. G. Butateladze, director of the institute and member of the Academy of Sciences Georgian SSR, formulated a process for obtaining caffeine from scraps of tea shrubs and waste products of the tea industry. The institute was therefore in a position to cooperate closely with the factory from the very beginning of its operation. Scientists of the institute have developed a method of purifying caffeine without using lead salt, thereby reducing the cost of caffeine production. By-products of caffeine have been used to make thealbinum and vitamin P. The manufacture of thealbinum from by-products of caffeine saved a large amount of tannin for the country. There still is great shortage of tannin in the USSR.

While searching for effective cardiac drugs, the scientists of the institute discovered that Digitalis ciliare is a valuable source of raw material for steroid preparations. A drug called tribestris, which increases the acidity of gastric juices, was derived from a plant called Tribulus. This plant also is a source of very valuable steroid saponins. Diosgenin is one of the components of saponin: it is used in medical industry as a raw material for the synthesis of cortisone and other medical preparations. It was found that an effective drug against dermatomycosis can be derived from Tribulus. Tribulus was found to be widespread in the Georgian SSR.

Scientists of the Tbilisi Chemicopharmaceutical Scientific Research Institute are searching for new steroid compounds also from other plants of southern flora. This work is being carried on in close cooperation with the All-Union Scientific Research Chemicopharmaceutical Institute.

While making a study of astringents, scientists of the institute also found out what pharmacological and clinical differences in effectiveness exist among tannins of various orgins. This opens up new prospects for their therapeutic use.

Plant collectors of other departments of the institute have also been successful in their work.

81. Fulfillment of Seven-Year Plan

"We Shall Fulfill the Seven-Year Plan Ahead of Schedule," by L. A. Mayorov, Moscow Chemicopharmaceutical Plant imeni L. Ya. Karpov; Moscow, Meditsinskaya Promyshlennost' SSSR, Vol XIII, No 11, Nov 59, pp 6-9

The Moscow Chemicopharmaceutical Plant imeni L. Ya. Karpov fulfilled the 8-month plan of 1959 by 18 August and increased production by 22 percent over the corresponding period of 1958. The plant is primarily engaged in the manufacture of vitamins and antibiotics. The production of vitamin $B_{12}$ has been increased more than threefold over that in 1958. In 1959, the plant began the production of new antibiotics: grizemyn, fumagilline, colymycine, cricine, and eulevomycetin. Improved methods of production are being introduced in the plant. The plant will successfully fulfill the Seven-Year Plan, which envisages the doubling of production by the plant without considerably increasing its facilities or personnel.

## Physiology

82. Pressure Trauma Studied

"An Analysis of Factors Causing Barotrauma of the Ears When Exposed to High Pressure," by A. P. Velitskiy and V. I. Voyachek, Clinic of Ear, Nose, and Throat Diseases of the Military Medical Order of Lenin Academy imeni S. M. Kirov; Kiev, Zhurnal Ushnykh, Nosovykh, i Gorlovykh Bolezney, No 5, Sep/Oct 59, pp 28-30

The author of this article states that the results of observations of 110 student divers between 20 and 25 years of age showed that pathological processes in the nose and nasopharynx facilitate the appearance of barotraumas of the ears in persons exposed to high-pressure conditions. Barotrauma was usually observed in persons with pathological processes which obstructed ventilation of the tympanic cavity, such as a deviated septum, hypertrophic rhinitis, and catarrhal otitis.

To prevent barotrauma, divers should be carefully selected and subjected to an examination prior to each submersion. In examining each diver, particular attention must be paid to the condition of the nose and nasopharynx, and the permeability of the Eustachian tubes.

83. Hypothermia Produced by $CO_2$

"Analysis of the Mechanism of the Hypothermic Effect of Carbon Dioxide and the Use of $CO_2$ for Producing Deep Hypothermia in Warm-Blooded Animals," by I. S. Repin, Department of General Pathology, Institute of Experimental Medicine, Academy of Sciences USSR; Moscow, Patologicheskaya Fiziologiya i Eksperimental'naya Terapiya, No 5, Sep/Oct 59, pp 48-56

The author of this article discusses experiments conducted on 72 rabbits to determine the effect of various concentrations of $CO_2$ (5%, 10%, 15%, and 20%) in the inspired air on body temperature and on thermoregulation. The inhalation of air which contained between 15% and 20% $CO_2$ resulted in the suppression of physical and chemical thermoregulating reactions. This was caused by a depression in heat production, by muscular tremor at all stages of physical chilling, and by an increase in heat emission into the immediate environment. The obstruction of thermoregulation was not connected with the general anesthetic effect of $CO_2$, did not depend on hypoxemia, and remained the same when the $O_2$ content in the inhaled gaseous mixture was increased to 50% and the content of $HbO_2$ in the arterial and venous blood was normal. On inhalation of a gaseous mixture containing between 15% and 20% $CO_2$, the body temperature dropped to 2-3°C during the first 60-90 minutes and then gradually stabilized at 34-36°C. There was no reaction to pyrogens against this background. It is possible to develop hypothermia by additional physical chilling during $CO_2$ inhalation. When the body temperature in rabbits was reduced to 20°C as a result of chilling, they recovered spontaneously from the hypothermic condition. After being warmed and given $CO_2$, rabbits whose body temperature had remained at 18°C for a period of 60-90 minutes recovered from hypothermia and their vital functions were completely restored.

84. Effect of Microwaves on Excitability of Man's Visual Organs

"Changes in the Excitability of Man's Optic Analysors Under the Effect of Microwaves," by N. I. Matuzov; Moscow, Byulleten' Eksperimental'noy Biologii i Meditsiny, Vol 48, No 7, Jul 59, pp 27-30

This research is a study of the reaction of the human organism, especially its central nervous system, to the effect of nonthermal doses of microwaves (ultrahigh frequency electromagnetic waves in the amount of one milliwatt/$cm^2$).

Since man's optic analysors are the most "corticalized" organs, shifts in the functional condition of the visual organs arising as a result of the effect of microwaves enabled the author to evaluate the nature of the effect of these waves on the central nervous system.

Results of the experiments showed that the excitability of the visual organ which has been adapted to darkness due to the effect of microwaves is increased.

Since the intensity of the microwave action in these experiments was clearly within the range of nonthermal doses, the shifts that have been observed in the visual analysors may be linked to the specific effect of these waves. The nature of this effect has not yet been determined.

## Public Health, Hygiene, and Sanitation

### 85. New Book on Medical Aid After Mass Attack

Meditsinskoye Obespecheniye Naseleniya v Usloviyakh Primeneniya Sredstv Massovogo Porazheniya (Medical Protection of the Population Under Conditions in Which Agents of Mass Affection Are Used), State Publishing House of the Belorussian SSR; Minsk, 1959, 408 pp

The foreword to this book on the functions of the MPVO (Local Antiair Defense) after the use of chemical and radiological weapons offers the following statements of purpose:

"The reading of a course of lectures and the accumulation of practical training in basic nuclear physics and dosimetry, radiation sickness and the toxicology of military toxic substances, and in the organization and tactics of the MPVO medical service by audiences at the Belorussian Institute for the Advanced Training of Physicians have always been accompanied by insistent demands from physicians to create a scientific textbook in which all the essential problems involved in the above-mentioned subjects would be presented in concise form.

