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REPORT

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CENTRAL INTELLIGENCE AGENCY

SCIENTIFIC

INFORMATION REPORT

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PLEASE NOTE

This report presents unevaluated information extracted
from publications of the USSR, Eastern Europe, and China.
The information selected is intended to indicate current
scientific developments and activities in the USSR, in the
Sino-Soviet Orbit countries, and in Yugoslavia, and is dis-
seminated as an aid to United States Government research.

SCIENTIFIC INFORMATION REPORT

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NOTE: Items in this report are numbered consecutively.

I. BIOLOGY

1. Radiosensitivity of Various Structural Elements of the Cell Studied

"Radiosensitivity of Cell Organelles," by L. P. Breslavets,
Institute of Biophysics of the Academy of Sciences USSR; Moscow,
Izvestiya Akademii Nauk SSSR, No 3, May/Jun 58, pp 282-290

The author briefly reviews literature on radiosensitivity of various cell components to ionizing radiation. Data from literature and the author's own research indicate that the radiosensitivity of various cellular elements and organelles depends on the type of organ in which the irradiated cells are located. The nucleus is thought by most authors to be the most radiosensitive component during the process of cell division, and this applies to the sperm cells, the ova, and the spores of plants. However, the nucleus can be less sensitive than the plastids and the mitochondria while the former is in the cells of resting tissues (mesophylla of mature leaf). A significant amount of data points to the great sensitivity of the cytoplasm, and a number of researchers think that physicochemical changes in the plasma may lead to changes in the nucleus. Changes in chloroplasts due to radiation, if the dose is large enough, may produce changes in the vital activities of the entire cell.

The author concludes by stating that in comparing data, one is led to think that radiosensitivity of structural components and cellular organelles depends on the tissues or on the organs in which the irradiated cells are located.

2. Systematic Research on Accumulation of Radioactive Cerium by Mollusks Conducted by Ural Biophysics Laboratory

Accumulation of Radioisotope of Cerium by Fresh-Water Mollusks,"
by G. G. Polikarnov, Sevastopol Biological Station of the Academy
of Sciences USSR, Priroda, No 5, May 58, pp 86-87

Mollusks were selected for this research due to their ability to extract from the most dilute solutions significant amounts of certain chemical elements and accumulate them in their organs.

The biophysics laboratory of the Ural branch of the Academy of Sciences USSR is conducting systematic research on the accumulation of radioactivity by mollusks, crabs, oysters, etc. The author conducted research in this laboratory (Miassovo Bio-Station, Il'men Reservation) during the summer of 1947, under the direction of Ye. A. Timofeyeva-Resovskiy, on accumulation of cerium-144 by mollusks.

Attention is drawn to the fact that mollusks are capable of concentrating cerium-144 (a beta radiator) to levels that are hundreds and thousands of times greater than that of the surrounding water.

3. Chinese Use Radioisotope in Experimental Morphology

"An Autoradiographic Study on the Uptake of Radiosulphate (S^{35})-methionine in the Embryonic Tissue and Yolk Material of the Developing Chick Embryo," by Hsieh She-p'u (薛 社 普) and P'u I-sen (蒲 い与 森), Department of Experimental Morphology, Chinese Academy of Medical Sciences; Peiping, Chieh-p'ou Hsueh-pao (Acta Anatomica Sinica), Vol 3, No 2, 1958, pp 69-78

This article presents the details of experiments performed to investigate by radioautography the intussusception of radiosulphate (S35)-methionine in the developing chick embryo. The radioisotope was supplied by the Isotope Laboratory (同 位 素 室) of the Chinese Academy of Medical Sciences. The atomic emulsion used was prepared by the Institute of Physics, Academia Sinica. Kodak magic lantern emulsion was also used experimentally and found inferior.

An English abstract of the Chinese text and photomicrographs are included.

II. CHEMISTRY

Chemistry and Technology of Fuels and Propellants

4. Production of Jet Fuel From Kerosene Cracking Fraction by Treatment With Aluminum Chloride

"On the Problem of Production of Synthetic Fuels," by M. G. Mamedli and M. S. Aliyev, Azerbaydzhan Industrial Institute imeni M. Azizbekov; Baku, Izvestiya Vysshikh Uchebynkh Zavedeniy -- Neft' i Gaz, No 6, Jun 58, pp 73-76

A procedure is described by which the middle fraction (kerosene fraction) of deep thermal cracking can be converted into satisfactory T-1 jet fuel with the aid of aluminum chloride. The characteristics of the fuel obtained by treatment with $AlCl_3$ are described in detail.

<u>Chemistry and Technology of Nuclear Fuels and
Reactor Construction Materials</u>

5. <u>A Collection of Articles on the Geology of Uranium</u>

<u>Voprosy Geologii Urana</u> (Problems of the Geology of Uranium),
Atomizdat, Moscow, 1957, 160 pp (Supplement No 6, <u>Atomnaya
Energiya,</u> 1957)

CPYRGHT

"This collection of articles deals with problems of the formation of
uranium deposits, methods of investigating these deposits, and the mineral-
ogy of uranium.

"Among the problems pertaining to the origin of uranium deposits,
principal attention is paid in a number of articles published in this
volume to processes of the genesis of uranium deposits in connection with
the formation of alluvial rocks. The important role played by diagenesis
and by subsequent epigenetic and metamorphismic phenomena, which bring
about a redistribution and enrichment of uranium under favorable geological
conditions, is illustrated by factual data. Processes are discussed which
lead to the formation of epigenetic infiltrational deposits of uranium
in coal fields. USSR and non-USSR hypotheses pertaining to the formation
of such deposits are subjected to critical consideration. The implications
from the standpoint of prospecting are brought out.

"In the papers on the mineralogy of uranium several new uranium min-
erals are described. Additional information is given on the new uranium
mineral nenadkevite, which has already been described in <u>Atomnaya Energiya</u>.
Results of thermoanalytical investigations of a number of uranium minerals
are reported. In the course of these investigations new possibilities of
identifying some minerals which cannot be readily identified otherwise
were realized.

"The collection of articles describes methods of radiometric test-
ing for uranium of tricomponent ores which contain radioactive elements
of the uranium and thorium series.

"Experience acquired outside of the USSR in the search for uranium
deposits is reviewed in an article dealing with the application of aero-
geophysical methods in a number of countries.

"This collection of articles contains information of interest to
specialists who are engaged in prospecting for and investigation of uranium
deposits and to geologists who study nonuranium minerals which may be ac-
companied by uranium ores." (Editor's Preface, p 4)

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The table of contents lists the following articles: V. S. Karpenko, "Phenomena of the Metamorphism of Uranium Ores"; R. V. Getseva, "Characteristics of the Alluvial-Metamorphogenic Type of Ore Formation"; Z. A. Nekrasova, "The Problem of the Origin of Uranium Accumulations in Coals"; V. A. Polikarpova, "New Data on Nenadkevite"; Z. A. Nekrasova, "An Aqueous Uranyl-Ammonium Phosphate (Uramphite)"; A. A. Chernikov, O. V. Krutetskaya, and V. D. Sidel'nikova, "Ursilite, a New Uranium Silicate"; A. A. Chernikov, "On the Conditions of the Formation of Sodium Autunite"; G. P. Sidorov, R. N. Rafal'skiy, "A Hydrothermal Synthesis of Uraninite"; Ts. L. Ambartsumyan, "Thermoanalytical Investigation of Some Uranium Minerals"; V. L. Shashkin, I. P. Shumilin, "A Radiometric Method for the Determination of the Uranium Content in Ore Samples"; V. L. Shashkin, I. P. Shumilin, and M. I. Prutkina, "The Interrelationship Between the beta- and gamma-Radiation of Naturally Occurring Radioactive Elements"; Ya. G. Ter-Oganesov, T. I. Gvayta, Yu. V. Roshchin, and V. I. Zubova, "Methods and Techniques of Aerogeophysical Prospecting for Uranium Deposits Abroad."

6. **Investigation of Solid Phases Formed As a Result of the Neutralization of Phosphoric Acid - Uranyl Phosphate Solutions With Ammonia**

"On the Solubility and Composition of Solid Phases in the System $NH_3 - UO_3 - H_3PO_4 - H_2O$," by L. S. Itkina, I. S. Rassonskaya, and N. M. Chaplygina, Institute of General and Inorganic Chemistry imeni N. S. Kurnakov, Academy of Sciences USSR; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 3, No 7, Jul 58, pp 675-1687

The solubilities in the system $NH_3 - UO_3 - H_3PO_4 - H_2O$ were determined at 25° at phosphoric acid concentrations within the range of 15-30%. It was established that as the content of ammonia in the solution increases, the concentration of uranium drops sharply, reaches a minimum, and then increases up to a maximum corresponding to a combined crystallization of ammonium uranyl phosphate and trisubstituted ammonium phosphate. Investigation by physical methods of the solid phases corresponding to a state of equilibrium resulted in the conclusion that the equilibrium solid phases represent two types of solid solutions which contain equimolar quantities of UO_2 and PO_4 and variable quantities of ammonia.

In connection with the work in question, different uranyl phosphates and ammonium uranyl phosphates were synthesized and their properties determined. These salts were used for introducing uranium into the solutions studied.

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7. Heats of Solution of the Hydrates of Uranyl Nitrate in Ethers

"Determination of the Heats of Solution of Hydrates of Uranyl Nitrate in Diethyl Ether and Dibutyl Ether," by V. M. Vdovenko and I. G. Suglova; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 3, No 7, Jul 58, pp 1573-1577

The heats of solution of the dihydrate, trihydrate, and hexahydrate of uranyl nitrate in dibutyl ether and diethyl ether have been measured in the concentration range of 0.002-0.02 mols per mol of the solvent. Because of the less pronounced basic properties of dibutyl ether, the heat of solution of the hydrates in it is more highly endothermic than that in ethyl ether. The changes in the heats of solution of the trihydrate and hexahydrate with the concentration are ascribed to changes in the type of solvation of the dissolved salts.

8. Solvent Extraction of Rare Earth Elements

"The Extraction of Some Rare Earth Elements With Tributyl Phosphate," by V. Jerabek and A. K. Lavrukhina, Institute of Geochemistry and Analytical Chemistry imeni V. I. Vernadskiy, Academy of Sciences USSR, and Institute of Nuclear Physics, Czechoslovak Academy of Sciences; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 3, No 7, Jul 58, pp 1703-1708

The investigation which has been carried out made it possible to establish the dependence of the degree of extraction of small quantities of rare earth elements with tributyl phosphate on their order number when these elements are extracted in the presence of relatively large quantities of uranium, iron, and other elements. A rapid method is proposed for the separation of unweighable quantities of promethium from large quantities of other elements which enter into the composition of uranium ores. This method makes it possible to conduct subsequent investigations on the detection of the radioactive isotope Pm^{147} in uranium ores. This isotope is formed as a result of the spontaneous fission of U^{238}.

9. Determination of Thorium by Titration With a Sequestering Agent

"Complexometric Determination of Thorium With the Use of 1-(2-Piridylazo)-2-Naphthol as an Indicator," by A. I. Busev, L. V. Kiseleva, and A. I. Cherkesov, Moscow State University; Moscow, Zavodskaya Laboratoriya, Vol 24, No 1, Jan 58, pp 13-16

A method for the titration of thorium with the sequestering agent trilon is described. 1-(2-Piridylazo)-2-naphthol is used as an indicator. According to the author, this method can be applied in the analysis of monazite sand and other minerals containing thorium after the phosphoric acid has been separated.

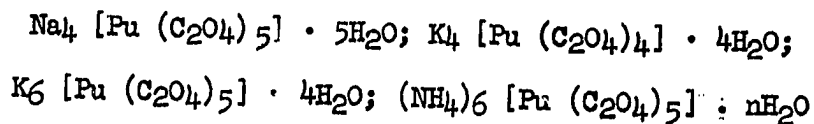10. The Chemical Characteristics of Transuranium Elements

"On the Dual Chemical Nature of Actinides" by Ye. S. Makarov, Institute of Geochemistry and Analytical Chemistry imeni V. I. Vernadskiy, Academy of Sciences USSR; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 3, No 5, May 58, pp 1079-1088

It is brought out that actinides exhibit a dual chemical nature and that they resemble lanthanides on the one hand and elements of the IVa, Va, and VIa subgroups on the other hand. Under the circumstances the name actinides is not considered to be quite appropriate for transuranium elements. The chemical behavior of the elements in question is explained by taking their atomic structure into consideration. This paper was presented at a meeting of the Scientific Council of the Institute of Geochemistry and Analytical Chemistry imeni V. I. Vernadskiy, Academy of Sciences USSR, held on 12 March 1957.

11. Complex Oxalates and Carbonates of Plutonium

"Complex Oxalates of Tetravalent Plutonium," by A. D. Gel'man and L. P. Sokhina; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 3, No 5, May 58, pp 1100-1104

The following complex compounds of tetravalent plutonium were isolated for the first time in the solid state and analyzed;

$$Na_4 [Pu (C_2O_4)_5] \cdot 5H_2O; \quad K_4 [Pu (C_2O_4)_4] \cdot 4H_2O;$$

$$K_6 [Pu (C_2O_4)_5] \cdot 4H_2O; \quad (NH_4)_6 [Pu (C_2O_4)_5] \cdot nH_2O$$

The correctness of the formulas of these complex compounds was confirmed by determinations of molecular electric conductivities and molecular weights. It was established that complex compounds of the constitution

$$(K,Na)_4 [Pu (C_2O_4)_4] \cdot 4H_2O$$
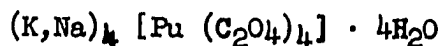
are capable of existing in two forms: in the form of red crystals and that of crystals of a greenish yellow color. It was found that the complex oxalates of tetravalent plutonium are stable in aqueous solution both at low temperatures and on heating. When alkali or acid is added to the solution of a complex compound of the type described, there is either formation of hydroxide or dissociation of the complex compound into its constituent parts.

"Preparation and Investigation of the Properties of Some
Oxalates of Hexavalent Plutonium," by A. D. Gel'man and
L. Ye. Drabkina; Moscow, Zhurnal Neorganicheskoy Khimii,
Vol 3, No 5, May 58, pp 1105-1108

Plutonium oxalate of the composition $PuO_2 C_2O_4 \cdot 3H_2O$ was isolated. The solubility of this plutonyl oxalate in nitric acid (0.5 - 3 N) in the presence of oxalic acid and ammonium oxalate was determined. It was established that the composition of the simplest complex compound obtained by dissolving plutonyl oxalate in ammonium oxalate corresponds to the formula $(NH_4)_2 [PuO_2(C_2O_4)_2]$.

"Preparation and Investigation of the Properties of Some Carbonates of Hexavalent Plutonium," by L. Ye. Drabkina, Institute of Physical Chemistry, Academy of Sciences USSR; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 3, No 5, May 58, pp 1109-1110

Ammonium plutonylcarbonate was isolated in the solid state and its composition investigated. The composition was found to correspond to the formula $(NH_4)_4 [PuO_2 (CO_3)_3]$. It was established that as a result of the decomposition of ammonium plutonylcarbonate at 120-130° the monocarbonate PuO_2CO_3 is obtained.

"Determination of the Composition and Dissociation Constants of Complex Oxalate Ions of Hexavalent Plutonium," by A. D. Gel'man, L. Ye. Drabkina, and A. I. Moskvin, Institute of Physical Chemistry, Academy of Sciences USSR; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 3, No 7, Jul 58, pp 1546-1550

The solubilities of plutonyl oxalate in HNO_3 - $(NH_4)_2C_2O_4$ solutions have been determined at concentrations of ammonium oxalate ranging from 0 to 0.4 mols per liter. It was established that in these solutions the complex ions $[PuO_2C_2O_4]^0$ and $[PuO_2(C_2O_4)_2]^{2-}$ are formed, the over-all dissociation constants of which are equal to 2.2×10^{-7} and $(3.4 - 4.3) \cdot 10^{-12}$, respectively.

"Plutonium Carbonates of Sodium (Part 2)," by A. D. Gel'man and L. M. Zaytsev; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 3, No 7, Jul 58, pp 1551-1554

Three sodium-carbonate complex compounds of plutonium have been isolated and investigated, namely $Na_4[Pu(CO_3)_4] \cdot 3 H_2O$; $Na_6[Pu(CO_3)_5] \cdot H_2O$;

and $Na_6[Pu(CO_3)_5] \cdot H_2O$ The assumption is regard to the effect of the

concentration of the carbonate ion on the composition of the complex carbonates that are formed was confirmed by the synthesis of well-defined plutonium carbonates of sodium. This assumption was originally made in connection with the investigation of the corresponding potassium compounds (cf Zhurnal Neorganicheskoy Khimii, Vol 3, 1958, p 1304).

"Mixed Oxalate-Carbonate Compounds of Tetravalent Plutonium (Part 3)," by A. D. Gel'man and L. M. Zaytsev; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 3, No 7, Jul 58, pp 1555-1560

The following seven mixed carbonate-oxalate complex compounds of plutonium have been isolated and investigated:

$K_2[Pu(CO_3)_2C_2O_4] \cdot n H_2O$; $Na_4[Pu(CO_3)_2(C_2O_4)_2] \cdot 3 H_3O$; $Na_4[Pu(CO_3)_3 C_2O_4]$

$\cdot n H_2O$; $K_4[Pu(CO_3)_3C_2O_4] \cdot n H_2O$; $K_6[Pu(C_2O_4)_3(C_2O_4)_2] \cdot n H_2O$;

$K_{10}[Pu(C_2O_4)_4(C_2O_4)_3] \cdot n H_2O$; $K_{12}[Pu(CO_3)(C_2O_4)_7] \cdot n H_2O$

It was established that there is a dependence between the concentration of carbonate and oxalate ions in the solution containing the complex compound and the chemical composition of the latter. The dependence which has been found makes it possible to establish the conditions necessary for the formation of a complex compound of the desired composition. Some problems pertaining to the structure of the products have been investigated. Determination of the molar conductivity and of the apparent molecular weight indicated that all of the substances studied are of the complex compound type.