"Proceeding in accordance with the persistent wishes of their audience, the authors have prepared this manual, which is a stenograph of a course of lectures read at the Belorussian Institute for the Advanced Training of Physicians during 1955-1958.

"The stenographs were subjected to careful review and verification by the authors so as to render them readable for a wide circle of physicians. Mathematical computations and chemical formulas were omitted in the transcription of the stenographs; however, this was not done at the expense of the basic ideas and concepts of nuclear physics, defense, and the chemistry of military toxic substances.

"The authors of the book are clearly of the opinion that the individual ideas and propositions presented in the handbook are not rigid and will be altered, supplemented, or possible excluded altogether (this concerns especially problems of the organization of the MPVO medical service and the pathogenesis and therapy of radiation sickness). Such stationary establishments of the MPVO medical service and the PPM [Polkovoy Punkt Meditsinskoy Pomoshchi, Regimental Medical Aid Post] and the SPM [Statsionarniy Punkt Meditsinskoy Pomoshchi, Permanent Medical Aid Post] which lose their significance when agents of mass attack from the air are used, can be an example of the latter, and will obviously be completely eliminated.

"The course of lectures herein published is an attempt to classify and to present in one manual the disconnected published data on certain contemporary and highly pressing problems of the MPVO medical service.

"With profound thanks, the authors solicit the suggestions and critical observations of the readers for improving this manual."

The table of contents of the manual is as follows:

Chapter 7. Principles of Protection From Contemporary Agents of Mass Affection (P. F. Zverev, L. F. Suprok)

Chapter 8. Measures for Protection From Radiological Damaging Properties of a Nuclear Weapon in the MPVO Medical Service System (P. F. Zverev)

## Radiology



86. Hyperoxia Affects Blood Regeneration in Radiation Sickness

"The Effect of Hyperoxia on Blood Regeneration in Experimental Acute Radiation Sickness," by B. V. Aretinskiy, Tr. 20-y Godichn. Nauchn. Sessii Sverdl. Med. In-ta (Works of the 20th Annual Scientific Session of Sverdlovsk Medical Institute), 1957, pp 130-131 (from Referativnyy Zhurnal -- Biologiya, No 21, 10 Nov 59, Abstract No 94838, by E. B. Glikson)

"Rabbits were subjected to total gamma irradiation by 1,000 r (from a 22-Mev betatron) and were placed in a chamber containing 50-60% $O_2$ at atmospheric pressure, a temperature of 18-20° C, and 60-70% humidity for 10 hours daily for 20-31 days. Leukopenia was less pronounced, restoration of the number of leukocytes and regeneration of the red blood occurred more rapidly and $O_2$ consumption by the myeloid tissue (according to data from examination in a Barburg apparatus) was higher in these animals than in control rabbits which had not received oxygen therapy after irradiation. The $O_2$ consumption by the bone marrow is increased in acute radiation sickness."



87. Functional Changes in Skin Vessels During Acute Radiation Sickness

"Concerning Changes in Certain Indexes of the Functional Condition of Skin Vessels in Monkeys Suffering From Acute Radiation Sickness," by V. V. Yakovlev and L. F. Semenov; Moscow, Meditsinskaya Radiologiya, Vol 4, No 11, Nov 59, pp 52-56

The research reported in this article is a study of certain functional conditions of the skin vessels of 33 monkeys (Macaca rhesus) suffering from acute radiation sickness. The results of the study showed that: the arterial blood pressure (taken at the tip of the middle finger) and skin temperature drop throughout the course of radiation sickness; the tonus of the arterial blood vessels always exceeds the preirradiation level; and the reactivity of the skin vessels to thermal stimulation drops.

The authors explain the constriction of the peripheral blood vessels as an index of a compensatory of reaction directed, on the one hand, toward decreasing heat loss, and on the other hand, toward supporting the disturbed circulation. Because the conservation of heat in an organism, and the maintenance of blood pressure at a constant level are of great significance to the irradiated organism, the constriction of skin vessels, which is the result of complex neuro-humoral phenomena, is seen frequently in various species of experimental animals.

88. Therapeutic Use of B-Complex Vitamins in Treating Shock Combined With Radiation Sickness

"New Data on Changes in Oxidation-Reduction Processes of Tissue Respiration and of Certain B-Complex Vitamins in Traumatic Shock (Alone and in Combination with Radiation Sickness)," by Docent V. G. Mitrofanov, Second Chair of General Surgery and Central Scientific Research Laboratory of Nutrition, Military Medical Order of Lenin Academy imeni S. M. Kirov; Moscow, Vestnik Khirurgii, Vol 83, No 7, Jul 59, pp 112-126

Various stages of traumatic shock alone and in combination with radiation sickness were studied on a total of 471 rats, rabbits, and dogs. Tables included present pertinent data on changes in the oxidation-reduction capacity of various tissues, and on the effect of B-complex vitamins on these changes. The tissues studied include the brain (both cerebral hemispheres, the subcortical layer, and the brain stem), liver, kidneys, heart, lungs, and the muscles.

Results of the experiments showed that changes in oxidation-reduction processes in various tissues differ with time and with the development of radiation sickness and shock.

The presence of disturbed cellular respiration in the brain and other organs during shock caused by electrical or mechanical agents and also during shock against a background of radiation sickness provides a basis for the therapeutic use of B-complex vitamins, which are closely connected with oxidation-reduction processes.

The author concludes that shock and radiation sickness are reciprocally aggravating.

89. Use of Antihistamine Substances in Treating Radiation Sickness

"On the Use of Phenergan (Diprozin) and Aminazine (Megaphen) in the Prophylaxis and Therapy of Acute Radiation Sickness," by V. V. Antipov and F. D. Mashbits, Central Scientific Research Experimental Institute of Military Medicine; Moscow, Patologicheskaya Fiziologiya i Eksperimental'naya Terapiya, Vol 3, No 3, May/Jun 59, pp 77-78

The presence of histamine-like substances has been demonstrated in the blood of irradiated animals. Consequently, the authors resolved to study the therapeutic and prophylactic effects of phenergan and aminazine on irradiated mice, rats, and rabbits.

Results of the experiments described showed that aminazine administered one hour before irradiation induced a lighter form of radiation sickness in the experimental animals and prolonged their life. This favorable effect is attributed to decreased oxidative processes in the organism. No therapeutic effects were noted after the use of aminazine (during or after irradiation), and no favorable effects resulted from the use of phenergan.

Phenergan and aminazine used after irradiation made the course and outcome of radiation sickness more severe in certain cases. The authors attribute this effect to the increased permeability of the blood vessels, inhibition of leukocytosis and the phagocytic activity of leukocytes and the decreased resistance of the organism to infections.