12. A Procedure for the Purification of Niobium

"Separation of Niobium From Titanium by an Ion-Exchange Method," by O. V. Al'tshuler, Ye. A. Subbotina, and A. F. Afanas'yeva; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 3, No 5, May 58, pp 1192-1199

A procedure has been developed by separating niobium from titanium in the form of their complex ions with the application of the anion-exchange resin EDE-10. The data obtained in the investigation of the equilibrium and kinetics involved in the ion exchange of niobium and titanium indicate the existence of several types of complex ions in hydrochloric acid solutions. The composition of these ions is determined by the concentration of HCl. The comparison of the behavior of niobium with that of titanium in the separate and mixed solutions of these elements indicate that there is formation of complex ions containing both elements. For this reason, the separation of the two elements is difficult. The investigation of the behavior of tantalum in hydrochloric acid solutions indicated that its adsorption, as distinguished from the adsorption of niobium and titanium, is not of the ion-exchange type.

The purpose of the investigation was development of a procedure suitable for the purification of large quantities of niobium. The laboratory results indicate that the procedure is suitable for this purpose. After completion of the treatment a final content of titanium amounting to only 0.15% was achieved when suitable eluents were used.

[For additional information on nuclear fuels and reactor construction materials, see item No 50.]

Inorganic Chemistry

13. <u>Synthesis of Calcium Superoxide by the Irradiation of $CaO_2 \cdot 2H_2O_2$ With Ultraviolet Light</u>

"Formation of $Ca(O_2)_2$ by the Irradiation of $CaO_2 \cdot 2H_2O_2$ With Ultraviolet Rays (Part 5)," by I. I. Vol'nov, V. N. Chamova, and A. N. Shatunina, Institute of General and Inorganic Chemistry imeni N. S. Kurnakov, Academy of Sciences USSR; Moscow, <u>Zhurnal Neorganicheskoy Khimii</u>, Vol 3, No 5, May 58, pp 1095-1097

As a result of the irradiation of $Ca O_2 \cdot 2H_2 O_2$ with ultraviolet rays, peroxidic substances were obtained which had a lemon yellow color and contained in addition to $Ca O_2$ approximately 7% by weight of $Ca (O_2)_2$. The products obtained were not homogeneous and the $Ca (O_2)_2$ contained in them was found to be rather unstable.

"The Effect of the Surface on the Process of the Formation of $Ca(O_2)_2$ From $CaO_2 \cdot 2H_2 O_2$ (Part 6)," by I. I. Vol'nov and V. N. Chamova, Institute of General and Inorganic Chemistry imeni N. S. Kurnakov, Academy of Sciences USSR; Moscow, <u>Zhurnal Neorganicheskoy Khimii</u>, Vol 3, No 5, May 58, pp 1098-1099

By subjecting to vacuum drying $Ca O_2 \cdot 2H_2 O_2$ at $50°$ and a pressure of 10 mm of mercury during 100 minutes under conditions when one gram of the diperoxy hydrate was spread out over an area of 900 sq cm, calcium peroxide preparations were obtained for the first time which contained approximately 40% by weight of calcium superoxide in addition to CaO_2, calcium hydroxide, and calcium carbonate. The results obtained can be regarded as a confirmation of I. A. Kazarnovskiy's equation for the formation of superoxides from peroxyhydrates.

14. <u>Retention of Water by Perchloric Acid Monohydrate in Non-Aqueous Systems</u>

"Perchloric Acid and its Derivatives; Part 4 -- The Binary System Perchloric Acid Monohydrate-Acetic Acid," by A. A. Zinov'yev and V. P. Babayeva, Institute of General and Inorganic Chemistry imeni N. S. Kurnakov, Academy of Sciences USSR; Moscow, <u>Zhurnal Neorganicheskoy Khimii</u>, Vol 3, No 6, Jun 58, pp 1428-1432

It was established that the compound $HClO_4 \cdot H_2O \cdot 2CH_3 COOH$ exists in the system perchloric acid monohydrate-acetic acid. This proves that the monohydrate of perchloric acid retains its water firmly in the non-aqueous system in question. At a temperature of about $-24.5°$ the monohydrate of perchloric acid undergoes a transition into the solid state. The nature of the compound formed at this temperature has not been clarified.

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The purpose of the investigation described was clarification of the question as to whether perchloric acid, which is very hygroscopic, retains water in nonaqueous systems.

15. Preparation of Anhydrous Perchloric Acid

"Perchloric Acid and Its Derivatives; Part 5 -- The Properties of Perchloric Acid and Methods for Its Preparation," by A. A. Zinov'yev, Institute of General and Inorganic Chemistry imeni N. S. Kurnakov, Academy of Sciences USSR; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 3, No 5, May 58, pp 1205-1209

Perchloric acid is the only oxygen acid of chlorine which can be obtained in an anhydrous state. Anhydrous perchloric acid is a volatile, highly hydroscopic liquid. The water that is combined with perchloric acid is not in a free state but forms hydrates. Anhydrous perchloric acid is obtained by eliminating the water from perchloric acid hydrates followed by distillation of the anhydrous acid in vacuum. Because of the very low stability of perchloric acid at elevated temperatures, its distillation from mixtures obtained after dehydration of perchloric acid containing water and also its repeated distillation are best done continuously. Equipment which is suitable for a continuous process of this type is described in this article.

16. The Polymorphism of Oxonium Perchlorate

"Perchloric Acid and Its Derivatives; Part 7 -- On the Polymorphism of Oxonium Perchlorate," by B. Ya. Rosolovskiy and A. A. Zinov'yev, Institute of General and Inorganic Chemistry imeni N. S. Kurnakov, Academy of Sciences USSR; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 3, No 7, Jul 58, pp 1589-1591

It has been established for the first time that the perchlorate of oxonium undergoes a reversible phase transition at minus 23.4°. This transition is accompanied by an increase in the density of the oxonium perchlorate.

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Insect Repellents

17. Acetyltetrahydroquinolines as Mosquito Repellents

"Research on Repellents; II -- Acetyltetrahydroquinolines as Mosquito Repellents," by Ye. Kh. Zolotarev, M. L. Fedder, T. V. Kalakutskaya, L. G. Yubin, and B. A. Dmitriyev, Chairs of Entomology and Organic Chemistry of Moscow State University imeni M. V. Lomonosov and the Central Scientific Research Disinfection Institute, Ministry of Health USSR; Moscow, Nauchnyye Doklady Vysshey Shkoly, Biologicheskiye Nauki, No 2, 1958, pp 37-40

The purpose of this paper is to present the results of research involving the use of acetyltetrahydroquinolines as mosquito repellents under laboratory and natural conditions. Favorable results were obtained in experiments on Aedes communis Deg., A. cinereus Mg., A. vexans Mg., A. maculatus Mg., A. Excrusians Wlk. and A. cyprius Zudl. in the Oksk and Astrakhan state forests.

In addition to recommending the use of these quinolines as mosquito repellents the authors present data for synthesizing 1-formyl-1,2,3,4,-tetrahydroquinoline, 1-propionyl-1,2,3,4-tetrahydroquinoline, and 1-capronyl-1,2,3,4-tetrahydroquinoline.

Organic Chemistry

18. Organophosphorus Insecticides

"The Structure and Insecticidal Activity of Certain Phosphorus-Containing Acid Anhydrides," by A. I. Razumov, N. N. Bankovskaya, and I. D. Neklesove, Tr. Kazansk. Khim.-Tekhnol. In-ta, No 3, 57, pp 219-227 (From Referativnyy Zhurnal Khimiya,
No 14, 1958, Abstract No 47855)

"25 g of $(C_2H_5O)_2P(O)Cl$ were heated with 24 g of $C_2H_5P(O)(OC_2H_5)_2$ at 114-129° for 40 minutes for the preparation of $(C_2H_5O)_2P(O)OP(O)C_2H_5(OC_2H_5)$ at 35% yield. The boiling point is 120-122°/0.3 mm; n_D^{20} 1.4280; d_4^{20} 1.1664. In an analogous manner, the following compounds were also prepared (the temperatures are in degrees, heating time in minutes, yield in %, boiling points in °C/mm, n_D^{20}, d_4^{20}): $[C_2H_5(C_2H_5O)P(O)]_2O$, 106-128, 60, 42, 120.5-121/0.5, 1.4365, 1.1457; $(C_2H_5O)_2P(O)OP(O)(C_2H_5)_2$, 140-158, 60,

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35, 128-129/0.3, 1.4414. 1.1469; $C_2H_5(C_2H_5O)P(O)OP(O)(C_2H_5)_2$, 106-130,

60, 23, 124-126/0.3, 1.4502, 1.1194; $(C_2H_5)_2P(O)OP(O)(C_2H_5)_2$, 86-112,

105, 43, 142-143/0.3, 1.4648, 1.1042. The rate of hydrolysis was studied, as well as the insecticidal activity (on Calandra granaria). In a number of symmetric and unsymmetric anhydrides, the rate of hydrolysis and the insecticidal activity drops with decreasing molecular weight of the ester radicals in the molecule."

19. Detection of Cytisine for Forensic Purposes

"Reactions Detecting Cytisine in Forensic Chemical Investigations," by I. A. Marenich, Khar'kov Pharmaceutical Institute, Chair of Forensic Chemistry; Kiev, Ukrainskiy Khimicheskiy Zhurnal, Vol 24, No 3, 1958, 388-390

Cytisine is an alkaloid whose toxicity is close to that of strychnine and curare, and satisfactory methods for detecting it in biological matter are lacking. The purpose of the present investigation is to select a microcrystalloscopic reaction for cytisine that is sufficiently accurate and sensitive. Crystals of cytisine iodobismuthiate, dibromocytisine bromide, and cytisine chloroplatinate were investigated. A table giving the optical properties of the crystals is given. The reaction with iodine in sodium bromide yields the dibromocytisine bromide crystals; however, this reaction is also positive for atropine. Atropine can be distinguished from cytisine by using other reactions producing the other crystals.

20. Chinese Research on Organophosphorus Compounds

"Studies on Organo-Amido-Phosphorus Compounds; II -- The Influence of the Alkyl Radicals of Dialkyl-phosphites on the Preparation of Dialkyl Amido-phosphonates," by T'ung Tseng-shou (童 曾 壽) and Ch'en Shih-ts'ung (陳 世 驄), Department of Chemistry, Academy of Medical Sciences; Peiping, Huahsueh Hsueh-pao (Acta Chimica Sinica), Vol 24, No 1, 1958, pp 30-35

This item presents experiments undertaken to observe how, in the preparation of dialkylanilinophosphonates, $(RO)_2P \cdot NH$, the reaction of eight dialkylphosphites, $(RO)_2P-H$, with aniline in the presence of carbon tetrachloride and a tertiary base is influenced by the size of the alkyl radical.

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An English summary of experimental results is published in the journal, which received the article for publication in July 1957.

"Researches on Organophosphorus Compounds; IV -- The Anomalous Reaction of Some Alcohols With Phosphorus Pentasulfide," by Hu Ping-fang (胡 秉 方) and Ch'en Wan-i (陳 萬 義), Peking Agricultural University; Peiping, Hua-hsueh Hsueh-pao (Acta Chimica Sinica), Vol 24, No 1, 1958, pp 112-116

This article, published with an English abstract, presents the anomalous reactions of ter-butyl, ter-amyl, and benzyl alcohols, respectively, with phosphorus pentasulfide at above 80 degrees.

"Ter-butyl alcohol and ter-amyl alcohol gave corresponding olefins (63-67 percent) and a small quantity of a thio alcohol, whereas benzyl alcohol gave dibenzylthio ether (41 percent) and an unknown semisolid containing phosphorus. However, at 45-60 degrees ter-butyl alcohol and benzyl alcohol gave the expected 0,0-di-ter-butyl-dithiophosphoric acid ester (71 percent) and 0,0-dibenzyl-dithiophosphoric acid ester (83 percent), respectively. The former reaction product decomposed at 70 degrees, giving ter-butyl thio alcohol and some olefins. The latter decomposed at 80-100 degrees, yielding dithio ether, but no thio ether or olefins.

"Lead salts of the 0,0-dialkyldithiophosphoric acid esters and derivatives were prepared and the new organophosphorus compounds analyzed."

21. **Chinese Test Domestic Organophosphorus Insecticide**

"Preliminary Experiments in the Use of the Organophosphorus Insecticide Dipterex for Exterminating Mosquito Larvae," by Ch'en K'ang-ch'uan (陳 九 川) and Ch'en Chin-pao (陳 金 宝); Peiping, Chung-hua Wei-sheng Tsa-chih (Chinese Journal of Hygiene), No 2, 1958 (from Chung-hua I-hsueh Tsa-chih (National Medical Journal of China), Vol 44, No 6, 1958, p 620

"Results of field experiments indicate that Dipterex, experimentally manufactured in China, is effective against mosquito larvae when used in a concentration of 0.2 ppm, and against flies when used in a higher concentration. It appears to be a promising insecticide. The cost of production would be about the same as for DDT since the raw materials are available in China."

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Radiation Chemistry

22. Chinese Experiments in Oxidation by Mercury Resonance Radiation

"Oxidation of Sulfur Dioxide by Photochemical Reaction and Photosensitization," by Ch'en Shih-wei (陳 時 偉); Peiping, Hua-hsueh Hsueh-pao (Acta Chimica Sinica), Vol 24, No 2, 1958, pp 187-193

The experiments presented in this item were performed to investigate the mechanisms of oxidation of sulfur dioxide by photoreaction and by photosensitization and also to determine the quantum yields in sulfur trioxide by each of these reactions.

Mixtures of SO_2, O_2 or air, N_2, and/or mercury vapor were exposed to mercury resonance radiation under atmospheric pressure at room temperature. The mechanisms of photoreaction and photosensitized reaction are proposed in disagreement with theories advanced by Blacet and Kornfeld, respectively. Determined values of quantum yields of these two reactions are tabulated and discussed. The over-all quantum yields of photoreaction were found to be 1.12 at 1849.6 Å and 0.31 at 2537.5 Å, while those of photosensitized reaction were 1.39 and 0.68 at the lines 1849.6 Å and 2537.5 Å, respectively.

As for the structure of the crystal quartz reaction tube used in these experiments, the author refers to his earlier contribution in Hua-hsueh Hsueh-pao (Acta Chimica Sinica), Vol 23, No 3, 1957. Methods of purification, radiation, and light exposure determination are reportedly described in his contribution to Journal of Physical and Colloid Chemistry, Vol 53, 1949, p 486. Other techniques employed in this study are presented in the article.

"Optimum Condition and Quantum Yield of Ozone Formation by Mercury Resonance Radiation," by Ch'en Shih-wei (S. W. Chen), Department of Chemistry, Lanchow University, Lanchow; Peiping, Hua-hsueh Hsueh-pao (Acta Chimica Sinica), Vol 23, No 3, 1957, pp 179-187

This article, received for publication in December 1956, describes work completed by the author at the University of Illinois and is published with an English abstract of the Chinese text:

"Under atmospheric pressure, the shorter line 1849.6 Å of mercury resonance radiation is responsible for ozone formation in oxygen, and not the longer line 2537.5 Å. The presence of van der Waals molecule, O_4 or $(O_2)_2$, has no influence on ozone formation. The suggestions made by Wulf, Herzberg, Rollefson, and Burton that the primary step of photochemical formation of ozone is at line 2530 Å in Warburg's experiment is hereby disproved.

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"According to the latest absorption data of the oxygen molecule in the ultraviolet region, the mechanism of ozone formation in oxygen by line 1849.6 Å may be described as

$$O_2(^3\Sigma_g^-) + 1849.6\ \text{Å} \longrightarrow 2O\ (^3P)$$

$$O_2(^3\Sigma_g^-) + O(^3P) + M \longrightarrow O_3 + M,$$
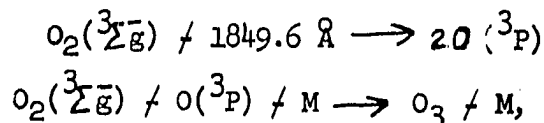
with a theoretical quantum yield of slightly less than 2, while its actually determined value was 1.87.

"It was found that the quantum yield of ozone formation decreases considerably with a decreasing flow rate of oxygen and decreases slightly with increasing temperature. It is only slightly influenced by admixture with nitrogen.

"For the purpose of manufacturing ozone industrially, dry air can be used as the source of oxygen, and a mercury lamp with suitable pressure of rare gas, prominent in 1849.6 Å line, is the best source of radiation. The work can be performed at room temperature and atmospheric pressure with a gas stream of moderate flow rate."

"Mechanism and Quantum Yield of Ozone Formation by Mercury Photosensitization," Ch'en Shih-wei (S. W. Chen), Department of Chemistry, Lanchow University, Lanchow; Peiping, Hua-hsueh Hsueh-pao (Acta Chimica Sinica), Vol 23, No 3, 1957, pp 188-195

This article, received for publication in December 1956, describes work completed by the author at the University of Illinois and is published with an English abstract of the Chinese text:

"Formation of ozone by mercury photosensitized reaction was extensively studied. The longer line 2537.5 Å of mercury resonance radiation can produce ozone indirectly through the excitation of mercury atoms, whereas the shorter line 1849.6 Å accomplishes this reaction both directly and indirectly.