90. Role of Humoral Factors in Pathogenesis of Radiation Injuries

"The Role of Humoral Factors in the Reaction of an Organism to the Effect of Ionizing Radiation," by A. G. Sverdlov; Moscow, Meditsinskaya Radiologiya, Vol 4, No 11, Nov 59, pp 19-24

The author studied the role of humoral factors in the pathogenesis of radiation damages (leukopenia, lysis of leukocytes, decreased catalase activity, and paranecrosis, etc.).

Only the ears of rabbits were subjected to ionizing radiation (X-irradiation by 1,800 r with filter, and 1,000 r without filter); the rest of the animals' bodies were carefully protected by lead shields Results of blood studies representing changes in basic hematological indices due to local irradiation are presented.

The author presents the following conclusions: (1) following the local irradiation of a field with which an organism is connected only through vascular means, the development of leukopenia, lymphopenia, and other symptoms of radiation damage can be observed; (2) the irradiation of a humorally isolated field is not accompanied by any noticeable changes in essential hematological indices; (3) the intravenous administration to intact animals of a perfusate taken from irradiated tissues causes blood changes characteristic of radiation damage. This property is eliminated by boiling the perfusate, and it is not connected with substances found in the perfusate which affect the work of the isolated frog heart.

91. Therapeutic Use of $B_{12}$ and $B_6$ Vitamins in Chronic Sublethal Radiation Sickness

"The Use of Vitamins $B_{12}$ and $B_6$ During the Repeated Action of X Rays," by O. I. Belousova and E. K. Grabovenko; Moscow, Meditsinskaya Radiologiya, Vol 4, No 10, Oct 59, pp 41-46

The authors studied the efficacy of vitamins $B_{12}$ and $B_6$ on subacute disturbances of hematopoiesis caused by daily X irradiation by 20 r, total dose of 500 r. Tests were conducted on 35 dogs.

The authors present the following conclusions:

1. The use of vitamins $B_{12}$ and $B_6$ over a long period of daily X irradiation did not prevent the disturbance of hematopoiesis, but the inhibition of hematopoiesis, and especially of erythropoiesis in dogs treated by vitamins $B_{12}$ and $B_6$, was less marked.

2. A tendency toward an earlier normalization of the erythroblastic and myeloblastic elements was noted in the bone marrow of dogs treated by the vitamins than in the controls.

3. The leukocyte and thrombocyte content of the peripheral blood of dogs to which vitamins $B_{12}$ and $B_6$ had been administered was higher during the 2-3 weeks following the cessation of irradiation effects than in the control animals.

4. The combined use of vitamins $B_{12}$ and $B_6$ was most effective. The bone marrow of these animals was rich in cellular elements throughout the period of experimentation (150 days) and it contained large quantities of regenerating forms of the white and especially of the red element.

5. The use of Vitamin $B_{12}$ alone during the initial period of irradiation caused accelerated maturation of the erythroblastic elements of the bone marrow, which resulted in the development of an earlier erythropenia in the irradiated animals than in the control animals.



92. Study of Tissue Dose of Neutrons

"Tissue Dose of Neutrons," by A. M. Kogan, G. G. Petrov, L. A. Chudov, and P. A. Yampol'skiy; Moscow, Atomnaya Energiya, Vol 7, No 4, Oct 59, pp 351-362

This research is devoted to the determination of the dosimetric characteristics of neutrons of intermediate energies. The interaction of the neutrons with paraffin under the effect of a broad beam of neutrons at normal incidence and with energies in the range of 100 ev to one Mev was calculated on an electronic computer. Results of this calculation are used in computing the components of the tissue neutron dose formed as a result of slowing-down processes in the tissue. The dose caused by the capture of neutrons is calculated on the basis of experimental data obtained by the authors on the distribution of slow neutrons in paraffin and on the reflection of neutrons from the surface of a hydrogen-containing medium. Data on depth distributions of components of a neutron dose for thermal neutrons and for neutrons with energies of 100 ev; one, 30, 240, and 500 kev; and one Mev have been obtained. Depth distributions of the biological dose for neutrons of the same energies and the values for the biological dose based on unit neutron flux have been determined.

These topics are discussed under the following headings: (1) Energy Imparted by Neutrons to the Tissue Due to Elastic Scattering; (2) The Tissue Dose Due to Protons of the $N^{14}$ (n, p) Reaction; (3) The Dose Due to Captured Gamma Rays; and (4) The Biological Neutron Dose. Various mathematical formulas, tables, and graphs accompany the article.

93. Effect of Ionizing Radiation on the Course of Acute Salmonellosis

"The Effect of X Irradiation on the Course of Acute Salmonellosis," (Experimental Research), by B. A. Chukhlovin, Chair of Epidemiology of the Naval Medical Academy; Moscow, Meditsinskaya Radiologiya, Vol 4, No 11, Nov 59, pp 57-59

The present article is a study of the effect of ionizing radiation (500 r) on the course of acute salmonellosis in mice.

The experimental animals were infected per os by cultures of salmonella in a dose of one billion microorganisms; weakly virulent Bacillus breslau (strain 4801) and Bacillus heidelberg, which cause a nonlethal general infection, were selected for a dynamic study of the infection process at various stages of radiation sickness.

Results of bacteriological and clinical studies substantiated the fact that the irradiation of these experimental animals at any period (3, 7, 15, 21, and 28 days) after infection aggravates the course of the infection. In these experiments, irradiation was especially unfavorable when performed on the 3d and 7th day after infection, i.e., during the period of incubation and generalized infection.

94. Radioactive Influenza Virus Used to Trace Infectious Particles

"The Use of Radioactive Influenza Virus for Studying the Fate of Infectious Particles After Their Penetration Into the Host Cell," by L. Khoyl, Priroda Virusov (The Nature of Viruses), 1958, pp 223-230 (from Referativnyy--Zhurnal Biologiya, No 21, 10 Nov 59, Abstract No 91592, by V. A. Isachenko)

"This research was performed with influenza virus A tagged with $P^{32}$ or $S^{35}$. Radioactive influenza virus (100 hemagglutinating units) were introduced into the allantoic sac of chick embryos, and the chorioallantoic membrane was examined after 1 1/2 hours of incubation. The experiments showed that after the penetration of the influenza virus into the cell, its particles disintegrated. On the basis of the distribution of $P^{32}$ in extracts from the chorioallantoic membrane, it was shown that the destruction of influenza virus phospholipids is accompanied by the appearance of low molecular phosphorus compounds, and the fission of the nucleoproteid, by the appearance of free NK and amino acids.

The experiments with influenza virus tagged with $S^{35}$ demonstrated that part of the influenza virus protein is hydrolysed to amino acid after penetration into the cell, but that a large part of it is connected with some insoluble cellular component from which it can be separated by extraction with physiological solution. In the case of virus tagged with both $P^{32}$ and $S^{35}$, a large part of the radioactive material is connected with insoluble cellular components: influenza virus protein--with cytoplasmic components, and nucleic acid--with the cell nucleus. In the author's opinion, the influenza virus consists of particles of soluble antigen and hemagglutinins, surrounded by a membrane consisting of lipoproteids and nucleoproteids. Several problems were discussed: the structures of virus particles, the possibility of including $P^{32}$ in nuclear substance as a result of the adsorption at the time of extraction, and the interference of virus particles, when a significant amount of tagged substances of dead particles can be included in cellular substance. The author's explanation of the results raises doubts because of the use of influenza virus with a low percentage of infectious particles in the experiments."