"The suggested mechanism of ozone formation in oxygen by the action of excited mercury atoms in the $3P_1^o$ state may be

$$Hg\ (^1P_1^o) + O_2\ (^3\Sigma_g^-) + M \longrightarrow HgO_2 + M$$

$$HgO_2 + O_2\ (^3\Sigma_g^-) \longrightarrow HgO + O_3$$

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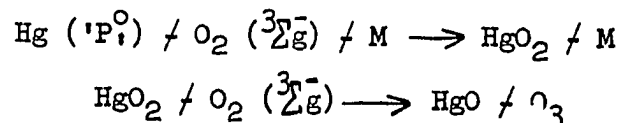
The mercuric oxide once formed may further undergo many reactions; theoretically, the quantum yield would be less than 1, while the value we determined is 0.51.

"The suggested mechanism of ozone formation by mercury atom in the $'P_1^o$ state may be

$$Hg('P_1^o) + O_2(^3\Sigma_g^-) \longrightarrow Hg('S_0) + 2O(^3P)$$

$$O(^3P) + O_2(^3\Sigma_g^-) + M \longrightarrow O_3 + M$$
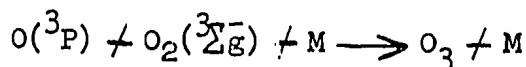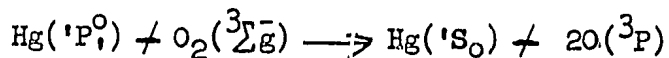
with a quantum yield less than 2, while the value determined in the present work is 1.15.

"Every mercury atom may be capable of passing through a great many complete cycles in ozone formation when irradiated. The quantum yield increases with increasing flow rate but decreases with increasing temperature at which the oxygen was saturated with mercury vapors."

[For additional information on radiation chemistry, see item No 13.]

Radiochemistry

23. Review of Progress in Nuclear Chemistry

"The Present-Day State of Nuclear Chemistry," by A. K. Lavrukhina, Uspekhi Khimii, Vol 27, No 5, May 58, pp 517-550

In this article, work in the field of nuclear chemistry is reviewed on the basis of both USSR and non-USSR publications. A bibliography consisting of 376 references, of which 158 are USSR, follows the article. Nuclear chemistry is defined as the branch of science which deals with relationships pertaining to the transformations of nuclei of chemical elements. The subject is reviewed under the headings of methods of nuclear chemistry, nuclear reactions taking place under the action of slow particles, fission of nuclei of heavy elements under the action of slow (thermal) neutrons, nuclear transformations taking place under the action of high-energy particles, nuclear reactions taking place under the action of multiple-charge ions, and nuclear reactions occurring in nature.

In the section on methods employed in nuclear chemistry, it is pointed out that one of the most effective methods used for the detection of nuclear reactions is the chemical identification of their radioactive products by radiochemical procedures. Another method is that of employing thick photoemulsion layers and the third method is based on the investigation of ionization phenomena taking place as a result of the emission of particles formed during the reaction studied. According to the author, only the application of all three methods makes it possible to investigate the processes in question completely. It is emphasized that although

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methods of analytical chemistry are used in radiochemical investigations, radiochemical analysis has special distinguishing characteristics because of the necessity of identifying radioisotopes on the basis of the type of radiation, the energy of radiation, and the half-life of the radioisotopes.

It is pointed out that investigation of nuclear transformations occurring under the action of high-energy particles is carried out at present exclusively with the aid of physical methods. It is added that mass spectrometry is being used for the determination of quantities and mass numbers of stable isotopes and that this method is being applied extensively for the analysis of isotopes of rare earth metals formed as a result of the fission of uranium and plutonium under the action of thermal neutrons.

In the section of the fission of nuclei of heavy elements by slow (thermal) neutrons, it is stated that extensive work on the identification of splinter elements formed as a result of the fission of uranium has been done by Khlopin and his pupils in the USSR. The characteristics of the fission of thorium, uranium, plutonium, americium, and curium are discussed. The practical importance of research on the fission of uranium from the standpoint of application in the field of nuclear energy is emphasized.

In the part of the article which discusses nuclear reactions taking place under action of high-energy particles, radiochemical investigations by Seaborg of products of the bombardment of uranium with alpha particles are mentioned. It is stated that similar investigations were undertaken in the USSR beginning in 1950.

The mechanism of the splitting of nuclei by fast particles is discussed in some detail, considering the two possible cases, namely the splitting of the nucleus in a highly excited state under emission of neutrons and protons and the splitting of the nucleus following emission of a large number of neutrons (emission splitting).

The emission of light nuclei in transformations taking place under the action of fast particles is discussed in considerable detail. Work on the formation of light nuclei (beryllium isotopes) as a result of the fission of uranium and thorium under the action of thermal and fast neutrons is reviewed.

In the concluding section of the article, that on nuclear reactions in nature, the role played by radioactive processes in the formation of elements present in the earth's crust is pointed out. Natural decay processes and nuclear transformations taking place in uranium ores are discussed. The significance of data on the isotopic composition of elements occurring in nature for the solution of geochemical problems is pointed out.

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The article concludes with a reference to Lavrukhina's work in which the yields of all isotopes of rare earth elements formed as a result of the fission of uranium under the action of 680-meV protons were evaluated. This made it possible to establish the role of the fission process in the formation of the elements in question. Comparison of the isotopic composition of stable isotopes formed as a result of the fission of uranium with that of natural rare-earth elements showed that the latter could not have formed as a result of the fission of nuclei of heavy elements exposed to the action of high-energy protons.

"Progress of Nuclear Chemistry," by A. K. Lavrukhina, Doctor of Chemical Sciences, Institute of Geochemistry and Analytical Chemistry imeni V. I. Vernadskiy, Academy of Sciences USSR; Moscow, Priroda, Vol 47, No 6, Jun 58, pp 9-18

This article covers the same ground as "The Present-Day State of Nuclear Chemistry" by A. K. Lavrukhina, Uspekhi Khimii, Vol 27, No 5, May 58, pp 517-550 (cf preceding item) and the subject matter is arranged in approximately the same manner. The treatment is much briefer and on a more popular level, however. The concluding part of the article in Priroda (pp 17-18), which consists of sections on the synthesis of new chemical elements, production of radioactive isotopes, and production of nuclear power, gives information that is not contained in the more extensive review in Uspekhi Khimii.

In regard to the synthesis of new elements, it is stated that application of the chain reaction of uranium fission on an industrial scale makes it possible to produce some of these elements in large quantities. In connection with this, it is mentioned that a reactor with a relatively low power capacity of 1,000 kw is capable of yielding 2 grams of plutonium per day and more than one gram of fission splinter elements, from which technetium and promethium can be isolated in a pure state. Technetium is used as a structural material for reactors, while promethium is used for miniature electric batteries which have a long useful life.

Following a discussion of applications of isotopes in science and technology, which is given in the section on the production of radioactive isotopes, it is suggested that powerful sources of radiation can be used to advantage in conducting industrial chemical processes, such as the oxidation of nitrogen of the air to nitric acid, petrochemical syntheses based on the cracking of petroleum, etc. It is furthermore suggested that nuclear transformations will be used in the not too distant future for the production of alloy steels without the use of rare and expensive metals, i.e., steels will be produced by the irradiation with appropriate particles of melts consisting of iron and other cheap metals.

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In the concluding section of the article, which deals with the production of nuclear power, the cost of nuclear power and the planned construction of nuclear electric power stations in the USSR under the Sixth Five-Year Plan are discussed. Reference is made to work on controlled thermonuclear reactions done in the USSR and elsewhere and to the possibility of generating nuclear power by the low-temperature synthesis of helium and hydrogen nuclei with the aid of μ^- mesons.

Miscellaneous

24. Future Plans for the Development of Chemistry in the USSR

"Chemical Science in the Service of Socialistic Industry," by A. Topchiyev; Moscow, Kommunist, No 9, Jun 58, p 43-50

In connection with the decisions of the May Plenum of the Central Committee CPSU, the scientists and organizations of the Academy of Sciences, according to the article, have a very responsible task in contributing to the increased production of synthetics and plastics. Such outstanding men as N. N. Semenov, A. N. Nesmeyanov, V. A. Kargin, I. L. Knunyants, S. S. Medvedev, K. A. Andriyanov, B. A. Dolgoplosk, V. V. Korshak, A. A. Korotkov, and many others have already made valuable contributions to the science and techniques of polymers. During the past few years, primary attention of the investigators has been directed toward the search for methods of synthesizing new polymers possessing specific properties, primarily heat resistance and high chemical stability. Much effort has also been exerted on the development of the chemistry and physics of high-molecular compounds.

Research has been conducted at the Institute of High-Molecular Compounds on the development of new organic glasses; the feasibility of producing organic glasses, with a heat resistance far surpassing that of the glass presently produced [plexiglas], was demonstrated. A series of practical examples were presented and the feasibility of increasing the heat resistance of such materials was demonstrated. A series of theoretical investigations were carried out with clear plastics and the results of these investigations will permit the determination of methods for increasing the physicomechanical properties of plastics.

The Physicotechnical Institute, together with various institutes connected with industry, has accomplished important work in obtaining especially stable materials. The results of these investigations are being introduced to industry.

At the Institute of Organoelemental Compounds, theoretical investigations were conducted with results which will provide the basis for development of industrial methods for producing synthetic fibers, plastics, high-temperature lubricating oils, aromatic substances, and others. This institute, together with branch institutes, developed new heat-resistant materials based on organosilicon compounds -- fire-resistant enamels which are effective at temperatures up to 550°. The development of new methods for synthesizing organosilicon monomers, polymers, and materials based on these compounds is being conducted at the institutes of Organic Chemistry and Chemistry of Silicated. These institutes have synthesized isoprene, the raw material for obtaining synthetic rubber.

Investigations on the synthesis of rubber by the Institute of High-Molecular Compounds have resulted in a method of obtaining a resin possessing a wider range of temperature stability than natural rubber.

The Petroleum Institute, on the basis of vast research conducted with branch institutes of the chemical industry, developed a technological method for obtaining polypropylene, a valuable material in the polymer industry. A highly effective variation in the process was suggested by the Institute of Chemical Physics. Theoretically interesting and practically important results were attained during the investigation of the processes for obtaining polyethylene and polypropylene with the use of metal oxide catalysts -- a series of new polymers and copolymers were obtained.

A general theory of polymerization, which will be widely used in advancing the present production of rubber and plastics, is being developed by the scientists of the Academy of Sciences. Investigations on the structure and mechanical properties of polymers will provide an opportunity for determining the general relationship between the size and configuration of the polymer molecules and the feasibility of deriving new materials from these polymers. The investigation of the action of high energy radiation on polymers will aid in the development of new products which will answer special requirements. Important work is being done on the utilization of radiation in the polymerization process.

The program for accelerating the development of the chemical industry levies on the Academy of Sciences USSR a series of important concrete tasks. To elevate Soviet science and techniques in the area of polymers and monomers and to attain a leading position in the world in these fields, broad theoretical and practical work must be directed toward these problems. During the next few months, with the cooperation of the institutes of the Academy of Sciences USSR, and the Academies of Sciences of the union republics and higher learning establishments, a prospective plan for these works will be presented.

During the next few years, the Institutes of the Academy of Sciences USSR and the institutes of the Academies of Sciences of the union republics should aid industry in the development of those processes which industry will require in order to meet the plans of development called for from 1959 to 1965. This concerns the development of mass production facilities for the production of polyethylene and polyprolylene, production of high-temperature resistant organic glass and highly resistant fibers, plastics, and polyamides, and the development of industrial production of new types of synthetic rubbers and many other technical processes which will be projected.

In connection with the over-all development from 1958 to 1960, a series of new institutes will be organized under the Academy of Sciences USSR, the Siberian Branch, the Academies of Sciences of the union republics, along with a number of new divisions under the institutes of Chemical Physics, Physical Chemistry, High-Molecular Compounds, Organoelemental Compounds, in the Physicotechnical Institute as well as under the insitutes of the Academies of Sciences of the Latvian SSR and Armenian SSR. It is proposed that an Institute of Petrochemical Synthesis be formed on the basis of a number of laboratories of the Petroleum Institute. It will becone a center which will direct a series of affiliated institutes and industrial laboratories concerned with monomers and petrochemicals produced by the oil and gas industry, as well as with olefins and polymers.

All the world is aware of the achievements of Soviet reaction engine techniques which unquestionably have attained their present level of development as a result of the efforts of the petroleum industry and petroleum chemists. Further advances in reaction motor techniques will require the development of new types of special fuels, lubricating oils, and various additives; this is one of the leading trends in petroleum chemistry.

Work on developing effective processes for separating complex hydrocarbon systems, especially hydrocarbon gas, should be accelerated. This is necessary in order to obtain high-quality polymer materials. The natural gas laboratories of the Oil Chemistry Institute should focus their attention on this problem.

A group of scientists at the Institute of Chemical physics will investigate chemical kinetics -- the basis for directing chemical reactions. A department for investigating the dispersion of polymer systems should be organized at the Institute of Physical Chemistry.

The basic institute of the Academy of Sciences USSR which will concern itself with the chemistry and physical chemistry of polymers will be the Institute of High-Molecular Compounds located in Leningrad. It will play the role of an academic institute in the great Leningrad complex where many technological problems pertaining to plastics and their treatment are determined.

More attention should be focused on high-molecular inorganic compounds used as construction materials, improvement of soil structure, and many problems connected with adhesives.

An institute should be organized in the Academy of Sciences USSR which will concern itself with natural compounds -- polysaccharides, proteins, and other high-molecular compounds. It is a proven fact that the chemistry of natural compounds plays an important role in the therapy of bacterial diseases.

The Academy of Sciences is confronted with a huge task in attempting to organize these institutes and departments, as well as supplying cadres and providing space, scientific equipment, and over-all guidance of activities.. The academy will take an active part in selecting the most important problems concerning the production and utilization of polymer materials.

There is still much work to be done by the Academy of Sciences in the publication and informational field, involving the issuing of technological literature, the organization and publication of new journals, and an increase in the output of express information. The following periodicals will be published: Vysokomolekulyarnyye Soyedineniya (High Molecular Compounds), Plastmassy (Plastics), and Khimicheskiye Volokna (Chemical Fibers). In addition, the president of the Academy of Sciences USSR has ordered the publication of a series of popular scientific brochures within the next few months; they were written with the aid of leading scientists in the country.

[For information on analytical chemistry, see item No 102.]

III. ELECTRONICS

Communications

25. Consideration of Noise in PPM-FM Transmission

"Fluctuation Noises in FM Radio Lines During Transmission of a
Multichannel Signal With Pulse-Phase Modulation," by G. A.
Malolepshiy; Moscow, Radiotekhnika, No 7, Jul 58, pp 11-24

The problem of noise immunity is considered in the PPM-FM transmis-
sion of multichannel signals. Graphs are given for determining noise
immunity in such systems. The threshold of the system is examined and
an analysis is made of operation above and below the threshold of im-
provement.

In i-f amplifiers having identical passbands there is some loss in
the signal-to-noise ratio of a PPM-FM system operating above the threshold
of improvement (5-10 db). However, at a threshold signal level of 2-8 db
the system has an advantage over the signal-sideband modulation-FM receiver
(for the same number of channels).

A PPM-FM system is found to be more satisfactory when it is necessary
to increase the maximum communication range at the expense of an increase
in the noise level.

26. Ferrographic Method of Facsimile Transmission

"Ferrography -- Magnetic Method of Image Recording," by V. A.
Vatsenko and V. G. Patrunov; Moscow, Elektrosvyaz', No 7, Jul
58, pp 49-55

In 1956 experiments with ferrographic recording of facsimile messages
began at the Moscow Communications Electrical Engineering Institute. In
the first series of experiments magnetic drums were used; later experiments
were extended to recordings on magnetic tapes.

The controlling factor of quality of ferrographic reproduction is
the dimension of the recording slit in the magnetic head. The length of
the slit should be about 10 microns; this will assure passage for the
whole spectrum of facsimile signal (1,300 ± 500 c at 60 rpm of the drum)
with a rather low aperture distortion. The width of the slit is chosen
equal to the scanning feed, which is generally about 0.2 mm. Black mag-
netite and heat-treated carbonyl-iron powders (P-4 and P-8) were found to
be the best for ferrographic recording.

Up to 250 copies can be obtained from an original facsimile record-
ing, but such a multicopying process requires redeveloping of the original
after every print. The ferrographic recordings display exceedingly sharp
contrast; to produce semicontrast recordings special treatment is required.

Ferrographic facsimile images are inferior to those obtained by opti-
cal methods, but are superior to those obtained by electrochemical and
electrothermal methods.

27. New Development in Pulse-Time Modulation

"Pulse-Time Modulation With Variable Period and Identification
Code," by A. N. Svenson; Moscow, Elektrosvyaz', No 6, Jun 58,
pp 21-29

This article describes a new variant of pulse-time modulation which
permits considerable narrowing of the spectrum of the transmitted signal.
The method is especially adaptable to multiplex radio-relay communication.
It was shown theoretically that this new pulse-time modulation method,
which incorporates the identification code, is about six times as effec-
tive as conventional pulse-time modulation when applied to radio-relay
communication lines. In this new system the modulator and discriminator
units are substantially more complicated in construction than the equiva-
lent units of a conventional pulse-time modulation system.

The effectiveness of the new pulse-time modulation system can be
further improved in case of duplex radio-relay communication, when the
spectrum can be further narrowed.

28. Automatic Telephones in USSR

"To Extend Automation in the Field of Communications" (unsigned
article); Moscow, Elektrosvyaz', No 6, Jun 58, pp 3-4

The article contains the following passages.

"To our regret, up to the present, city telephone stations are auto-
matized only to an extent of 50% and rayon telephone stations only to an
extent of a few percent and, in the case of intercity telephone networks,
the automation has only just begun.

"We can no longer be satisfied with the existing 'order' system in
intercity communication, where one has to wait to be connected. An urgent
national problem is to organize a fast intercity telephone system. Such
a system can be set up by extending telephone networks and building multi-
channel cable and radio-relay lines. As the extent of telephone network
automation increases, the creation of a unified automatic telephone net-
work for the whole Soviet Union will come closer to reality.

> "Realization of such a system on the territory of a nation as huge as the USSR will not be easy and will require appreciable time."

29. "Svet" Transistorized Radio Receiver

"Radio Receiver 'Svet'" (unsigned article); Moscow, Vestnik Svyazi, No 5, May 58, cover page

The Institute of Radiobroadcast Reception and Acoustics has built a small superheterodyne receiver called the "Svet" ("Sputnik") which has seven transistors and uses printed circuits. The set is designed for long- and medium-wave reception. It has a power output of 100 milliwatts; sensitivity varies from 1,500 to 800 microvolts per meter. Electric power to the set is supplied from a small TsNK-0.4 storage battery which is recharged by a 5-v silicon solar battery. The weight of the receiver is 800 g and its dimensions are 185 x 125 x 49 mm.

30. New Soviet Patents in Field of Communications

"Authorship Certificates" (unsigned article); Moscow, Elektrosvyaz', No 6, Jun 58, p 78

Class $21a^4$, 14_{01}. No 109137. M. V. Verzumov. A Method of Single-Sideband Modulation in Radiotelephone Transmitters.

Class $21a^4$, 14_{01}. No 109288. M. B. Rabinovich and A. M. Mekkel'. Single Tube Oscillator With Noncontact Modulator for Frequency Modulated Voice-Frequency Carrier Telegraphy.

Class $21a^4$, 14_{02}. No 108979. V. A. Nyurenberg. Device for Automatic Control of Radiobroadcasting Installations.

Class $21a^4$, 27. No 109252. A. V. Pashkov. Electromagnetic Relay.

Class $21a^4$, 30_{35}. No 109313. Yu. S. Karp. Device for Signal Demodulation of Frequency- or Amplitude-Modulated Signals.

Class $21a^4$, 46. No 109293. V. D. Kuznetsov. Traveling-Wave Antenna.

Class $21a^4$, 46_{02}. No 109292. V. L. Frumovich. Antenna Assembly With Controlled Directivity Pattern.

Class $21a^4$, 46_{06}. No 109994. A. L. Drabkin. Recurrent Circuit Waveguide Device for Matching Load Impedance With Effective Resistance Within a Frequency-Band Range.

Class $21a^4$, 71. No 109254. G. V. Kal'man. A Method of Measuring the Speed of Voltage Pulse Build-Up Which Drives a Magnetron.

Class $21d^2$, 42_{01}. No 108786. Yu. A. Gayevenko. Ferroresonant Voltage Regulator.

Class 21e, 36. No 108732. G. Kh. Novik and I. A. Aronov. Electronic Phasemeter.

Class 21g, 13_{01}. No 109304. Ye. V. Baranov. Power Oscillator Tube With Cylindrical Cathode.

Class 21g, 38. No 109140. B. N. Konovalov. A Method for Eliminating Delay at Cutoff of Transistor.

Class $21a^2$, 36_{02}. No 109331. A. S. Yukhnevich. A Method of Double Multiplexing of a Telegraph Communication Channel for Facsimile Operation.

Class $21a^3$, 38. No 109291. V. G. Bosenko. Layout for High-Frequency Subscriber Automatic Telephone Line.

Class $21a^4$, 24_{01}. No 109679. N. A. Simonov and N. V. Deryugin. Automatic Frequency-Tuning Device.

Class $21a^4$, 66_{01}. No 109329. G. H. Kalinin. Control Method for Plane Reflector Antennas.

Class $21a^4$, 71. No 107448. D. I. Mirovitskiy. Instrument for Reflection Coefficient Measurement of Inclined Incidence Wave on Sample.

Class $21a^4$, 71. No 109328. A. D. Selivanovskiy. Directional Loop coupler for Coaxial Lines.

Class $21a^4$, 71. No 109639. V. K. Gordeyev. Compensation Method of Measuring Pulse Amplitude.

Class 21b, 8. No 109345. A. A. Vyselkov, and G. I. Rogova. Primary Electrochemical Current Source.

Class 21c, 42_{02}. No 109354. L. S. Orelovich. Method of Automatic Switching-On of Auxiliary Power Supply.

Class $21d^2$, 12_{02}. No 109934. V. M. Kvyatkovskiy and A. Ya. Ozol. Device for Automatic Excitation Arc Restriking in a Mercury-Arc Rectifier.

Class $21d^2$, 42_{01}. No 109965. E. A. Sukazov. Ferroresonant Voltage Regulator.

Class $21d^2$, 54. No 109919. S. M. Yegudov and S. I. Novikov. Measuring Device for AC Voltage Regulator.

Class 21e, 29$_{02}$. No 109915. V. M. Pochekayev. Device for Measuring Capacitance and Inductance by Resonance Method.

Class 21e, 36. No 109294. N. N. Malakhov. Device for Controlling Nonuniformity of Frequency Response in Four-Terminal Networks.

Class 21e, 36. No 109327. F. S. Iskozer. Wattmeter for Measurement in High-Frequency Circuits.

Class 21g, 13$_{20}$. No 109056. M. I. Yelison and G. F. Vasil'yev. Heaterless Cathode Assembly for Electronic Vacuum Instruments.

Electromagnetic Wave Propagation

31. New Audio-Frequency Pulse Amplifier

"A New Highly Effective Power Pulse Amplifier for Audio-Frequency Oscillations," by D. V. Ageyev, V. V. Malanov, and K. P. Polov; Moscow Radiotekhnika, No 6, Jun 58, pp 47-51

A new method is suggested for pulse amplification of audio-frequency oscillations. The characteristics and operation of the system are discussed.

A simplified circuit diagram of the amplifier used in the experiments and its parameters are given. Results of the investigation showed that at maximum signal level and at a frequency of one kc the efficiency of the amplifier was on the order of 84%. Nonlinear distortion in the passband of the amplifier was 3-6%.

The advantages of the amplifier are that it has a high efficiency (near 100%) and does not require a pulse transformer.

32. Experiments With New Traveling-Wave Tube

"On a Traveling-Wave Tube With Secondary Electron Multiplier," by D. N. Venerovskiy; Moscow-Leningrad, Zhurnal Tekhnicheskoy Fiziki, No 5, May 58, pp 1089-1095

This article describes attempts to develop a tube in which it would be possible to simultaneously amplify a low-frequency signal, generate a carrier frequency, and modulate the carrier by a low-frequency signal.

Conditions necessary for achieving such an operation in a single tube involve replacing the electron gun and oxide thermionic cathode in the ordinary traveling-wave tube with a secondary electron multiplier and an electron-optical adapter in place of the secondary electron collector. The coefficient of secondary emission must be independent of the magnitude of load current on the emitter, this being acccmplished by the use of emitters of magnesium and beryllium alloys on copper, aluminum, and nickel bases.

In operation, the primary electron beam from the gun is directed to the first dinode of the multiplier and, after passing all the dinodes, is amplified to the necessary magnitude. From the last dinode the electrons are focused by the electron-optical device through the tube where an interaction occurs between the electron flow and the field of the delay system.

Since the multiplier is a linear wide-band amplifier, modulation of the primary electron beam results in modulation of the output current of the multiplier and beam current within the traveling-wave tube.

A description of the experimental tube and its dimensions are given. The multiplier used in the tube was developed by G. S. Wildgrube in the USSR and consists of nine amplification stages providing an output current of 20 ma for a primary beam current of one μa.

On the basis of preliminary experiments the author draws the following conclusions.

1. There is a linear relationship between the amplitude of the excited electromagnetic field and the current of the electron beam for changes of the latter from 0.5 to 1.2 ma.

2. The amplitude build-up time of oscillations in the tube, for abrupt changes in beam current, does not exceed 10^{-6} sec.

3. A possible change in generated wavelength due to a threefold increase in beam current does not increase the error of wavelength measurement by more than 0.5%

33. Quartz Oscillators

"Bridge Circuits of Harmonic Quartz Oscillators," by M. M. Pruzhanskiy; Moscow, Radiotekhnika, No 6, Jun 58, pp 29-46

The operation of bridge circuits in harmonic quartz oscillators is analyzed. On the basis of this analysis a quasilinear method is suggested for transforming the results of the investigation into a simple

graphical form. This method may be used with a sufficient degree of accuracy to determine the amplitude and frequency of oscillations in quartz oscillators and to determine the relationship between different circuit parameters and the amplitude and frequency of oscillators with an inductance-capacitance and pure capacitance bridge in a feedback circuit.

The frequency of oscillations in the bridge circuits is found to be equal to or very near the series resonant frequency of the quartz, and, consequently, greater frequency stability is obtained.

34. Computation of Helical Spiral-Beam Antenna

"A Helical Spiral Antenna With Constant Pitch," by N. P. Timirev; Moscow, Radiotekhnika, No 6, Jun 58, pp 18-28

Equations are developed for determining the components of the radiation field of a helical spiral-beam antenna with constant pitch. The case of an antenna having a very small conical parameter is examined, and it is found that, from the viewpoint of radiation, the "beam" turns of a helical spiral antenna may be replaced by some equivalent cylindrical spiral having the same number of turns and constant parameters.

It is shown that, in principle, it is impossible to obtain circular polarization in a helical spiral along its axis.

Recommendations are given for the choice of optimum constant radiation parameters.

35. Effect of Window in Waveguide on Losses

"Losses in a Waveguide Due to the Presence of a Window With Finite Conductivity in the Wall of the Waveguide," by I. V. Lebedev, Tr. Mosk. Energ. In-ta, 1956, No 18, pp 369-379 (from Referativnyy Zhurnal -- Elektrotekhnika, No 7, May 57, Abstract No 15730)

The effect of the presence of a rectangular window lacking ideal conductance on losses in a waveguide is considered. A relationship is established between losses and dimensions of the window, location of the window, and dimensions of the waveguide. Computations are expanded to include the case of a window filled with an electron-ion plasma, allowing determination of the magnitude of voltage of the electrical field in the plasma with an independent charge.

Radar

36. Computation of Effective Radar Range

"Computation of Effective Range of Pulse Radar According to
Its Parameters and a Given Probability of Target Detection,"
by M. M. Gerdov; Moscow, Radiotekhnika, No 7, Jul 58, pp 55-61

Certain formulas are introduced which may be used for computing effective radar range. The effect of internal receiver noise and fluctuations of the returned signal due to movement of the target are considered in the computations. The appearance of useful signal and noise at the output of the receiver are treated as compatible factors.

The formulas presented do not take into consideration the effect of reflections from the Earth in the formation of antenna radiation patterns or the attenuation of radio waves in the atmosphere.

Radar parameters may be computed with these formulas in cases of visual detection and in angle and range tracking of a target.

It is concluded that operation with large-scale images would improve accuracy as well as the effective range for a given probability of detection. This may be accomplished in practice by the use of a sweep delay in range scanning.

37. Consideration of Noise in Automatic Range Finding Systems

"The Effect of Fluctuations on the Operation of an Automatic
Range Finder," by I. N. Amiantov and V. I. Tikhonov; Moscow,
Avtomatika i Telemekhanika, No 4, Apr 58, pp 325-333

Some problems concerning stability and errors due to noise fluctuations in automatic range finding systems are examined.

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"The operation of the most simple types of automatic range finders are considered for cases of sufficiently small fluctuations and a stationary target. Generalizations are made in relation to: (a) more precise and more complicated types of range finders, (b) consideration of the nature of movement of the target, and (c) making assumptions concerning the small size of the fluctuations and, in particular, determining erroneous operation of the coincidence tubes."

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Instruments and Equipment

38. Development of Wideband Noise Generator

"A Wideband Noise Generator for the Decimeter Band," by A. D. Kuz'min and A. N. Khvoshchev; Moscow, Radiotekhnika, No 7, Jul 58, pp 36-42

A noise generator is described which is capable of covering a frequency band of 300-3,000 Mc without retuning. The generator consists of a coaxial line, the inner conductor being a spiral coil wound around a gas-discharge tube. The ends of the wire are attached to standard 50-ohm coaxial plugs. The characteristic impedance of the generator is 50-ohms. All details of the generator are made of silver-plated brass.

In a frequency band of 300-3,000 Mc the generator has a noise temperature of $15,900^\circ$ K $\pm$ 7% and a standing-wave ratio of less than 1.5. Damping was greater than 35 db.

It is noted that the noise generator described is not suitable as a technical instrument owing to certain imperfections in design but is satisfactory for experimental work.

A significant part of the experimental work was performed by A. A. Sidorova and V. S. Savel'yev at the Scientific Research Institute of the Ministry of the Radio Engineering Industry.

39. Computation of Magnetic Amplifier

"Computation of a Magnetic Amplifier by Linear Magnetization Characteristics," by L. V. Safris, Sb. Nauch. Statey. Rostovsk. In-t Inzh. Zh.-d. Transp., 1956, No 20, pp 89-106 (from Referativnyy Zhurnal -- Elektrotekhnika, No 7, May 57, Abstract No 14830)

It is shown that, with certain assumptions, the linearized characteristics of a core magnetized simultaneously by constant and alternating magnetic fields may be used in an analysis of operation and for computing a magnetic amplifier. The values used in the computation are analogous to those of mutual conductance, plate resistance, and amplification factor of an electron tube. Experimental verification shows that the accuracy of computations is sufficient for the preliminary computation of a magnetic amplifier.

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Computers and Automation

40. Specifications of New Counting Tubes

"Commercial Gas-Discharge Counting Tubes (Decatrons)," by I.
Ya. Breydo and G. M. Yankin; Moscow, Radiotekhnika, No 7,
Jul 58, pp 80-86

Basic parameters and design data are given for gas-discharge counting
tubes with cold cathodes -- type YeG1 and YeG2 decatrons -- produced in
the USSR. The article examines various control-unit circuits and notes
the applications of decatrons.

Electrical specifications for the two decatrons include the fol-
lowing:

Ignition voltage, anode-cathode: no more than 300 volts.

Supply voltage: 360-450 volts.

Counting speed for YeG1 decatron: not less than 8,000 pulses per
second (average of 10,000 pulses per second).

Counting speed for YeG2 decatron: not less than 3,000 pulses per
second (average of 6,000 pulses per second).

Duration of control pulses: 30-50 μ sec.

Life of decatron: an average of more than 500 hours.

41. MARS-300 Centralized Control Electronic Machine

"Electronic Machine for Centralized Control," by B. M. Yakob-
son; Moscow, Priborostroyeniye, No 7, Jul 58, pp 4-8

At the Independent Design-Technological Bureau for Biological and
Physical Apparatus (SKTB BFA), the MARS-300 machine for centralized
control of industrial processes was built. The first model of this
machine was intended for control of technological processes at a syn-
thetic rubber plant. The MARS-300 machine can measure and control tempera-
ture, vacuum, and flow at 300 different points. Maximum speed of the ma-
chine for sampling all the 300 points is 30 sec. The machine provides
information in digital form by printing on a card, or in the form of sig-
nals on a mnemonic network. The MARS-300 is built with 780 relays, 35
step-selector switches, 26 electronic tubes, 600 germanium diodes, 2,000
resistors, and 200 capacitors. The over-all size of the machine is
2,000 x 2,000 x 600 mm.

42. **Simulation of Electrical Circuits**

"System Simulation Units," by V. A. Ivanov, Sb. Rabot po Avto-matike i Telemekhanike, Moscow, Academy of Sciences USSR, 1956, pp 134-145 (from Referativnyy Zhurnal -- Elektrotekhnika, No 7, May 57, Abstract No 19268)

A description is given of the circuit for a delay unit and some special transducer units for the formation of an output voltage which is a linear, parabolic, or exponential function of the value of the mechanical movement. On the basis of the transducer units, a circuit for a differential bridge is given which has inductive data units for subsequent rectification and amplification of signals. For the creation of functional relations of the circuit, elements are given which have corresponding characteristics of electron tubes.

43. **EI-S Electronic Analog Computer**

"The Specialized EI-S Electronic Analog Computer," by N. S. Nikolayev; Moscow Byulleten' Tekhniko-Ekonomicheskoy Infor-matsii, No 3, 1958, pp 8-10

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Following is the full text of the article.

The EI-S electronic analog computer is being successfully employed at the All-Union Scientific Research Institute for the Petroleum Industry.

The EI-S electromodel is intended, in general, for the solution of problems concerning underground hydraulics associated with the rational development of large-scale petroleum deposits. Nevertheless, it is possible to solve other engineering problems on it which are reducible to partial differential equations of the Laplace and Fourier type for boundary conditions of the first, second, and third kind and for initial conditions both fixed and variable according to time. The form of the region for the problems may be varied, and the boundary conditions may be given on the exterior as well as on the interior contours of the region.

The precision of the problem's solution on the EI-S electromodel is characterized by the errors of the finite-difference method and instrument errors of the electromodel. The total magnitude of error does not exceed several percent of the maximum value of the unknown quantities.

The EI-S electromodel is constructed according to the block-section principle. Its basic element is a trizonal matrix of electrical conductors on which are gathered the parameters of the region for the problem to be solved. The central zone has 75 x 95 junctions and consists of two matrices. The junctions of both matrices may be connected, thus yielding the possibility of modeling three-dimension regions (with one space relative to the z axis). The matrix of middle zone has a mesh spacing two

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times greater than the central zone, but consists only of one layer. The dimensions of the middle zone are 59 x 75 junctions. The matrix of the periphery zone has an eight times wider mesh spacing than the central zone; its dimensions are 39 x 39 junctions. The matricies of the central, middle, and peripheral zones are connected with the help of special matching circuits, transition zones assuring an even transfer from a matrix with a fine mesh spacing to a matrix with a wider mesh spacing.

For greater working convenience and better utilization of the matrix it may be "cut" into a series of strips and interconnected in a long strip or ring.