95. Avirulent Strains of Newcastle Disease Virus Compared

"Comparative Investigations of Avirulent Strains of Newcastle Disease Viruses," by H. Majewska, Laboratory of General Virology; Warsaw, Medycyna Weterynaryjna, No 10, Oct 59, pp 626-629

This article deals with a comparative investigation of four avirulent strains of the Newcastle disease viruses; Hertfortshire, $F_{107}$, PIW, and Lederle. The strains were compared by means of: the adsorption and elution tests, the agglutination test with erythrocytes of various animal species, a determination of the thermostability of the hemagglutination characteristics, a determination of susceptibility to the inhibiting action of substances in the rabbit (serum), a determination of the replication curve in the amnio-allantoic cavities, a determination of the interferential properties and of virulence for chickens, and a determination of the neutralizing power of serums and the maximum $LD_{50}$ for chick embryos.

Results of these experiments indicate that the RIW and Lederle strains are more pathogenic for chick embryos than strains H and $F_{107}$. Replication of the RIW strain was more intensive in the amnio-allantoic cavity.

It was further demonstrated that strains which are less pathogenic for chick embryos and which become freed from infected embryonic membranes more quickly have more efficient interferential properties.

The adsorption and elution test with hen erythrocytes can be used in attempts to differentiate these strains.

## Miscellaneous

96. USSR Medical Industry in 1959

"Medical Industry on the 42d Anniversary of the Great October Revolution," (Editorial); Moscow, Meditsinskaya Promyshlennost' SSSR, Vol XIII, No 11, Nov 59, pp 3-5

A brief survey of the accomplishments of the medical industry of the USSR in the period between the 41st and 42d anniversaries of the October Revolution is presented. The production of drugs, medical instruments, and equipment increased by 12 percent over the corresponding period of the past year; the production plan for the first 6 months of 1959 was fulfilled 102 percent; the production plan for antibiotics was fulfilled 104 percent in the same period, including an increase in the production of vitamin $B_{12}$; the plan for the production of endocrine preparations was fulfilled 105 percent.

Many new drugs, medical instruments, and apparatuses are being manufactured in 1959. The Chemicopharmaceutical plant imeni Karpov is manufacturing colimycin and fumagillin--two new antibiotics; the Moscow Medical Preparations Plant No 2 is producing micerin; the Akrikhin Plant is manufacturing tetridine, bencaine, leukogen, dinezine, and other preparations; the Moscow Electro-Medical Equipment Plant is manufacturing an electric knife, and an artifical respiration apparatus, types RIA-1 and RIA-2; the Mosrentgen Plant is manufacturing an improved medical X-ray diagnostic apparatus, type RUM-10.

Facilities for further increase in the production of drugs and other medical products and for the fulfillment of the Seven-Year Plan, which calls for a 2-2.5 as many drugs, medical instruments, and equipment to be produced, have been created in the country. There need be no doubt that our workers will successfully cope with their tasks.

97. Problems of Otorhinolaryngology

"Basic Problems of Soviet Otorhinolaryngology (On the Problematic Plan of Scientific Research Work in 1960 of the Academy of Medical Sciences USSR) (editorial); Moscow, Vestnik Otorinolaringolii, Vol XXI, No 5, Sep/Oct 59, pp 3-15

An outline of the plan of scientific research work in the field of otorhinolaryngology to be carried out in 1960 is presented. The plan comprises five main groups of research work: (1) angina and chronic tonsilitis, (2) chronic supurative otitis media and its complications, (3) physiology and pathology of the acoustic analyzer and of the voice, (4) occupational diseases and mechanical traumas in otorhinolaryngology, and (5) oncology in otorhinolangology. The main themes of study in each group are enumerated.

98. Training of Psychiatrists and Neuropathologists

"System and Forms of Training Physician-Psychiatrists and Neuropathologists in the USSR," by M. G. Savchenko; Moscow, Zhurnal Nevropatologii i Psikhiatrii imeni S. S. Korsakov, Vol 59, No 10, Oct 59, pp 1253-1255

Brief information on the system of training psychiatrists and neuropathologists in the USSR is given. Most of the training is being done in the Institutes for the Advanced Training of Physicians. Several such institutes are mentioned in the article. The institutes are being equipped with new instruments and apparatuses. Radioelectronic methods of investigation and therapy will be introduced in the course of the new Seven-Year Plan.

99. Mechanical Brains Discussed

"Mechanical Brains and Higher Brain Functions," by B. Kh. Gurevich, Institute of Physiology imeni I. P. Pavlov, Academy of Sciences USSR; Moscow Voprosy Psikhologii, No 4, Jul/Aug 59, pp 3-15

Taking as an illustration the work of D. M. Mackayon "The Problem of the Formation of Concepts by Computers," the author of this article shows that at present there is a tendency to bring closer together the principles of the control system formed by electronic computers and the principles of the stimulus and response theory of behavior. The characteristics of the nervous system and higher brain functions are considered in the light of I. P. Pavlov's theory. It can be concluded that the comprehension of a conditioned reflex retains a clearly behavioristic tint in cybernetics and that past experience is taken into account on the basis of statistics of successful and unsuccessful actions. The functional evolution of the brain in higher animals, especially in humans, to a considerable extent took the form of the development of methods for generalizing accumulated experience. It is obvious, therefore, that the higher function of the brain is qualitatively more complicated and more flexible than the structure of any mechanical brain. In conclusion, the author of this article states that although modern mechanical brains are not comparable with the human brain which invented them, it is very surprising that mechanical brains have been perfected in such a short time to an extent which permits comparison of them with highly developed classes of animals. The author warns against excessive enthusiasm, because the physiological mechanisms of consciousness have not yet been fully understood. The development of mechanical brains will depend largely on the extent to which cybernetics finds a language common to modern physiology of the central nervous system.

100. Soviet-Hungarian Scientific Cooperation Plans for 1960

"Hungarian-Soviet Scientific Agreement Signed in Moscow" (unsigned article); Budapest, Nepszabadsag, 20 Nov 59, p 2

Under the leadership of Mate Major, Corresponding Member of the Hungarian Academy of Sciences, a Hungarian academy delegation held discussions in Moscow on the 1960 work plan of the cooperation agreement between the Hungarian Academy of Sciences and the Academy of Sciences USSR. The work plan was signed on 18 November 1959.

According to the plan, the two academies will exchange visits of 50 scientists or scientific workers each; in addition, representatives will be mutually invited to conferences and programs organized by the two academies.