The flexible capacity of the region for the problem to be solved (or the right part of Fourier's equation) is simulated with the help of capacitors connected to the junction points of the matrix. The value of capacitance for each magazine may change by unit steps 15 times. Through these capacitances the initial conditions are assigned for the solution of the Fourier equation.

The EI-S model consumes about 75 kilowatts in the heaviest operation (when all units are working). All the energy is converted by electronic rectifiers and stabilizers which are located in the model's section of power supply blocks. The power supply of the model is sectionalized and this permits supplying the voltage only at the working junctions of the model.

All the working circuits of the model have an automatic signaling for their good working order or trouble condition (light and sound). The most important junctions, in case of impairment, are automatically replaced by auxiliaries without interrupting the process of the problem's solution.

The model is provided with a control-testing apparatus, enabling one to perform a quick check on all functioning junctions, replacing them at that time with auxiliaries.

The model has approximately 8,000 electron tubes, hundreds of thousands of resistors, capacitors, and other radio and electrical devices. For guaranteeing the normal temperature of the system, each block of the model is provided with a ventilating cooling system which is switched on automatically at the time of switching on of the block. The blocks and units of the model occupy an area of approximately 200 square meters.

From the standpoint of volume of the actual operations, the number of junction points, and the variety of assignment of boundary conditions, the EI-S model is a unique mathematical machine.

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The EI-S model differs from the most perfect EM-5 and EM-8 matrix electronic models (the laboratory models of which were produced by the Laboratory of Electrical Modeling of the Academy of Sciences USSR) by ⎗ considerably larger matrix capacity, 20,000 junctions instead of 2,000 in the EM-5); by the method of setting-up the parameters of the matrix, executed according to the principle of setting up of the conductors, owing to which there is the possibility of simulating a region with heterogeneities (1:2,000 instead of 1:100 in the EM-5); by the number of assigned channels for the boundary conditions (750 instead of 120 in the EM-5 model); by the significantly greater flexibility of the timed program of boundary conditions channel operation as compared with the EM-5 and EM-8 models, which only permit switching on of the channels at an arbitrary moment of solution, but not turning them off (the EI-S guarantees their turning on and turning off); by the great accuracy of the region assignment, assignment of boundary conditions, and measurement of the results of the solution; by the possibility of an automatic change of the character of the boundary conditions in the solution process; and by the presence of 50 functional transformers which permit one to assign 50 varieties of time variables for boundary conditions.

Functional transformers in matrix models were in general not used before. The EI-S makes possible for the first time the step-by-step approximation of a function with the help of electronic units without the application of electromechanical elements (relays and step-by-step selector switches.

44. Universal Programs

"An Algorithm for the Automation of a Numerical Solution for the Plane Dirichlet Problem of Laplace's Equation," by M. A. Aleksidze, Institute of Precision Mechanics and Computer Engineering, Academy of Sciences USSR, and Mathematical Institute imeni A. M. Razmadze, Academy of Sciences Georgian SSR; Moscow, Doklady Akademii Nauk, SSSR, Vol 119, No 5, 1958, pp 847-850 (article presented by Academician S. L. Sobolev on 27 November 1957)

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Following is the full text of the article.

1. For the successful exploitation of electronic digital computers of the universal type it is necessary to have universal programs (UP) for the entire class of problems which have well-developed general numerical methods of solution. The advantages of UP over problem programing are the complete automation of both stages of programing and a substantial decrease in volume of the initial information. The initial information for the UP solution of the first boundary value problem will be the coded

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equations for the boundary of the region and the functions defined on the boundary. It is assumed in the described algorithm that the equations are given in parametric form and that with increase in the parameter the region is traversed from the right.

The unusual unwieldiness and monotypic nature of the final calculations during the solution of boundary value problems by the matrix method make application of electronic digital computers extremely effective. The complete automation of the solution for a boundary problem also presupposes automation of the following processes: (a) replacement of the boundary with a broken region consisting of sides and diagonals of the matrix, (b) transfer of the matrix region into the interior storage unit (VZU) of the computer (linearization of the region), (c) finding of all boundary points and the necessary information for formation of irregular difference equations at all these points, and (d) immediate calculation and deduction of the final results into a form convenient for decoding.

2. We consider the finite difference analog of the Dirichlet problem for Laplace's equation

$$\triangle_h \; u = 0 \; \text{in } G_h \, , \qquad\qquad u\Big|_{\Gamma_h} = \psi \, ,$$

where $\triangle_h$ is one of the matrix approximations of the Laplace operator.

$\triangle_h \; u \, (A) = \sum C \, (A,B) \, u \, (B)$ We will call the points B, for which $C(A,B) \neq 0$, the neighbors of A in the sense of operator $\triangle_h$. We will name as counting points the junction points of the matrix lying within the region G_h or on the contour Γ_h. A counting point will be on the boundary if the distance from it to the boundary of the region along coordinate lines is less than the mesh spacing of the matrix. In the contrary case the counting point will be internal.

For the purpose of automation, classification of the counting points as interior points and boundary points is not sufficient. The number of point types depends on the nature of the boundary problem, on the geometry of the region, and on the formulas approximately replacing the differential operators. In the case of the simplest approximation of Laplace's operator and correction of functional values at boundary points according to Collatz, a further additional classification of the set of boundary points is necessary. Double boundary points are points lying simultaneously on the contour and on the broken approximating contour. The remaining boundary points, depending on the direction of their reference value, are divided into groups of the right, left, upper, and lower boundary points. The values of the function at the calculating points employed for correction of the functional values at the boundary points are called reference values.

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With regard to the considered regions we assume that they are bounded by a finite number of curves given in parametric form satisfying the Lipschitz condition of order 1. The Lipschitz constants on individual sections of the boundary must be given in the initial information. The regions may have apertures and narrow inlets and can form a number of disconnected calculating points.

For linearization of the region having a fixed column height we find the smallest rectangle enclosing the given region in its entirety and afterward the columns of the rectangle are transferred into the VZU of the machine; whereon the neighboring points will be found in rigorously defined cells.

For marking the bulk of the storage it is possible to utilize either a local mark (to store in each cell an indication to which type of point the given cell relates, or an integrating mark (to comprise and store individual information concerning alternation of all point types in each column). The choice of a local or integrating mark depends on the geometry of the region, on the capacity of the computer's VZU, and on the number of divisions in a storage cell. In the case of an arbitrary region the local mark is expeditious for the BESM [high-speed electronic computer].

We will call the numbers of the straight lines forming the joints the whole number coordinates. Thus we will call $[y/h-(Y_0 - 512 h)/h]$, $[x/h - (x_0 - 512)/h]$ the integer parts where x, y are the coordinates of the given point and x_0, y_0 are the coordinates of the initial point for the contour traversing. It is not difficult to see that the whole number coordinates of a boundary point and of the lower corner of the square, where the given point is located, coincide.

We say that a boundary point is found if, in addition to the whole-number coordinates, all necessary information for its processing is obtained. For locating boundary points it is possible to move along the straight lines forming the matrix region and to find the intersections with the boundaries of the region or to move along the boundary and to find the intersections with the straight lines. Because of the difficulty in providing the initial information in the first case, we choose the second method.

We divide each square of the matrix into nine sections (Figure 1) and compile the collations E_1, E_2 and the comparisons E_3, E_4, E_5, E_6

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E_1	$<$	$[x]_{n+1}$	$\langle [x]_n \rangle$
E_2	$<$	$\langle [y]_{n+1} \rangle$	$\langle [y]_n \rangle$
E_3	$<$	$\langle \mu \rangle$	$\langle \epsilon \rangle$
E_4	$<$	$\langle \mu \rangle$	$\langle \epsilon \rangle$
E_5	$<$	$\langle \nu \rangle$	$\langle \epsilon \rangle$
E_6	$<$	$\langle \nu_1 \rangle$	$\langle \epsilon \rangle$

where $\langle a \rangle$ denotes the address of the cell where a is stored; $[x]_{n+1}$, $[y]_{n+1}$, and $[x]_n, [y]_n$ are the whole-number coordinates of the points $f(s)$ and $f(s+\Delta s)$. Δs satisfies the inequality

$$|x(s) - x(s + \Delta s)| < h, \qquad |y(s) - y(s+\Delta s)| < h. \qquad (1)$$

We will consider collation and comparison presented above as logical expressions. Collation (comparison) is true ($E_i = 1$) if the command following by number is performed after it; in the contrary case collation (comparison) is false ($E_i = 0$).

Let us consider all the possible cases generated by the binary alternatives E_i. The 64 possible cases may be grouped in the following manner: after the cases 55, 59, 61, 62, and 63, the next step is made along the contour, after 7, 11, 13, 14, 15, 29, 30, 31, 39, 43, and 47, inverse passage is made according to the contour with the spacing $\Delta s/2$; after 5, 6, 9, 10, 21, 22, 23, 25, 27, 37, 38, 41, 42, 45, 46, 53, 54, 57, and 58 in conjunction with right traversing of the region the whole number coordinates of the boundary points and all information necessary for correction of the value of the function in them are stored. The remaining cases are impracticable from the fact that the inequalities

$$\mu < \epsilon, \quad \mu_1 < \epsilon$$

and the inequalities

$$\nu < \epsilon, \quad \nu_1 < \epsilon$$

cannot be satisfied simultaneously. ($\epsilon \ll h$).

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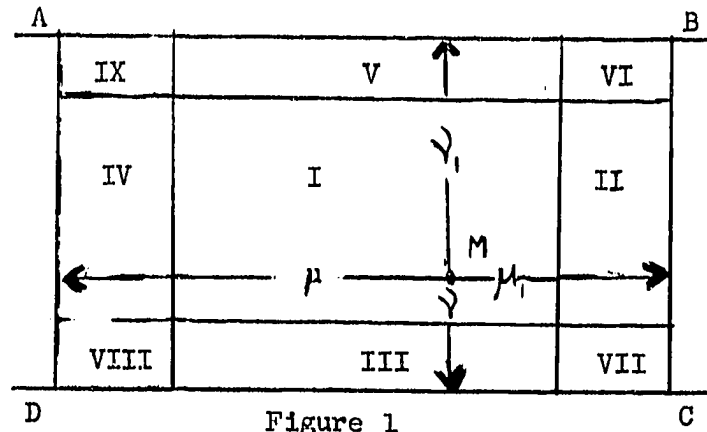
Figure 1

Let us analyze the case 46 (101110) as an example. The error of collation E_2 is indicated by the egress of the boundary either above or below, and the error E_6 indicates that we are located in section V. From (1) this is possible only for an egress below the boundary. In conjunction with a right traversing of the region, with junction A as the left-boundary point, ν and ψ are stored.
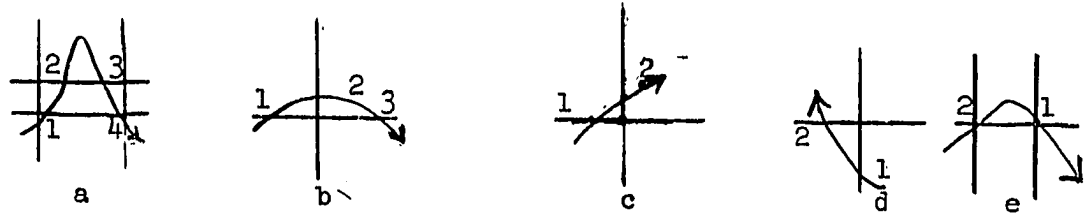
Figure 2

Simultaneously with the intersections the maximum and minimum whole-number coordinates which give the possibility of linearizing the region with a column of constant height, and ψ max, the order of which is taken as the scalar multiplier, are stored. The maximum principle yields the possibility of carrying on calculations with a fixed point and to store the indices in columns. The address of the cell will be stored in the ten smallest powers of the boundary points where the coding of the information is stored for correcting the values of the function at that point.

3. All the points of intersection are checked after they are found. In Figure 2 are given all the fundamental cases for right-boundary points. In case a the intersections remain intact while going from 1 to 4; in the contrary case they are nullified; the condition $\int_2 + \int_3 > h$ is verified

for identification of the direction. (δ_i is the distance from the point
i to the boundary). In case b the values of the function at point B are
interpolated and the point is marked as a double boundary point; the inter-
sections are nullified. In cases c and d the intersection which is the
farthest from the boundary is nullified. In case e the intersection 1 is
nullified. After this the boundary values are arranged. The actual ad-
dress for the boundary point ([x] , [y]) will be

$$N = ([x]-[x]_{min}) \, ([y]_{max} - [y]_{min} + 1) + [y] - [y]_{min}.$$

The initial values for the interior points are calculated according to the
formula

$$(1/ac+1/bd) \, u_0 = u_a \, / \, a(a+c) \; + \; u_b \, / \, b(b+d) \; + \; u_c \, / \, c(a+c)$$
$$+ \; u_d \, / \, d(b+d),$$

where u_0, u_a, u_b, u_c, and u_d are the values of the function at the points

$(0;0)$, $(a;0)$, $(b;0)$, $(0;-c)$, $(0;-d)$.

In the case of the Libmanovsky iteration a boundary (not double)
point requires 27 commands and an interior point requires 24. The com-
puter itself determines, according to the known formula of Gershgorin,
the moment of the iteration's termination by the failure to assure the
necessary accuracy of solution of the difference equations.

In conclusion, I wish to express gratitude to Ye. A. Volkov for
guidance during the construction of UP.

45. <u>Method Used To Find Pseudorandom Numbers in Strela-1 Described</u>

"Pseudorandom Numbers for the 'Strela' Computer," by I. M. Sobol'; Moscow, <u>Teoriya Veroyatnostey i yeye Primeneniya</u>, Vol 3, No 2, 1958, pp 205-211

Following is the full text of the article.

Random numbers are necessary for all calculations performed by the Monte-Carlo method. If the calculations are performed on a high-speed calculating machine (computer), it is not convenient to utilize tables of random numbers. Generally, the so-called pseudorandom numbers are employed. These numbers are determined by some recurrence formula (hence they are, of course, not random), but they must behave as random numbers. The use of pseudorandom numbers is generally accepted as being expedient at present. (Concerning this refer to Items 11, 14, 17, 19, and 5 of the bibliography.)

In our work the pseudorandom numbers, applied in calculations on the "Strela-1" computer, are described and certain results of an analysis concerning the randomness of these numbers are presented.

Section 1. Introduction

1. Several Methods for Obtaining Pseudorandom Numbers

Random digits are cited in tables of random numbers (for example in 3, 4, and 5 of the bibliography); by grouping them in samples of n, it is possible to obtain n-place random numbers. For calculations on a computer it is more convenient to immediately generate n-place random numbers multiplied by 10^{-n}, i.e., values (rounded off) of the random variable γ, uniformly distributed on the interval (0,1).

Two methods of obtaining pseudorandom numbers are mostly referred to in the literature.

a. The Mid-square Method -- This method was proposed by Neuman, 11 of the bibliography. In this method an n-place number x_k is squared and the middle n digits of the square are used for x_{k+1}; $\gamma_k = 10^{-n} x_k$.

For an investigation of the numbers generated by this method see 12, 13, and 14 of the bibliography. In 17 it is proved that the distribution law for the numbers generated in this manner does not tend to a uniform distribution.

b. The Method of Deductions (sometimes called the Method of Comparison) -- This method was proposed by Lehmer, 10 of the bibliography.

$$x_{k+1} \equiv p \, x_k \mod M; \quad \gamma_k = M^{-1} x_k.$$

The merits of this method follow: From a number theory consideration it is possible to determine the length of the period beforehand; it is possible to directly calculate the number for any index k; the calculation is very convenient for a computer having a fixed point. (If there is a special command in a computer with a floating point to deliver the product of the residual digits, then the method of deduction is also easily realized. There is no such command in the "Strela.")

In Lehmer, $p = 23$ and $M = 10^8 + 1$; the period of the sequence is 5882352. See 15 of the bibliography for other values of p and M. The results of an investigation of the numbers obtained by the method of deductions are found in 2 of the bibliography ($p=23$, $M=2^{35} + 1$). In the American literature reference is often made to the work of O. Taussky and J. Todd, "The Generation and Testing of Pseudorandom Numbers," presented at the symposium on Monte-Carlo methods, 1954.)

At present these numbers are being more widely utilized.

2. Criteria for Randomness

For testing random tables Kendall and Babington Smith (see 6 and 8 of the bibliography) used four tests, which are used up to the present with small changes: (T1) frequency test, (T2) serial test (an error in (T2) was detected and rectified by Good in 1953; see 16 of the bibliography), (T3) gap test, and (T4) poker test. The set of digits satisfying all these tests we propose to name locally random.

Sometimes the gap test is replaced by the test (T5): the run test (see 2 and 5 of the bibliography). In certain cases only a part of these tests is conducted.

In each of the tests the digits investigated are classified according to some principle, and the obtained empirical distribution is compared with the theoretical. The χ^2 criterion generally serves for comparison.

Several other tests may be found in 7, 16, 12, 13, 18, and 21 of the bibliography.

3. Deterministic Viewpoint

The solution of a great number of problems by Monte-Carlo methods reduces to the calculation of the mathematical expectation of a certain function, i.e., to the calculation of a definite integral. It is possible to depart from the probability point of view and to consider that process of calculation as completely determined. Then (after simple normalization):

$$\int_0^1 \int_0^1 \cdots \int_0^1 f(p) \, dV = \lim_{N \to \infty} 1/N \sum_{i=1}^{N} f(p_i), \tag{1}$$

where $\{p_i\}$ is a given (not random) sequence of points of the d-dimensional unit cube K. This point of view is developed in more detail in 23 of the bibliography.