The two delegations worked out 30 mutual research themes each in the physical, chemical, biological, technical, and social sciences. Among other things, Hungarian and Soviet scientists will jointly examine the phenomena of luminescence and will cooperate in the development of protein research. The Soviet academy will assist Hungarian scientists in tracking artificial satellites and Soviet scientists will study the achievements of Hungarian researchers in observing variable stars.

The document was signed by Mate Major for Hungary and by Nuzhdin, Corresponding Member of the Academy of Sciences USSR, for the Soviets.

The 1960 work plan for cooperation between the Hungarian Academy of Sciences and the Academy of Medical Sciences USSR was also signed on the same day. It calls for the exchange of 12 visits each, and was signed by Academician Dr Pal Gegesi-Kiss, rector of the Budapest Medical Sciences University, and by Academician P. G. Sergeyev, vice-president of the Academy of Medical Sciences USSR.

101. Rumanian-Soviet Resuscitation Conference

"Problems of Resuscitation" (unsigned article); Bucharest, Scienteia, 11 Dec 59, p 2

On 7 and 8 November 1959, a Rumanian-Soviet scientific conference was held in Bucharest to study the problems of anesthesiology and resuscitation. Attending the conference were Prof Dr E. N. Meshalkin, chief of the Department of Thoracic Surgery and Anesthesiology, Institute for the Advanced Training of Physicians in Moscow, and Prof V. A. Negovskiy, director of the Experimental Laboratory for the Resuscitation of Organisms, Academy of Medical Sciences USSR.

In an interview with a Scinteia editor, Professor Negovskiy discussed resuscitation achievements in the USSR, noting that 3,500 persons have been restored to life through resuscitation methods. Negovskiy also commends Academician Parhon, Professor Danielopolu, and academicians Hortolomei and Burghele for their efforts in this field in Rumania.

102. Cold Hardened Titanium Sheet

"Increasing the Strength of Titanium Base Alloys by Cold Plastic Deformation," by Ye. V. Petunina, Candidate of Technical Sciences, and Engr V. L. Poplavskaya, Central Scientific Research Institute of Ferrous Metallurgy; Moscow, Metallovedeniye i Termicheskaya Obrabotka Metallov, No 10, Oct 59, pp 24-27

Investigations were conducted on the possibilities of increasing the strength of titanium alloys IMP-1A (industrially pure titanium produced by the calcium hydride method) and IMP-7 (alloy of titanium with 3% Al and 2% V) by cold plastic deformation. Annealed sheets of both alloys were reduced 10, 20, and 30% by cold rolling and then held for different periods at temperatures of 300, 350, and 400°C to determine softening time. Greatest strength for both alloys was achieved by 20% reduction; tensile strength of alloy IMP-1A increased from 67.8 to 90.8 kg/mm$^2$ and from 88 to 100.5 kg/mm$^2$ for alloy IMP-7. Further reduction showed little increase of strength. Greatest decrease in plastic properties occured with 10% reduction. Specimens of alloy IMP-1A reduced 10, 20, and 30% showed drops in tensile strength of 4.2, 5.7, and 6.7 kg/mm$^2$, respectively, when held at 300°C for one hour. When held at 400°C, corresponding drops in tensile strength were 7.9, 14.9, and 15.6 kg/mm$^2$. No change in tensile strength was noted for alloy IMP-7 when held for one hour at 300°C. Holding for 15 minutes at 350 and 400°C showed drops in tensile strength of 2 and 3.7 kg/mm$^2$, respectively and drops of 2.4 and 4.5 kg/mm$^2$ when held at these temperatures for 5 hours. Preliminary tests of spot weldments of both cold worked alloys showed no weakening.

103. Heat Treatment in Drawing Titanium Wire

"Heat Treatment in Drawing Titanium Wire," by V. P. Severdenko, Academician of the Academy of Sciences Belorusskoy SSR, and V. Z. Zhilkin, Candidate of Technical Sciences; Moscow, Metallovedeniye i Termicheskaya Obrabotka Metallov, No 10, Oct 59, pp 20-23

Alloy VTI-D (industrial titanium), in various initial conditions, was employed in tests to establish optimum parameters in annealing titanium for wire drawing (diameters of 1.0, 2.5 and 4.0 mm). It is shown that annealing may be satisfactorily conducted in ordinary furnaces without a protective atmosphere, in melts of chloride salts, and by the electrocontact method. Most satisfactory results were obtained by annealing in melts of chloride salts. In furnace annealing, heating temperatures must be from 650 to 750°C with 2-3 minute holding periods.

Annealing temperatures and holding periods must be reduced with a decrease in wire diameter. Optimum conditions for annealing in fused salts consists of heating to 680-720°C and holding for 0.5---2 minutes. Practically instantaneous heating without significant surface oxidation is achieved by annealing in fused chloride salts.

104. Notch Sensitivity of Alpha-Alloys of Titanium

"Concerning the Notch Sensitivity of Alpha-Alloys of Titanium," by Engr V. I. Chernetsov; Moscow, Metallovedeniye i Termicheskaya Obrabotka Metallov, No 10, Oct 59, pp 27-32

A study is presented of the effects of such factors as notching, temperature, speed of deformation, interstitial elements (oxygen, nitrogen, and hydrogen), and aluminum on titanium and its alpha-alloys at temperatures from 20 to -196°C. Alloys of titanium (made from sponges TG-0 and TG-1 containing 0.031 to 0.042% N and 0.0035 to 0.004% H), with 3 to 5% Al, showed a good combination of properties in operation at the above-mentioned temperature range. Aluminum increased notch sensitivity of titanium, but to a lesser degree than the interstitial elements. At equal tensile strengths above 55 kg/mm$^2$, alloys of titanium with aluminum were less sensitive to notching than commercially pure titanium. Engineering specifications requiring tensile strengths up to 55 kg/mm$^2$ may be satisfied with commercially pure titanium, with due consideration to its low creep strength at room temperatures. Tensile strength requirements of 55 to 80 kg/mm$^2$ may be met by alloys of titanium made from sponge TG-0 with up to 5% aluminum or sponge TG-1 with up to 4% aluminum. Beta-stabilizing elements may be added to titanium-aluminum alloys to improve hot working, but in quantities not exceeding their solubility in the alpha-phase. Other alloying elements must be used to increase tensile strengths above 80 kg/mm$^2$.

105. Recrystallization Studies of Cold Deformed Tungsten

"Recrystallization of Cold Deformed Tungsten," by Engrs V. A. Lavrenko and I. Ye. Shiyanovskaya, Institute of Powder Metallurgy and Special Alloys of the Academy of Sciences Ukrainian SSR; Moscow, Metallovedeniye i Termicheskaya Obrabotka Metallov, No 10, Oct 59, pp 42-44

Compact high purity tungsten (from 99.989% pure tungsten powder) was deformed in a closed die at a pressure of 300 kg/mm$^2$ and then annealed for 2 hours at temperatures from 800 to 1,650°C in a vacuum furnace at $10^{-3}$ mm Hg. Processes of recovery and recrystallization were studied in relation to annealing temperatures by measurement of hardness, grain size, and microdistortions. Hardness increased from 20.5 to 33 $R_c$ as the result

of cold working. Annealing at temperatures from 800 to 1,300°C caused an insignificant drop in hardness as characterized by recovery. Marked softening occured at 1,300 to 1,400°C, indicating recrystallization, but no further decrease in hardness was observed with additional heating. Results are given of X-ray examinations of nondeformed, deformed, and annealed specimens.

106. Solubility of Zirconium, Niobium and Tantalum in Aluminum

"Solubility of Certain Transition Metals in Aluminum," by V. M. Glazov, Candidate of Technical Sciences, and Engrs G. P. Lazarev and G. A. Korol'kov, Institute of Nonferrous Metals imeni M. I. Kalinin and the Institute of Metallurgy, Academy of Sciences USSR; Moscow, Metallovedeniye i Termicheskaya Obrabotka Metallov, No 10, Oct 59, pp 48-50

Individual alloys of aluminum AV-000 (99.998%) with iodide zirconium (99.91%), niobium (99.857% Nb, 0.1% Ta, 0.03% Al), and tantalum (99.8% Ta, 0.1% Nb, 0.05% Al) were prepared by direct melting of the components. Billets were reduced 30%, and then diffusion annealed for a week at 500°C, followed by stepped annealing at 640, 500, 450, and 350°C with 50-hour holding periods at each temperature. Solubility of the transition metals in aluminum as determined by microhardness was as follows: 0.04 to 0.23% Zr, 0.06 to 0.02% Nb, and 0.07 to 0.22% Ta at 20 to 640°C, respectively, in percent by weight.

Alloys of Al-Zr were analyzed at the Chemical Laboratory of the State Scientific Research Institute of Rare Metals; those of Al-Nb, at the Institute of Metallurgy, Academy of Sciences USSR; and those of Al-Ta, at the Moscow Electric Lamp Plant and by the authors.

107. Investigation of Titanium-Aluminum-Niobium Systems

"Investigation of Alloys of the Ternary System Titanium-Aluminum-Niobium," by M. V. Mal'tsev, G. D. Danilova, and A. R. Avidon, Chair of Physical Metallurgy of the Krasnoyarsk Institute of Nonferrous Metals and the Laboratory of Alloys of the State Institute of Rare Metals; Orzhonikidze, Tsvetnaya Metallurgiya, No 5, 1959, pp 146-150

Procedures for preparing alloys of the ternary system Ti-Al-Nb containing up to 6% aluminum and 6% niobium are described. Isothermal sections of structural diagrams for temperatures of 1,100, 1,000, 900, 800, and 700°C, as well as a number of polythermal sections, are constructed from microanalytical data. X-ray analyses were conducted on certain alloys to pinpoint phase composition. It was noted that the acicular $\alpha'$-phase

formed from $\beta$-phase decomposition has a hexagonal close-packed lattice with smaller spaces than in an $\alpha$-phase. The solid solution $\alpha$ also has a hexagonal lattice, whereby spaces in the lattice decrease with increased temperatures.

108. New High-Strength Copper Alloys

"Effect of Certain Transition Elements on the Structure and Properties of Copper-Beryllium Alloys," by Chzhou Shi-Chan and M. V. Mal'tsev, Chair of Physical Metallurgy of the Moscow Institute of Nonferrous Metals and Gold; Ordzhonikidze, Tsvetnaya Metallurgiya, No 5, 1959, pp 133-142

Structural diagrams were constructed for alloys of the quasibinary systems Cu-$TiBe_2$, Cu-$CrBe_2$, Cu-$MnBe_2$, Cu-$FeBe_2$, and Cu-CoBe. New compositions of high-strength copper alloys were developed on the basis of quasibinary structural diagrams of Cu-$MnBe_2$ and Cu-CoBe, as well as investigations of heat treatment and physicomechanical properties. A copper alloy containing 1.5-1.6% Be, 4.6-5% Mn, and 0.1-0.2% Ti after heat treatment had practically the same strength as the beryllium bronzes BrB2 and BrB2.5, but exceeded them in ductility. This alloy has an elastic hystersis, cyclic strength, and endurance approximately equal to that of standard bronze and is recommended for substitution for beryllium bronzes in the production of springs, diaphragms, and other components with high elastic properties. Similar properties were exhibited by an alloy containing 1.2-1.3% Be, 3.7-4.0% Mn, and 0.1-2% Ti. A Cu-Be-Co alloy containing 0.3-0.35% Be and 1.9-2% Co of high-strength thermal and electrical conductivity is recommended for application in electric machine building, production of press forms in pressure casting machines, and other cases requiring these special properties.

[For additional information on metallurgy, see Chemistry, Nuclear Fuels and Reactor construction materials.]

# IX. PHYSICS

## Atomic and Molecular Physics

### 109. Gettering of Hydrogen

"Sorption of Hydrogen by Titanium and Zirconium at Low Pressures," by E. A. Ab, R. I. Plotnikov, and L. A. Khutsishvili, Zhurnal Tekhnicheskoy Fiziki, Vol 29, No 9, Sep 59, pp 1146-1151

Qualitative data on hydrogen sorption by powdered titanium and zirconium introduced at low pressure were obtained to study the feasibility of constructing efficient gettering pumps. It was found that sorption of hydrogen by these materials occurs even at room temperature, with maximums at 150-200°C. The sorption rate is nearly the same over the pressure range from $10^{-6}$ to $10^{-3}$ mm Hg. Gettering coats for the effective evaluation of hydrogen in vacuum devices have been developed.

## Mechanics

### 110. Conference on Mechanics To Be Held in January

"All-Union Congress on Theoretical and Applied Mechanics" (announcement); Moscow, Prikladnaya Matematika i Mekhanika, Vol 23, No 6, Nov/Dec 59, back cover

The All-Union Congress on Theoretical and Applied Mechanics will be held in Moscow on 27 January through 3 February 1960.

Work of the congress will be conducted in three sections:

I. Section on General and Applied Mechanics
Subsection:

1. Analytical Mechanics

2. Applied Mechanics

II. Section on Liquid and Gas Mechanics

1. General Hydromechanics
2. Aerodynamics and Gas Dynamics
3. Magnetohydrodynamics and the Theory of the Nonstationary Motion of a Gas
4. Motion of a Viscous Fluid, Boundary Layer, Turbulence, and Heat-Transfer
5. Motions of Liquids and Gases in Porous Media
6. Applied Hydrodynamics

III. Section on the Mechanics of Solids
Subsection:

1. Theory of Elasticity
2. Theory of Plasticity and Creep
3. Theory of Plates and Shells
4. Dynamics Problems
5. Mechanics of Loads
6. Structural Mechanics
7. Rheology

Address of the Organizational Committee of the congress is: Moscow D-40, Leningradskiy Prospekt, 7.