The passing to the limit in (1) is justified for a wide class of functions then and only then when the sequence $\{p_i\}$ is uniformly distributed in K. Here uniformly distributed is understood in the number theory sense; let π be any parallelepiped lying within K; let $S_N(\pi)$ be the number of points $\{p_i\}$ with indices $1 \le i \le N$ lying within π. The sequence $\{p_i\}$ is called uniformly distributed in the cube, if for any π:

$$\lim_{N \to \infty} S_N(\pi) / N = |\pi| \qquad \text{where } |\pi| \text{ is the volume of } \pi.$$

Section 2. Pseudorandom Numbers for the "Strela" Computer

The "Strela" is a triple-address computer having a floating point. The speed of calculation on the average is 3,000 operations per second. The cell in which the number x is stored consists of 43 binary columns (see figure).

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Diagram of a Number Expressed in the "Strela Computer"

sign of the mantissa   mantissa   sign of the order   order
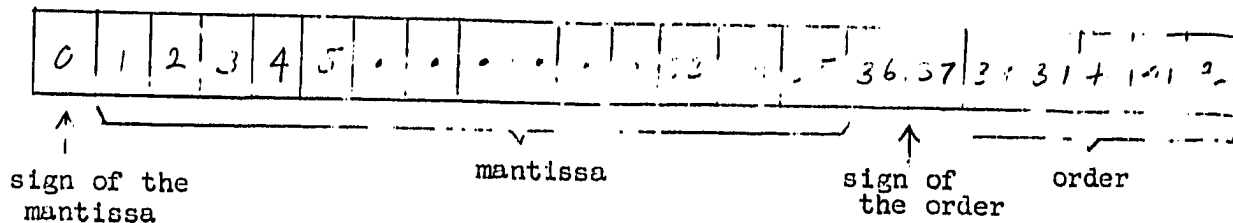
The machine works with binary numbers in normalized form:

$$x = \pm p \cdot 2^{\pm q},$$

where q is the order of the number, and p is the mantissa. Either a zero or one stands in the j-th column. We denote this quantity by ε_j. Then:

$$p = \varepsilon_1 2^{-1} + \varepsilon_2 2^{-2} + \ldots + \varepsilon_{35} 2^{-35}; \quad q = \varepsilon_{37} 2^5 + \varepsilon_{38} 2^4 + \ldots + \varepsilon_{42} 2^0.$$

Condition of Normalization: ε_1 is always equaled to 1, such that $0.5 \leq p < 1$. The sign "+" is represented by zero, the sign " − " is represented by one.

5. Determination of the Numbers

The number γ_{k+1} is obtained from the number γ_k with the third operation:

a. We multiply γ_k by 10^{17}.

b. We shift the expression of the product $\gamma_k 10^{17}$ seven columns to the left such that zeros are indicated in columns 36 to 42.

c. We take the absolute value of the obtained number (during this the number is normalized).

This will be γ_{k+1}.

Above all, it is necessary to note that the nature of the sequence $\{\gamma_k\}$ depends not only on the given γ_0, but on the method of rounding off employed in the computer.

We note further that the number 10^{17} and the number for determining the number of shifts are constant in the delivery unit (UVK) of the machine. Thus for calculation of $\{\gamma_k\}$ only one cell of the internal storage is required.

Finally, the danger of the sequence's degeneracy, that is, of some γ_k (and consequently of all the following) to become zero, is in practice exceedingly small. In fact for some γ_k to become zero, it is necessary that

$$0.5 \leq \gamma_{k-1} \cdot 10^{17} < 1;$$ in the contrary case digits

different from zero will be in the order of the product $\gamma_{k-1} 10^{17}$ and, on shifting, these digits fall into the mantissa γ_k. That means the sequence may degenerate only when γ_{k-1} belongs to a very narrow interval of values.

For the solution of different problems, several tens of values of γ_0 are employed. There were no cases of degenerate sequences during calculation.

6. Concerning the Periodicity of $\{\gamma_k\}$

Since a number N of different digits, which can be expressed in a computer is finite, sequences of any pseudo numbers are by necessity periodic. If γ_{k+1} is determined only through γ_k, then for emergence of the period it is necessary and sufficient that $\gamma_{k+1} = \gamma_i$ for any $i < k$.

We will say that the numbers $\gamma_1, \gamma_2, \ldots, \gamma_L$ form a segment of aperiodicity of length L, if they are different by pairs, but γ_{L+1} is equal to one of the γ_i for $1 \leq i \leq L$.

The periodicity of three sequences $\{\gamma_k\}$, beginning with the values $\gamma_0 = 1$, $\gamma_0 = 0.61328125$, and $\gamma_0 = 22.1394$ was verified.

The representations of these numbers in the "Strela" computer (see Paragraph 4) are:

010 000 000 000 000 000 000 000 000 000 000 000 0 000 001;

010 011 101 000 000 000 000 000 000 000 000 000 0 000 000;

010 110 001 000 111 011 001 100 011 000 110 101 0 000 101.

The segments of aperiodicity L proved to be 87834, 81745, and 74857, respectively. It is curious that in all three cases the length of the period formed is one and the same: 53535.

A number theory investigation has not been developed to explain the fact of constant length and to find its dependence on the multiplier 10^{17}. Multipliers different from 10^{17} were not investigated.

It is possible to utilize an elementary probability system for an estimate of the order of L. Let the probability of the appearance of any γ_k from a finite set γ_1, γ_2, . . , γ_N be equal to $1/N$ and not dependent on the values which appeared earlier. Then for $N \rightarrow \infty$ the mathematical expectation and standard deviation of L are determined with an accuracy up to a finite item.

$$E(L) = \sqrt{(1/2)\pi N}, \qquad \sigma(L) = \sqrt{(1/2)(4-\pi)N}.$$

In our case $N = 2^{35}$, $E(L) = E(L) = 2.3 \times 10^5$, $\sigma(L) = 8.6 \times 10^4$. The values of L for each of the three calculated sequences do not contradict these estimates, although all three values are appreciably less than $E(L)$.

In case of the numbers of Lehmer (see Section 1) $N = 10^8$, $E(L) = 1.25 \times 10^4$, $\sigma(L) = 6.6 \times 10^3$. Obviously, too lengthy segments of this sequence do not satisfy the system presented above. From this, however, it does not follow that they are poor as pseudorandom numbers.

7. Results of Analyzing the Numbers $\{\gamma_k\}$

For the tested group of numbers the quantities ν_{ij} were summed which are points with the coordinates (γ_{2k-1}, γ_{2k}), falling into the square

$$R_{ij} = \{i - 1/10 \leq x < i/10; \; j - 1/10 \leq y < j/10\}, \quad (i,j = 1,2, . . . ,10).$$

With the help of the Chi-squared criterion the distribution of the following quantities were checked, which were obtained from the table for:

(1) $\nu_i = \nu_{i\,hor} + \nu_{i\,vert}$; (2) ν_{ij} ; (3) $\nu_{i\,hor} = \sum_{j=1}^{10} \nu_{ij}$;

(4) $\nu_{i\,vert} = \sum_{j=1}^{10} \nu_{ij}$. We denote the corresponding values of Chi-

square by χ_1^2, χ_2^2, χ_3^2, χ_4^2; χ_5^2 . These are the values for χ^2 for

the criterion of independence of the indicators for the columns and rows

(1 of the bibliography). χ_6^2 and χ_7^2 are calculated for the checking of the

distribution of the lengths of the series and the number of numbers in
the series. (The numbers γ_{k+1}, γ_{k+2}, . . . , γ_{k+r} form a series

of length r, if they begin with a decimal digit different from the first
digits of γ_k and γ_{k+r+1}.

The χ_7^2 test is more rigid than the χ_6^2 test since the longer and more

infrequent series enter with a great importance.

For 50,000-numbers γ_k the numbers in the different series are:

$r = 1$	$r = 2$	$r = 3$	$r \geq 4$
40568	4010	417	40.

The theoretical values are:

40500	4050	405	45.

χ_8^2 is the test of the three-dimensional distribution of points with the

coordinates (γ_{3k+2}, γ_{3k+1}, γ_{3k}).

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Group No.	x^2_1		x^2_2		x^2_3		x^2_4	
1	6.43	0.70	103.8	0.36	10.30	0.33	24.33	0.004
2	5.04	0.83	86.84	0.80	6.69	0.67	3.59	0.93
3	12.54	0.19	90.76	0.72	10.27	0.33	6.77	0.66
4	3.64	0.93	109.9	0.22	11.12	0.27	8.23	0.51
5	15.98	0.07	130.9	0.02	6.72	0.67	18.39	0.03
Total 50,000	13.63	0.14	104.6	0.34	6.32	0.71	22.87	0.007

Group No.	x^2_5		x^2_6		x^2_7		x^2_8	
1	69.91	0.81	0.99	0.80	2.12	0.55	64.48	0.43
2	76.74	0.62	1.54	0.68	3.53	0.32	68.55	0.30
3	74.71	0.68	3.60	0.31	10.16	0.02	75.70	0.13
4	89.80	0.24	4.23	0.24	15.41	0.002	48.06	0.92
5	107.6	0.03	2.50	0.48	5.48	0.14	70.35	0.25
Total 50,000	75.46	0.66	1.39	0.71	5.07	0.17	63.64	0.46

50,000-numbers γ_k were investigated for $\gamma_0 = 1$. (The calculations were conducted on the "Strela-1" computer in the Department of Applied Mathematics, Mathematics Institute, the Academy of Sciences USSR. I. V. Posashkova took part in the conduct of the calculations.) The values of x^2 and the probabilities associated with them are presented in the table for five groups of 10,000-numbers each and for the whole groups of 50,000-digits.

Among the values of x^2_1, x^2_2, and x^2_6 corresponding to the general tests (T1), (T2), and (T5) only one (x^2_2 for the 5th group) exceeds the 5% level. If we take into account that high values of x^2 (that is, values exceeding the 0.1% level, 1 of the bibliography) are not present at all, then the results of the investigation may be considered satisfactory.

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Since a part of a locally random set of numbers is not necessarily locally random (6 of the bibliography), it would also be of interest to investigate smaller groups of numbers. Toward this goal group No 1 (one of the worst) was divided into 5 subgroups of 2,000-numbers. Among the 25 calculated values of χ_p^2 (p = 1, 2, 3, 4, 5) only one exceeds the 5% (but not the 1% level.

Calculation of a number of ones and zeros in the j-th column of the binary representation of the numbers γ_k (j 1, 2, . . . , 12) gave very good results. For that reason it is possible to expect that, in the case of necessity, several signs of γ_k may be utilized as random digits.

Conclusions

The numbers $\{\gamma_k\}$ are repeatedly used by me, for example, for the solution of integral equations by the Monte-Carlo method (24 of the bibliography). They were also used by O. B. Moskalev for the calculation of the passage of particles through a plane layer. As a rule in all 10,000-20,000 digits are used for a given γ_0. The initial values of γ_0 are chosen haphazardly from a table of random numbers. For some of them also, the distribution of $\{\gamma_k\}$ was checked.

Methods exist for the improvement of random numbers (9 and 17 of the bibliography). The simplest method in our case is to take the number

$$\overline{\gamma}_k \equiv (\gamma_{2k-1} + \gamma_{2k}) \bmod 1.$$

Nevertheless, the necessity in such an improvement did not exist.

In conclusion, I take this opportunity to thank A. N. Tikhonov for his interest in the present work. -- Letter to the editor, 20 January 1958.

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Materials

46. Photoelectric Properties of PbS Semiconductors

"Investigation of the Photoelectric Properties of Semiconductors of the PbS Group by the Capacitor Method," by B. T. Kolomiyets and V. N. Larichev, Physicotechnical Institute of the Academy of Sciences, Leningrad; Moscow-Leningrad, Zhurnal Tekhnicheskoy Fiziki, No 5, May 58, pp 921-924

The photoelectric properties of semiconductors of the PbS group (PbS, PbSe, and PbTe) are examined. Due to the high dark conductivity of this group and the resultant difficulty in measuring their conductivity during illumination, the capacitor method (Bergman's method) is used, which makes the magnitude of dark conductivity a negligible factor and in addition, under certain conditions, makes it possible to determine the sign of the luminescence carrier.

Using the capacitor method it was seen that the photoelectromotive force of the PbS semiconductors had a completely different nature from the photoconductivity found in activated layers of these same semiconductors. The width of the forbidden zone for this group of semiconductors, according to established data, agrees with values of activation energy computed in the long-wave range of photoconductivity. But if the activation energy is computed in the red zone of spectral distribution of photoelectromotive force, values are obtained which are 5-8 times greater than the width of the forbidden zone.

It is assumed that oxygen atoms, absorbed on the surface, form deep level-traps for electrons, and the photoeffect observed depends on the liberation of electrons from these traps under the influence of visible light. This assumption is supported by the fact that the magnitude, sign, and shape of the spectral distribution of photoelectromotive force depend greatly on the influence of oxygen and air.

47. Magnetic Spectra of Ferrites

"Magnetic Spectra of Ferrites," by L. A. Fomenko; Moscow, Uspekhi Fizicheskikh Nauk, Vol 64, No 4, Apr 58. pp 670-731

Ferrites belong to a group of substances having the general chemical formula of $MO \cdot Fe_2O_3$, in which M is a bivalent metal. From the standpoint of magnetic properties, those ferrites which have a spinel-type cubic crystal lattice are of greatest interest.

There are two types of ferrites: ferromagnetic ferrites of inverted spinel lattice and antiferromagnetic ferrites having a normal spinel lattice. Depending on the number of components, the ferrites are classified into simple and mixed, the latter being solid solutions of ferromagnetic and antiferromagnetic ferrites. The magnetic spectra of sintered polycrystalline ferrites, subjected to very weak fields in the frequency range from 0 to infrared, display five regions of dispersion, each defined by a distinct dispersion mechanism: (a) at low-frequency the mechanism of electron diffusion is very prominent, (b) at "infraradio-frequency" mechanical magnetostrictive resonance is in effect, (c) at radio frequency either joint or separate effect of gyromagnetic resonance and boundary resonance between ferromagnetic regions is apparent, (d) at superhigh frequency gyromagnetic resonance is predominant, and (e) at "infrared" frequency exchange field resonance is in effect.

Some of the ferrites examined in the article are $FeFe_2O_4$, $NiFe_2O_4$, $MnFe_2O_4$, $CoFe_2O_4$, $CuFe_2O_4$, $MgFe_2O_4$, $Li_{0.5}Fe_{2.5}O_4$, $CdFe_2O_4$, $ZnFe_2O_4$.

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48. Characteristics of Ferrites at Low Frequencies

"On the Question of Specific Inductive Capacitance of Ferrites at Low Frequencies," by A. L. Frumkin and S. D. Kholodniy, Sb. Statey Nauch.-Stud. O-va Mosk. Energ. In-ta, 1956, No 9, pp 142-147 (from Referativnyy Zhurnal--Elektrotekhnika, No 7, May 57, Abstract No 13954)

The authors classify some of the basic results of experiments recently conducted on an explanation of the nature of high specific inductive capacitance of ferrites in the low-frequency range. This is explained by the presence of relatively good conductive regions separated by ultrathin layers (on the order of 10^{-4} cm) with high electrical resistance.. It is suggested that these layers may be dependent on defects in the crystal structure at points of contact of the crystals with a different orientation of the axes. These defects result in additional donor or acceptor levels and an increase in the resistance of the boundary layer similar to the p-n interface in germanium.

49. Electric Conductivity of Lead Monoxide

"On the Electric Conductivity of Lead Monoxide With Additions of Cations of Higher Valency Which Are Foreign to the Lattice," by H. Gruenewald and W. Neumann, Institute of Experimental Physics, Advanced Pedagogical School, Sansouci, Potsdam; Leipzig, Annalen der Physik, Vol 1, No 6/8, 1958, pp 344-350

An investigation is made of the dependence of the electric conductivity of sintered lead oxide on the content of chromium oxide, neodymium oxide, and cerium oxide. The content of the foreign oxide was varied between 0 and 2.0 mol-percent; the investigated temperature range was 200-500 deg C.

It was found that an addition of up to 2 mol-percent Cr_2O_3 or CeO_2 to the PbO caused practically no change of electrical conductivity from that of the pure lead monoxide. Only with the addition of neodymium oxide is a weak but constant decrease of electrical conductivity with increased Nd_2O_3 content to be observed, if the 200 deg C isotherms are disregarded.

On the basis of the -- in comparison with other mixed phases -- almost complete independence of the electric conductivity of lead monoxide on the content of cations of higher valency, which are foreign to the lattice, in the temperature range 200-500 deg C, it is assumed that, in this case, some dislocation mechanism other than the exclusive formation of substitution defects in the cation portion of the lattice and of an equivalent number of electron defects must take place.

The investigation is being continued.

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50. USSR Report on Production of Rare Elements in East Germany

"On the Investigation and Production of Rare Elements in the
GDR," by V. G. Tronev; Moscow, Zhurnal Neorganicheskoy Khimii,
Vol 3, No 7, Jul 58, pp 1717-1718

In October 1957, I. N. Lepeshkov and the author of this article
visited the GDR German Democratic Republic), where they studied scientific
work connected with the treatment of inorganic salts and problems per-
taining to the chemistry and technology of rare chemical elements, specif-
ically rubidium, cesium, germanium, selenium, rhenium, and rare-earth
elements. The investigation of these elements in the GDR is conducted
principally at scientific research institutes and research departments
of the industrial branches in question.