## Experimental Physics

111. Measurement of X-Ray Scattering

"Equipment for Measuring of X-Ray Scattering at Small Angles," by A. I. Slutsker and Ye. A. Yegorov, Physico-technical Institute, Academy of Sciences USSR; Moscow, Pribory i Tekhnika Eskperimenta, No 5, Sep/Oct 59, pp 89-94

Equipment is described permitting the measurement of weak X-ray scattering at angles reaching very small values (of the order of minutes). The equipment makes use of the principle of a wide "semi-infinite" beam, securing, in comparison with other devices for studying X-rays under small angles, improved light power and a weak parasitic background. The equipment accomplishes scintillation recording of X-ray quanta.

112. Determination of Equipotentials

"Equipment with a Rubber Membrane for Automatic Determination of Equipotentials With Allowance for Space Charge," by K. G. Utkin, Leningrad Polytechnic Institute; Moscow, Pribory i Tekhnika Eksperimenta, No 5, Sep/Oct 59, pp 111-116

An improved method for determining the cathode emission current is described, using a membrane model and a device for self-recording of points with equal curvature, permitting a fast and very accurate determination of the field picture with allowance for the space charge. The results obtained with a membrane and with a usual instrument are compared.

113. Measurement of the Magnetic Field Strength

"A Device for Measuring Magnetic Field Strength Within a Wide Range," by A. N. Sus and N. N. Bogdanov, Saratov State University; Moscow, Pribory i Tekhnika Eksperimenta," No 5, Sep/Oct 59, pp 117-118

A device for measuring constant magnetic fields within the range of fractions of an oersted to 10 koe is described. The whole range is divided into four subranges -- 0 to 10, 0 - 100, 0 - 1,000 and 0 - 10,000 oersted. The device measures the mean value of the field within the limits of 5 $mm^2$. The calibrating curves of the device are linear, and the accuracy of indications, about 1%.

[For information on investigations in the field of paramagnetic resonance, see Chemistry, Physical Chemistry.]

## 114. Design of a Synchrotron

"Theory of Ring-Shaped Synchrotron With Radial Sectors," by V. I. Kotov, Yu. L. Obukhov, and V. A. Pushtarik; Moscow, Pribory i Tekhnika Eksperimenta, No 5, Sep/Oct 59, pp 19-22

Analysis of free oscillations in a ring-shaped synchrotron with radial sectors is carried out for an ideal case. The obtained formulas permit computation of geometrical parameters of the accelerator (angular apertures of sectors and gaps, the frequencies of free oscillations, etc.), as well as the tolerance of the average field index k.

## 115. Tolerances in Accelerator Design

"Determinations of Tolerances in Parameters of the Magnetic Field in Accelerators by Means of Proper Functions," by A. A. Kolomenskiy and A. P. Fateyev, Physics Institute, Academy of Sciences USSR; Moscow, Pribory i Tekhnika Eksperimenta, No 5, Sep/Oct 59, pp 22-26

The method of proper functions may be used for the study of the perturbation effect of the magnetic field on betatron oscillations of particles in cyclic accelerators (N. M. Blachman, Rev. Scient. Instrum, 22, 569 (1951)). The method consists of expanding the perturbations into proper functions (harmonics) of the corresponding differential operator, and the solution of the equation is sought in the form of series. The method of proper functions is convenient for the establishment of tolerances in the analysis of corrections of perturbations.

## 116. Klystron Use for Accelerators

"Design of Klystron Clustering for a Linear Accelerator of Electrons," by E. L. Burshteyn and A. D. Vlasov; Moscow, Pribory i Tekhnika Eksperimenta, No 5, Sep/Oct 59, pp 26-28

A method of design with optimal parameters of klystron clustering for a linear electron accelerator is described. It meets the specified standard of scattering of output energies for a maximum dosis of injected particles.

117. Neutron Spectrometer

"Spectrometer of Fast Neutrons," by Ye. A. Zherebin, L. G. Andreyev, and D. V. Timoshuk; Moscow, Pribory i Tekhnika Eksperimenta, No 5, Sep/Oct 59, pp 29-32

A neutron spectrometer of telescopic type on two scintillation counters is described. The neutron energy is determined according to the sum of amplitudes of pulses of these counters from the recoil protons formed in the first organic crystal, losing the remainder of energy in the second one. The coupling of the functions of radiator and detector in one of the scintillation counters and the method of addition provide the possibility of using crystals with an operating thickness equal to the maximum flight path of recoil protons, which considerably improves efficiency and eliminates boundary effects. Some spectra are presented, characterizing the basic parameters of the spectrometer.

118. Ring Scatterer for Neutrons

"Apparatus With a Ring Scatterer for Studying High Energy Neutron Scattering at Small Angles," by B. M. Golovin, V. P. Dzhelepov, Yu. V. Katyshev, A. D Konin, and S. V. Medved, Joint Institute for Nuclear Research; Moscow, Pribory i Eksperimenta, No 5, Sep/Oct 59, pp 33-35

An apparatus with a ring-shaped scatterer is described for the study of neutron scattering at energies of hundreds of Mev. The detector of the scattered neutrons is a telescopic array of scintillation counters with an aluminum converter ("neutron telescope"). This type of equipment permits measurements with neutron beams of relatively low intensity, and it is particularly handy for tests in scattering at small angles.

119. Controlled Diffusion Chamber

"Controlled Diffusion Chamber," by. A. P. Komar, M. V. Stabnikov, and D. A. Yashin, Physicotechnical Institute, Academy of Sciences USSR; Moscow, Pribory i Tekhnika Eksperimenta, No 5, Sep/Oct 59, pp 36-40

Data on construction and peculiarities of operation of a diffusion chamber controlled by an ionization chamber are reported. The ionization chamber is located in the sensitive layer of the diffusion chamber and operated on collecting of electron charges. Stereophotos of tracks obtained by this equipment are presented, and their applications in various physical research are explained.

120. Design of Photoelectron Amplifiers

"Determination of Some Parameters of Photoelectron Amplifiers and Scintillators," by V. V. Matveyev, G. K. Popkov, and A. D. Sokolov; Moscow, Pribory i Tekhnika Eksperimenta, No 5, Sep/Oct 59, pp 40-43

A device is described for fast determination of some parameters of photoelectron amplifiers and the selection of their feeding circuit. As a source of light, a scintillating flare or a neon lamp is used. This device facilitates the relative study of solid and liquid scintillating substances.

121. Scintillator Efficiency

"Average Light Output of Scintillators," by A. M. Ratner, Kharkov Affiliate, All-Union Institute of Chemical Reagents; Moscow, Pribory i Tekhnika Eksperimenta, No 5, Sep/Oct 59, pp 44-47

The correlation between the physical and the theoretical luminescence output is analyzed. The computation of an average output of light for a scintillator of cylindrical shape is presented at arbitrary values of coefficients of light absorption in the scintillator, the reflection coefficient from its inner surface, and the relative index of refraction on the boundary of the scintillator and the photomultiplier.