It is known that the GDR has large supplies of raw material for the
potassium industry in the form of naturally occurring potassium salts.
By using these potassium salts, an experimental production of rubidium
and cesium was developed during World War II. At present, the Institute
of the Potassium Industry and one of the industrial enterprises have re-
newed research work on the production of rubidium and cesium salts from
carnallites in addition to potassium and magnesium salts. Attempts are
being made to develop improved technological methods for the separation
of rubidium and cesium from potassium salts and the conversion of rubidium
and cesium concentrates into pure salts of these metals. This work is
being done at the Institute of the Potassium Industry in close collabora-
tion with the Institute of Inorganic Salts, Academy of Sciences of the
GDR, where all necessary prerequisites exist for the investigation of the
so-called trace elements contained in naturally occurring potassium salts.
At the same tim methods are being developed for the analytical determina-
tion of rare and trace elements contained in natural potassium - magnesium
salts and products of their industrial conversion. Of particular interest
in this respect is work done by Busch and Germann (1) [refers to bibliog-
raphy] on the improvement of methods for the spectroscopic determination
of trace elements, specifically, rubidium, cesium, molybdenum, boron, and
others after they have been concentrated by extraction with organic sol-
vents. The investigations on the subject are being conducted in collabora-
tion with industrial establishments. Research on the production of rare-
earth elements is being done at the Institute of Inorganic Chemistry of the
University of Leipzig under the direction of Prof L. Wolf (2-5) and at the
Development Department of the Nitrogen Plant at Pistritz under the direc-
tion of Engineer Koenig. Professors Wolf and Hein act as consultants in
connection with the work done at the Pistritz Nitrogen Plant.

An apatite concentrate containing 0.9% of rare-earth elements is used as crude material for the production of these elements. The first stage of the process consists in the well-known decomposition of apatite with nitric acid followed by precipitation from the solution freed of fluorine of a hydroxide concentrate with an approximate rare-earth element content of 2.7%. This is followed by conversion to oxalates and their calcination to form oxides. As a result of this treatment, enrichment of the concentrates up to a rare-earth content of 96% is achieved.

The second stage of research and testing in an experimental industrial installation consisted of the separation from the 96% concentrates of individual fractions rich in cerium and then of the elements of the cerium group, namely, neodymium, praseodymium, and yttrium earths and lanthanum. The technological procedure applied in the GDR involves the use of interesting processes not described in the literature hitherto; for instance, isolation of the cerium concentrate in the form of basic cerium sulfate in the presence of a large excess of ammonium nitrate and precipitation of the so-called didymium fraction as well as preparation of solutions rich in lanthanum with the aid of an aqueous suspension of magnesium oxide. Of the greatest interest is the third stage of the separation procedure involving an ion-exchange process. Progress in work along this line was achieved both at the laboratories of Leipzig University and at the experimental industrial installation. Professor Wolf received a GDR national prize in 1957 for the work in question.

The work in question is being conducted with the use of ion-exchange resins manufactured in the GDR, specifically, Wofatit KPS - 200, and of complex-forming compounds such as beta-hydroxyethyliminodiacetic acid. The details of this research and of the technological processes for the separation of rare-earth elements were repeatedly discussed in the GDR at special symposia, at one of which specialists in this field from Western Germany also participated; namely, Prof V. Noddak and Engr I. Noddak, who in October 1957 presented at the University of Jena a report on work done in Western Germany on the subject of rare-earth elements. One may assume that this work will be published soon.

Of great interest is work done at the Scientific Research Department of the Mansfeld Mining-Metallurgical Combine, which converts so-called copper-bearing shales containing, in addition to copper, small quantities of 47 other elements including rare elements such as selenium, rhenium, thallium, germanium, and others. The work in question indicates the high degree of chemical development of the GDR industry, where complete extraction of all valuable components from mineral raw materials and the so-called wastes is practiced. A striking example of this is the history of the investigation of rhenium which was discovered in Germany in 1925 and produced there for the first time in the world in 1930 on an industrial scale from the so-called scum which represents a waste product of the treatment of

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Mansfeld copper-bearing shales. After World War II, a production of rhenium was again organized at the lead-zinc plant of this combine. The rhenium is now produced from other waste products, namely, dust obtained in connection with the distillation of lead sulfide. On partial oxidation of this lead sulfide, water-soluble rhenium compounds are obtained.

A detailed description of this process for the production of rhenium, which is new in the world industry, has been given in an article by L. Wolf (6). Of particular interest is the circumstance that, in addition to the production of rhenium by the process described, cadmium, iodine, thallium, and other valuable components are produced from the dust.

Copper sludge [electrolytic copper refinery mud] is also treated at the Mansfeld combine according to a many-sided procedure developed there. At the copper electrolysis plant, gold, silver, platinum, palladium, nickel, and a large quantity of pure selenium are produced from the copper sludge. This selenium is necessary in the construction of instruments such as rectifiers and photocells. The technological procedure applies in the GDR for the extraction of selenium from copper sludge is very simple and efficient in comparison with procedures described in the literature and applied elsewhere. It differs from the technological processes applied earlier by the low temperature at which the sludge is roasted (about 300° instead of 700-800°). This step is followed by the leaching out of selenites with a weak solution of sodium hydroxide. This considerably simplifies the whole process, because the formation of selenates is avoided and no difficulties arise because the latter cannot be readily reduced to elemental selenium.

Great attention is being paid in the GDR to the production of the so-called semiconductor elements, namely, selenium, germanium, and silicon of high purity. Work on semiconductor elements is done at industrial plants (at Mansfeld on selenium and at Teltow on germanium), as well as at scientific research institutes. For instance, an Institute of the Applied Physics of Purest Substances was created in Dresden in 1957. At this institute the production of the purest silicon for the manufacture of diodes h been developed under the direction of Professor Rexor and Engineer En hardt. An investigation of methods for the production of other rare elements of high purity will be launched soon and the properties of these elements investigated.

It is known that rare elements, particularly very pure rare elements, are becoming increasingly important in the new technology. Collaboration in work on rare elements between technologists and scientists of the socialist countries will expedite progress in this field.

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51. Method for Determination of Germanium

"A Method for the Determination of Germanium in Ores, Coals, and Industrial Wastes," by V. A. Nazarenko, N. V. Lebedeva, and R. V. Ravitskaya, Ukrainian Affiliate of the State Institute of Rare and Minor Metals; Moscow, _Zavodskaya Laboratoriya_, Vol 24, No 1, Jan 58, pp 9-13

This article describes in detail a colorimetric method for the determination of germanium with phenylfluorone (9-phenyl-2, 3, 7—trioxy-6-fluorone), giving examples of its application in the analysis of pyrites, copper ore, zinc ore, lead ore, antimony ore, iron ore, coal, coke, and coal tar.

52. Secondary Electron Emission in Selenium

"Measurements of the Secondary Electron Emission in Selenium" by G. Oertel, Heinrich Hertz Institute, Berlin; Leipzig, _Annalen der Physik_, Vol 1, No 6/8, 1958, pp 305-318

A static and a dynamic method are used to investigate the secondary electron emission of selenium, its dependence on temperature, and the energy distribution of the secondary emission with various dosages of bromine and tellurium as parameters. Higher yields were obtained for

the crystalline samples than for the amorphous samples. The addition of bromine and tellurium likewise leads to higher values of the coefficient of secondary electron emission in relation to the acceleration voltage of the primary electron, whereby the maxima of the yield curves shift toward higher energies in the case of higher dosages. The yield of the crystalline form and that of the amorphous form are both independent of temperature. The energy distribution curves have maxima at approximately 2.3 ev and, in the direction of higher energies, drop all the more, abruptly, the greater the dosage.

53. **Elastic-Plastic Equilibrium of Anisotropic Shells**

"Elastic-Plastic Equilibrium of Anisotropic Shells," by M. Sh. Mikeladze, Tbilisi Mathematics Institute imeni A. M. Razmadze, Academy of Sciences Georgian SSR; Tbilisi, Soobshcheniya Akademii Nauk Gruzinskoy SSR, No 1, Jan 58, pp 13-20

The investigation of elastic-plastic equilibrium of plates and shells is attended by difficulties of a mathematical character. The difficulties become increasingly greater if the material of the shells is anisotropic. Limiting to investigation shells of special design and a type of stressed condition which is sufficiently general, simplifications by means of solving elastic-plastic problems can be obtained. The author attempts to substantiate this notion (1) by investigating shells of ideal three-layer construction consisting of two similar orthotropic bearing layers of relatively small thickness and an intermediate light filler which bears the effect of transverse forces; (2) by examining the character of elastic-plastic state of three-layer shells of which the complex stressed state is the "simplest"; and, finally, (3) by considering the elastic-plastic equilibrium of orthotropic cylindrical shells.

The work was presented by Academician N. I. Muskhelishvili and submitted for publication on 24 April 1957.

54. **Soviet Development of High-Voltage Power Rectifiers**

"High-Voltage Power Rectifier," by F. I. Butayev, N. S. Klimov, M. F. Kostrov, and A. A. Sakovich, All-Union Electrical Engineering Institute imeni Lenin; Moscow, Elektrichestvo, No 5,

CPYRGHT May 58, pp 1-7

"The directives of 20th Congress of the Communist Party of the Soviet Union contemplate the construction within the next 5 years of a dc high-voltage power line from the Stalingrad Hydroelectric Station to the Donbass. The electrical engineering industry should master the production of equipment needed for the construction of such a line."

The All-Union Electrical Engineering Institute imeni Lenin (VEI) has developed a high-voltage power rectifier, VR-93, designed to operate at 900 a and a maximum voltage of 130 kv. The construction features of this power rectifier differ considerably from the construction of conventional rectifiers used in industry and transport. A 120 MVA stand was built at the Direct Current Institute in Moscow which is capable of testing rectifiers and inverters under short-circuit conditions. For the Stalingrad

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Hydroelectric Station-Donbass transmission line (voltage between terminals 800 kv and line current 900 a) an eight-bridge circuit was suggested. The voltage across each bridge will be 100 kv. Two rectifiers will be connected in series in each arm of the bridge. The VR-93 rectifier is expected to maintain a reliable current rectification under all operating conditions of the dc power line.

The active participants in this project were N. P. Stepanov, N. P. Savin, N. M. Maslennikov, I. D. Shkolin, A. A. Pertsev, V. S. Grigor'yev, A. A. Timofeyev, R. I. Grigor'yeva, V. V. Bozhenov, I. V. Blond, A. A. Ivanov, Ye. P. Shmarina, and others.

V. MATHEMATICS

CPYRGHT 55. <u>Seminar on Mathematical Methods of Research Applied to Linguistics</u>

"Chronicle Notes," (unsigned item); Moscow, <u>Voprosy Yazykoznaniya</u>, No 3, May-Jun 57, pp 167

"Since September 1956, the Philological Faculty at Moscow State University has been conducting a seminar on certain applications of mathematical methods of investigation to linguistics. Linguists P. S. Kuznetsov, I. I. Rezvin, S. K. Shaumyan, V. V. Ivanov, T. N. Moloshnaya, I. A. Mel'chuk, and mathematicians R. L. Dobrushin, V. A. Uspenskiy, and O. S. Kulagina have presented papers and reports at meetings of the seminar. The Association on Problems of Machine Translation (Ob'yedineniye po problemam mashinnogo perevoda) has been in existence since December 1956 at Moscow Pedagogical Institute of Foreign Languages. The Association has issued No 1, 2, and 3 of its mimeographed publication <u>Byulleten'</u>.

"Also, in December 1956, an interfaculty seminar on machine translation began work at Leningrad university."

Bacteriology

56. Protection of the Organism Against Botulin Toxins

"The Significance of Antitoxic Immunity in the Protection of
the Organism Following Penetration by Bacterial Toxins via the
Respiratory Route. Report I: The Role of Passive Immunity in
Protecting the Organism From Respiratory Affection With B.
botulinus Toxins," by A. M. Yakovlev, Military Medical Order
of Lenin Academy imeni S. M. Kirov; Moscow, Zhurnal Mikro-
biologii, Epidemiologii i Immunobiologii. Vol 29, No 6, Jun 58,
pp 63-68

This article discusses the role of passive immunity in the protection
of the animal organism from infection with B. botulinus toxin via the
respiratory route. The following introductory remarks and description of
CPYRGHT the experimental method and apparatus employed are given:

"The significance of antitoxic immunity in the protection of the
organism from respiratory affection by bacterial toxins has yet not been
sufficiently studied. Considering the great practical significance of
protecting persons from respiratory affection with bacterial toxins, which
can occur under various circumstances, we attempted to investigate this
problem under experimental conditions. In these experiments, we naturally
concentrated our attention on B. botulinus toxin, a bacterial toxin which
has no equivalent in strength.

"The method of investigation was as follows: types A and B toxin
were introduced by the respiratory route into experimental animals (white
mice weighing 18-20 g and guinea pigs weighing 300-350 g). In one part
of the experiments, the toxin was introduced after establishing passive
immunity in the animals by administering types A and B specific antitoxic
serum (Khar'kovskiy Scientific Research Institute of Vaccines and Sera,
purified by the Diaferm-3 method); in the other part, the toxin was ad-
ministered to the animals first, and then the antitoxic serum.

"In cooperation with V. M. Nikitin, we built a special experimental
apparatus (Figure 1) for respiratory infection of the animals; the appa-
ratus consists of a sealed chamber with a capacity of 134 liters, a com-
pressor, a sprayer, a regulatory-measuring device, and a system for de-
contaminating the air.

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The animals were given toxins obtained by culturing types A and B botulism pathogens in cellophane bags according to the method described by Polson and Sterne (1946), and also by Zelevinskaya, Akimova, and others (1955). We obtained both liquid and dry toxins by this process. Experiments on white mice were performed with type A liquid toxins, laboratory series No 32 and 34/36, and experiments on guinea pigs -- with type A dry toxins, laboratory series No 12, and type B, series No 33/37.

"Type A liquid toxin, series No 32 contained 400,000 absolutely lethal subcutaneous doses per ml for white mice; type A toxin series No 34/36 contained 10 million doses; type A series No 12 contained $1.4 \cdot 10^6$ lethal doses per mg of amine nitrogen -- one Dcl was equal to $5 \cdot 10^{-9}$ g on subcutaneous introduction to white mice; type B dry toxin series No 33/37 contained 77 lethal doses per mg of amine nitrogen, and its Dcl was 10^{-4} g."

Several series of experiments were performed; the lethal doses of the toxins for white mice and guinea pigs were first determined via the respiratory route, and the clinical picture in the animals was studied. The series experiments consisted of the following: (1) A study of the resistance of passively immunized animals to respiratory affection with botulinus toxin; a group of white mice was given specific type A serum (15 AE per mouse), a second group received 50 AE of type B specific serum per mouse, a third group was given normal bovine serum, and other groups served as controls. Analogous experiments were performed on guinea pigs; antitoxic A and B sera were given to each pig in dosages of 250 AE per animal -- 10 pigs received A serum, and 10 received B serum, whereas no serum was given to controls. (2) The effectiveness of serum prophylaxis and therapy of botulinus intoxication which developed following respiratory introduction of the toxin was studied. Mice were given one Dcl of A toxin via the respiratory route; after prescribed intervals, mice selected from this group received one subcutaneous inoculation of 15 AE of type A antibotulinus serum. In parallel experiments, guinea pigs were given one Dcl of type A toxin and then 250 AE of A serum. Several guinea pigs were infected with one Dcl of a mixture of A and B toxins and were then given 250 AE of mixed A and B sera. (3) The duration of maintenance of the level of passive immunity capable of protecting the animals from respiratory infection was determined. (4) In the final series of experiments discussed, the minimum dose of antitoxic serum which protected white mice from one Dcl of A toxin (one AE) was determined. One day later, one AE of A toxin was given to one group of these mice, and 4 AE to another group. Increasing doses of A toxin were given subcutaneously and orally to the mice which had received one AE, with the resulting observation that the minimum protecting dose of serum almost completely protected mice from one Dcl and weakly protected them from 4 Dcl, both administered via the respiratory route. When the toxin was introduced subcutaneously, the mice were resistant to 20 Dcl, and when it was introduced orally -- to more than 50 Dcl.

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The author presents the following conclusions on the basis of these

results:

"1. The introduction of B. botulinus toxin by respiratory means has a stronger effect on the animal organism than the oral and even the subcutaneous methods, and requires more intensive passive antitoxic immunity for protection.

"2. Antitoxic serum protected the animals from intoxication for one week following the respiratory introduction of types A and B toxin; the intensity of immunity decreased to such an extent by the 11th-15th day that it did not prevent the animals from dying.

"3. Serum prophylaxis and serum therapy of experimental animals following the respiratory introduction of B. botulinus toxin, types A and B, can be effective if the serum is administered in a sufficient dose and not later than 10-12 hours after infection."

One illustration and the following graphs are included in the text: Resistance of Passively Immunized White Mice to Respiratory Intoxication With Different Doses of B. botulinus Type A Toxin. The Effect of Introducing Antitoxic Serum to White Mice Within Different Intervals After Respiratory Introduction of One Dcl of Type A Toxin. The Effectiveness of Serum Prophylaxis and Serum Therapy of Guinea Pigs at Different Intervals After the Respiratory Introduction of B. botulinus Toxin. The Period During Which Passive Immunity Is Maintained Following the Respiratory Introduction of B. botulinus Type A Toxin.

57. Respiratory Introduction of Botulinus Toxin Into Experimental Animals

"The Significance of Antitoxic Immunity in the Protection of the Organism Following Penetration of Bacterial Toxins via the Respiratory Route. Report II: Testing of Antitoxic Immunity in White Mice and Guinea Pigs Following the Intranasal Introduction of Botulinus Toxin," by A. M. Yakovlev, Chair of Microbiology, Military Medical Order of Lenin Academy imeni Kirov; Moscow, Zhurnal Mikrobiologii, Epidemiologii i Immunobiologii, Vol 29, No 7, Jul 58, pp 56-59

"The purpose of the research was a study of the protective role of active immunity following the respiratory introduction of B. botulinus types A and B toxin.