122. Pulse Fed Counters

"Hodoscope With Counters of Small Diameter in a Pulse Fed Circuit," by A. G. Morozov, K. G. Nebrasov, and M. I. Popov, Joint Institute for Nuclear Research; Moscow, Pribory i Tekhnika Eksperimenta, No 5, Sep/Oct 59, pp 64-68

Various gas-filled counters in a pulse fed circuit were tested, and the properties of the fillers used were analyzed. The operation of a hodoscope with neon-filled counters 7.5 mm in diameter is described.

123. Measurements of Strong Neutron Fluxes

"A System of Thermocouples for Measuring Strong Neutron Flux," by Yu. K Guskov and A. V. Zvonarev; Moscow, Pribory i Tekhnika Eksperimenta, No 5, Sep/Oct 59, pp 121-122

A neutron detector of simple construction permitting fast measuring of neutron flux in a wide energy range and under a strong gamma radiation background is described. The detector consists of two thermocouples. The device, although advantageous, has some shortcomings in that it loses its linearity at strong neutron flux and suffers from inertia.

124. Gas-Filled Counters

"Filament Gas-Filled Counters," by Yu. A. Prokof'yev and A. N. Sosnovskiy; Moscow, Pribory i Tekhnika Eksperimenta, No 5, Sep/Oct 59, pp 125-127

Reliable gas-filled counters with cathodes consisting of a system of metallic filaments are described, as well as two types of "carpets" assembled of such counters. Their characteristics are presented.

125. Monitoring Ionization Chamber

"Differential Ionization Chamber as a Monitor of Radiative Capture of a Synchrotron," by M. P. Piskov and I. N. Usova, Physics Institute, Academy of Sciences USSR; Moscow, Pribory i Tekhnika Eksperimenta, No 5, Sep/Oct 59, pp 127-128

A differential ionization chamber is described permitting considerable improvement in the monitoring of radiative capture of the synchrotron of the FIAN (Physics Institute of the Academy of Sciences USSR). The mean square error of monitoring with a usual thin-walled chamber was $\pm$ 4.6%. With the differential chamber, the error was reduced to $\pm$ 1.7%.

126. Hungarian Article Reviews Soviet Thermonuclear Research

"Thermonuclear Research in the Soviet Union," by Lajos Pocs, scientific researcher; Budapest, Magyar Tudomany, Oct 59, pp 533-538.

The article begins with a very general discussion of the physics of chemical energy production and of atomic fission and fusion. The author states that the Soviet Union began to work on peaceful thermonuclear energy production "around 1950," citing the work of A. D. Sakharov and Nobel Prize winner I. E. Tamm. In 1952, he notes, L. A. Artsimovich, working at the Institute of Atomic Energy, Academy of Sciences USSR, detected neutrons being released as a result of fusion in an electric discharge tube containing deuterium and tritium.

As the experiments became more sophisticated, the author continues, the discharges were photographed with a camera having a speed of 2 million frames per second, and methods were developed to measure the temperature and pressure of the plasma.

The author states: "These experiments were done at the Physics Institute of the Moscow University, at the Ukrainian Physicotechnical Institute, and at the Sukhumi Electrophysics Institute, as well as at the Institute of Atomic Energy, Academy of Sciences USSR." Although hope for practical application of the fast electric discharge fusion method has been abandoned, he adds, the experiments are being continued for their contribution to a study of plasma characteristics.

The theoretical work of M. A. Leontovich opened up the possibility for a "slower" electric discharge effect; this led to a study of heating methods and stability problems. The author then describes the construction of "Alfa" at the Institute of Atomic Energy. The chief aim of the experiments done with this machine, he says, was a study of the nature of instabilities. The author cites here the work of R. Z. Sadyeyev.

In 1953, G. I. Budker showed that a method different from the above could also be imagined -- the magnetic trap. One of these was OGRA, put into operation in the summer of 1958. Construction of OGRA was directed by I. N. Golovin. The author discusses the operation of this and other magnetic traps. He says: "If we bend the tube into a figure eight -- reminiscent of an inflated inner tube -- then the particles will not be able to escape. The plasma will remain together also if we extend the torus so that there are straight pieces between the two semicircular sections. The magnetic field in the straight section is stronger in some places and weaker in other places. Soviet physicists are doing experiments with such traps."

Finally, the author notes that common explosives can also be used to produce high temperatures. "Such experiments were done in 1952. Deuterium or deuterium-tritium mixtures were put into small ampules placed in the middle of TNT or an even stronger explosive. The temperature arising during explosion initiates a thermonuclear reaction. Metering instruments placed nearby indisputably indicated the production of neutrons. The instruments were destroyed during the explosion, but the neutron-indicating pulses were transmitted to distant monitors first. This experiment has no practical significance...."

127. Hungarian Subcritical Reactor

"New Subcritical Atomic Reactor" (unsigned article); Budapest; Nepszabadsag, 13 Nov 59, p 2

On 5 November 1959, the Central Physics Research Institute activated a subcritical atomic reactor. The new equipment was described at a press conference on 12 November 1959. Academician Lajos Janossy, director of the institute, said production of isotopes will begin in January.

Ferenc Szabo, chief of the Reactor Physics and Technology Laboratory of the institute, reported on the nature of the subcritical reactor. The reactor has fewer fuel elements than would be needed for a critical reactor; it was set up in 2 1/2 months. It will be used for experiments on reactor physics. Plans call primarily for experiments which will give Hungarian experts the knowledge needed to build a small-output power reactor of their own design.

(Note: Nepszabadsag, 7 Nov 59, p 10, had reported that the subcritical reactor used reserve fuel elements from the experimental reactor.)

128. Hungarian-Italian Cooperation in Physics Noted

"Facchini's Statement on Work of Hungarian Atomic Scientists" (unsigned news item); Budapest, Nepszabadsag, 14 Nov 58, p 10

U. Facchini, director of the CISE Atomic Research Institute in Milan, spent several days in Budapest as guest of the Central Physics Research Institute of the Hungarian Academy of Sciences. Prior to his departure, he made the following statement to a Hungarian reporter:

"I first visited the Budapest institute 2 years ago, and on this visit, I noted a very considerable development.... Especially interesting are the experiments of Professor Janossy and his colleague, Naray Zsolt, on the nature of matter. In my opinion, very few scientists in either Europe or America are doing such profound research in this area....

"I can also report with joy that the Central Physics Research Institute and the Milan CISE have developed fruitful cooperation over the years. Italian researchers have visited Budapest, and Hungarian researchers have come to Milan...."

## Spectroscopy

### 129. Double Ray Spectrometer

"Double Ray Spectrometer for Studying Raman Light Spectra," by V. A. Zubov, G. G. Petrash, and M. M. Sushchinskiy, Physics Institute, Academy of Sciences USSR; Moscow, Pribory i Tekhnika Eksperimenta, No 5, Sep/Oct 59, pp 119-120

A photoelectric spectrometer is described, provided with a diffraction grating having a 5.5 angstrom mm dispersion, for the study of Raman spectra. The device operates on one and on double ray modes. In the latter case, the ratio of line intensity of the studied spectrum to the intensity of the exciting line is recorded, permitting the elimination of instability of the burning of the lamp and of the sensitivity of the photomultiplier.

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