The experiments were performed on white mice weighing 18-20 g and guinea pigs weighing 300-350 g. The animals were immunized subcutaneously with types A and B natural anatoxin, series No 6, prepared at the Institute of Epidemiology and Microbiology imeni Gamaleya, Academy of Medical

Sciences USSR. The intensity of the antitoxic immunity developed by the animals was determined one month after immunization. The resistance of the animals to the subcutaneous introduction of different doses of homologous toxins served as indexes of intensity of immunity. The resistance of the immune animals to certain lethal doses (Dcl) following respiratory introduction was then tested.

"The first series of experiments was performed on white mice. The animals were twice immunized subcutaneously with 20-day intervals between injections: 0.5 ml of type A anatoxin was then given to a group of white mice, 0.25 ml of type A anatoxin to a second group, a mixture of 0.25 ml of type A anatoxin and the same amount of type B to a third group, and 0.5 ml of type B anatoxin to a fourth group. On testing the intensity of immunity one and 2 months after immunization, it was found that the mice of all groups were resistant to one and 2 Dcl of subcutaneously introduced toxin of the same type as that with which they had been immunized.

"Simultaneously, 30 mice were taken from each group and given one Dcl of type A toxin via the respiratory route (see table).

"It is seen from the table that active antitoxic immunity was successfully established by two-time subcutaneous immunization of white mice with B. botulinus anatoxin type A in doses of 0.25 and 0.5 ml, and also with a mixture of this with type B anatoxin. But the intensity of the immunity was found to be inadequate for protecting all the experimental animals from one Dcl of type A toxin introduced by the respiratory route. Immunization of white mice with type B anatoxin did not completely protect them from respiratory intoxication with type A toxin.

"The following experiments were performed on guinea pigs. The animals were immunized twice subcutaneously with 20-day intervals between injections; animals of the first group were given 0.5 ml of type A anatoxin, animals of the second group received 0.5 ml of type B anatoxin, and animals of the third group were given a mixture of 0.5 ml of type A and 0.5 ml of type B anatoxin. There were 12 pigs in each group. A month after immunization, the antitoxic activity of the blood of the immunized animals was determined; for this operation, a mixture of sera from five pigs out of each group of animals was selected for titration. The content of antitoxins in the sera was determined in white mice by the method of the Control Institute with a dose of toxin titrated to 1/5 AE. It was found that one ml of serum from pigs immunized with type A anatoxin contained 0.25 AE; pigs immunized with a mixture of types A and B anatoxin contained 0.5 AE of type B antitoxin and 0.1 AE of type A antitoxin; pigs immunized with type B anatoxin contained 0.25 AE of type B antitoxin.

"At the same time, the resistance of two pigs out of each group to 100 Dcl of toxin of the same type as that with which they had been immunized was tested. The toxin was introduced subcutaneously. Testing showed that the immunized animals were resistant to the aforementioned doses of toxin.

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"After this, the animals of all three groups were given toxin by the respiratory route; the first group, type A toxin; the second, type B; and the third, a mixture of types A and B toxins. Five pigs from each group received one Dcl, and the other five were given 4 Dcl of the corresponding toxin. In each case, we selected an equal number of nonimmunized guinea pigs as controls.

"As seen in Figure 1, only one pig out of the immune pigs which had received one Dcl of toxin died; on introduction of four doses, more animals died. In the group of animals to which type A toxin was given, one out of 5 immunized pigs died, all died from type B toxin, and 3 out of 5 in the group of pigs which had received a mixture of types A and B toxin died. It must be noted, however, that in all cases the immunized animals died 1-2 days later than controls.

"It is seen from the data presented that by means of two-time subcutaneous immunization with B. botulinus it was possible to establish active immunity in guinea pigs of an intensity which protected the animals from respiratory intoxication with one certain lethal dose of the corresponding toxins. However, this immunity was found to be insufficient to afford the animals 100% protection from death from 4 Dcl of toxin. Pigs immunized with type B anatoxin and a mixture of types B and A anatoxins were found to be most weakly protected, although, as was demonstrated previously, the level of anatoxin in the blood of these animals was no lower than in animals immunized with type A anatoxin. It is evident from this fact that a higher intensity of immunity is required for creating a resistance against respiratory intoxication with type B toxin or a mixture of toxins than against type A toxin. These results are analogous with data which Chertkova and associates obtained on testing resistance in actively immunized guinea pigs after subcutaneous introduction of toxin.

"The second series of experiments was performed on guinea pigs to study the effectiveness of reimmunization with B. botulinus toxin by respiratory introduction: the same animals which survived after respiratory intoxication in the experiments described above were used in part of these experiments: one group of 5 pigs was immunized twice with type A anatoxin and received one Dcl of type A toxin one month after immunization; a second group of 5 pigs was immunized in the same manner with type B anatoxin and was given type B toxin after one month. All these pigs survived without any manifestations of botulism and did not become ill during the course of the following 4 months. Five months after immunization, three pigs out of each group were reimmunized with one ml of type A anatoxin for animals of the first group and type B anatoxin for animals of the second group; three control pigs were given 4 Dcl of type B toxin.

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"As seen from Figure 2, reimmunization 5 months after immunization was sufficiently effective and protected the animals upon respiratory introduction of 4 Dcl of the corresponding toxins; pigs not reimmunized were not resistant to the aforementioned doses of toxin. In reviewing the results of these experiments, however, it is necessary to take into account the fact that all the experimental pigs had been given botulinus toxin earlier, which can be considered supplementary immunization.

"The extreme difficulty and slight effectiveness of subcutaneous immunization of animals with small doses of harmful B. botulinus toxin are pointed out in the works of a number of authors; but considering the fact that in the given case the toxin was introduced by respiratory means to animals immunized earlier, i.e., in effect respiratory reimmunization of the animals had taken place, the possibility of a response reaction of the organism in view of the increase in the intensity of immunity cannot be excluded. To rule out this factor, we performed the following reimmunization experiments on fresh animals. Two groups of ten pigs each were immunized twice subcutaneously at 20-day intervals; the first group with type A anatoxin, and the second, with type B anatoxin in doses of 5 ml for each injection. Two months after immunization, five guinea pigs from each group were reimmunized by a subcutaneous introduction of one ml. of the corresponding anatoxin. After 7 days, all the animals received 4 Dcl of the toxins via the respiratory route: the first group, type A toxin; the second, type B. In each case, five fresh, nonimmunized pigs were used as controls.

"As seen from Figure 3, immunization of guinea pigs with B. botulinus anatoxins established a sufficiently high intensity of active immunity to protect the animals from respiratory intoxication with 4 Dcl of homologous toxin. The intensity of immunity was considerably lower in animals which were not immunized. As in the preceding experiments, (intoxication within one month and within 5 months after two-time immunization) the animals were found to be nonresistant to 4 Dcl of toxin introduced via the respiratory route.

Conclusions

"1. Active immunization against botulism protects animals from respiratory intoxication with specific toxins, but the establishment of a higher intensity of antitoxic immunity is required for this than for protection against subcutaneous intoxication.

"2. Two-time immunization of guinea pigs with B. botulinus types A and B toxin conferred active antitoxic immunity which protected the animals from respiratory intoxication with one Dcl of the corresponding toxins but was not enough to protect them from 4 Dcl of the same toxins.

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> "3. Immunization of experimental animals 2 and 5 months after immunization increased the intensity of antitoxic immunity to the extent that they developed resistance to respiratory intoxication with 4 Dcl of B. botulinus toxins by the 7th or 8th day following reimmunization."

The following graphs and tables are included in the article: Table 1 -- Resistance of Immunized White Mice to One Dcl of Type A Toxin Introduced by the Respiratory Route. Figure 1 -- Resistance of Guinea Pigs to Respiratory Intoxication With One and Four Dcl of B Toxin One Month After Immunization; (1) guinea pigs which died; (2) guinea pigs which survived. The same symbols are used in all additional figures. Figure 2 -- Effectiveness of Reimmunization of Guinea Pigs 5 Months After Immunization With B. botulinus Types A and B Toxins; (1) pigs immunized twice and reimmunized; (2) pigs immunized twice; (3) fresh, nonimmunized pigs. Figure 3 -- Effectiveness of Reimmunization of Guinea Pigs 2 Months After Immunization With B. botulinus Anatoxin, Types A and B. Markings are the same as those in Figure 2.

58. Protein Fractions in Type "A" Botulin Toxins

"A Study of the Proteins of Type "A" Botulin Toxins by the Electrophoretic Method on Filter Paper," by Yu. Z. Gendon, Sera Department of the State Control Institute for Sera and Vaccines imeni Tarasevich, Moscow; Moscow, Voprosy Meditsinskoy Khimii, No 3, May/Jun 58, pp 182-186

This article, which includes three tables and two photographs, is
accompanied by the following English Abstract:

> "A method for the electrophoretic fractionation of botulinic toxins, type "A," on filter paper and a method for the preparative isolation of separate fractions is described. The investigation of botulinic type "A" toxins, obtained under ordinary conditions and by cultivation in cellophane bags, showed the presence of five protein fractions, two of which are positively and three negatively charged. The negatively charged fraction with the slowest electrophoretic mobility predominated in toxins cultivated in cellophane bags, this fraction being the principal bearer of the toxic principle.
>
> "Electrophoretic fractionation on paper is a convenient test for the estimation of the extent of toxin purification and of its concentration. It has been shown, by means of this method, that the purification of botulinic type "A" toxins by precipitation with trichloroacetic acid leads to more extensive removal of inactive contaminants from the toxin than salting-out with ammonium sulfate. It was observed that purification and concentration of toxins cultiv₁ ₁d in cellophane bags resulted in more concentrated and less impure p₁ ₁parations of the active principle of botulinic toxin than the purification and concentration of ordinary crude toxin."

59. <u>Chinese Perform Bacteriophage Typing of Typhoid Bacilli</u>

"Bacteriophage Typing of 90 Strains of Typhoid Bacilli Isolated
in Manchuria During 1953-1955," by Tung Tien-shun (董 业 顺)
and Liu Ch'un-shan (刘 春 山), Dairen Serum and Vaccine
Institute; Peiping, <u>Chung-hua I-hsueh Tsa-chih</u> (National Medi-
cal Journal of China), Vol 44, No 6, 1958, pp 586-591

This article presents the details of experiments which culminated in
the bacteriophage typing of 90 strains of typhoid bacilli which had been
isolated in Manchuria during the period 1953-1955. The method described
by Craigie was followed. The 32 types of bacteriophage used in the ex-
periments were donated by Hungary in 1956. It was found that 32.2 percent
of the unknown strains were type D_2, and 21.1 percent were type A. Twenty-
one strains were not susceptible to any of the type bacteriophage used and
therefore were not differentiated.

Problems related to the typing of typhoid bacilli are discussed.

<center>Communicable Diseases</center>

60. <u>Brucellosis Among Practicing Veterinarians</u>

"Brucellosis as an Occupational Disease of the Veterinarian,"
by H. Linsert, Greifswald Office of Veterinary Testing and
Animal Hygiene; Leipzig, <u>Monatshefte fuer Veterinaer Medizin</u>,
No 13, 1 Jul 58, pp 407-410

The article reviews briefly the findings of other authors on the
serological determination of brucellosis in practicing veterinarians and
discusses some of the author's own findings in regard to the question of
whether active brucelloses, primarily chronic cases, can be detected sero-
logically.

In six out of seven cases where the disease was detected, it was a
matter of chronic brucelloses with, at the time, no indications of clini-
cal organic symptoms. Thus it was not clear whether it was a case of an
active chronic or cured inactive asymptomatic form. At any rate, none of
the cases could have been diagnosed with slow agglutination, if a titer
of 1:100 and above had been considered positive. On the other hand, the
complement fixation reaction also failed. It is noteworthy that the
flocculation reaction in all cases produced a positive result.

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To determine the reaction situation in brucellosis, blood samples of about 100 veterinarians were examined, of which 44.29 percent indicated a negative serological determination, 55.71 percent reacted positively. Agglutination titers of 1:40 + + and higher, CFR + + + or a satisfactory flocculation reaction, or a predominantly positive picture of several serological reactions were interpreted as positive reactions. It was found that about 50 percent of the examined veterinarians had undergone a brucellosis infection during their period of practice. Because of insufficient material, no statement can yet be made on the course of the infection on the basis of the seroreaction.

According to Loeffler and Moroni (Die Brucellose als Anthropo-Zoonose, Springer Verlag, 1955), acute brucellosis can, with a high degree of probability, be completely cured before irreversible organic damages have occurred. However, since brucellosis often is treated very late, since the time of infection is not known, and especially since, in most cases, very slight general initial symptoms are exhibited, permanent damage must be reckoned with, even when antibiotics are administered, since chronic brucelloses do not react as well to the latter.

The article concludes with the recommendation that every practicing veterinarian attempt to avoid a brucellosis infection, that indeterminate clinical phenomena be investigated from the viewpoint of a possible brucellosis infection, that periodic tests in humans be conducted at a central station through a cooperative effort of veterinarians and physicians, and that further information be collected to facilitate the evaluation of seroreactions and their relation to possible latent brucellosis.

Hematology

61. **Total Cholesterol and Cholesterol-Protein Content in Burn and Traumatic Shock Determined**

"Concerning the Question of the Composition of Cholesterol-Protein Complexes in Burn Shock," by P. I. Mymrikov, Sb. Nauchn. Rabot. Teor. i Klinich. Kafedr. Stalingr. Med. In-ta (Collection of Scientific Works of the Theoretical and Clinical Chairs of Stalingrad Medical Institute), Stalingrad, 1956, 123-131 (from Referativnyy Zhurnal -- Khimiya, Biologicheskaya Khimiya, No 11, 10 Jun 58, Abstract No 13972)

"Experiments on rabbits indicated that during burn shock total cholesterol content is sharply increased, cholesterol-protein complexes and the cholesterol that is firmly bound with proteins are decreased. On the

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contrary, the content of cholesterol that is loosely bound with proteins is increased. The same changes, but to a higher degree, were observed during agonal stages in rabbits. The same changes of cholesterol-protein complexes were observed in the blood of patients with clinical forms of burns. These changes of cholesterol-protein complexes of blood were observed in cases of traumatic shock."

62. Symposium Suggests Isolation of Antigens, and Preparation of Mono-
    specific Serum in Treating Leukosis

    "Symposium on the Problem of Leukosis" (unsigned article);
    Moscow, Meditsinskiy Rabotnik, No 48, 17 Jun 58, p 4

    A symposium was held (date not given) on the complex problem of leukosis, i.e., its etiology, pathogenesis, and therapy. It was pointed out at this symposium that the various scientific research institutions are conducting a thorough investigation on the virus etiology of leukosis in the development of radiation sickness.

    Besides mentioning that "mileran" (myelosan) was effective in treating leukosis, attention was focused on the fact that research should be directed toward the possibility of isolating a virus agent from leukocytic tissues of man and of animals. The necessity for studying specific immunological shifts occurring in the sick organism and the discovery of new chemotherapeutic agents for treating leukosis was stressed.

    Finally, it was stated that the task of various republic institutes with regard to the study of leukosis was the isolation of specific antigens and the preparation of monospecific antileukocyte serum in laboratories specially equipped for this purpose.

63. Soviet Cancer Research Reported in Czechoslovak Press

    "Local and Foreign News" (unsigned article); Prague, Obrana
    Lidu, 11 Jul 58, p 2

    The well-known Soviet scientist, A. Chizhevskiy, has come to the conclusion that cancer can be detected in its earliest stages according to the composition of the blood. His mathematical formula, showing the movement of blood cells in the veins of a healthy organism and the disturbance of this system in an organism afflicted by cancer, has been tested at the oncological institute in Karaganda.

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Immunology and Therapeutics

64. Components of Brucellar Antigens Investigated

"The Effect of Various Chemical Reactions on the Precipitino-
genic Properties of the Whole Antigen and the Polysaccharide
of Brucella," by T. T. Bogomolova, Chair of Biochemistry (head,
Doctor of Biological Sciences D. A. Tsuverkalov), Odessa Medi-
cal Institute; Kiev, <u>Vrachebnoye Delo</u>, No 5, May 58, pp 539-542

"An immunochemical study of pathogenic microorganisms revealed that
the specificity of their antigens can be determined by the functional
groups of the proteins and hydrocarbons which enter into their composi-
tion. As is already well known, the acetyl groups, glucosamine together
with the amino groups entering into its composition, and the various posi-
tions of carboxyl and alcohol groups at the end of polysaccharide mole-
cules are of especial importance with regard to the specificity of bac-
terial antigens.

"In previous work (<u>Vrachebnoye Delo</u>, No 8, 1957), we pointed out that
the whole antigen and the polysaccharide exhibit great activity as com-
pared with the protein in the precipitation reaction with brucellar sera.
This fact must be borne in mind when producing antigens for the serologi-
cal diagnosis of brucellosis.

"Since the functional groups which are responsible for the immuno-
logical specificity of the brucellar polysaccharide still have not been
investigated, we were interested in determining which of the chemical
groups of this precipitogen caused its specific interaction with the anti-
bodies of immune sera.

"Inasmuch as the Van Slyke method revealed amino groups in their
composition, we attempted to destroy them by deamination or to block them
by formalinization and acetylation.

"The whole brucellar antigen was subjected to the same action. Deami-
nation was performed with the aid of sodium nitrite and acetic acid; for-
malinization, with formaldehyde solutions of various concentrations; and
acetylation, with acetic anhydride and sulfuric acid. Following chemical
processing and dialysis, the treated precipitinogens were used to perform
precipitation reactions with brucellar sera. Control reaction between
normal sera and antigens which had not been subjected to chemical process-
ing and corresponding sera were performed simultaneously.

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"Following the chemical processing no amino acids were observed in any of the precipitinogens, although prior to this amino groups had been detected in brucellar polysaccharide. Using the Clark-Christien method, 26% acetyl groups were detected in the brucellar polysaccharide; prior to chemical processing there were no acetyl groups in the products being investigated.

"Serological investigation revealed that deamination deprived the polysaccharide but not the whole antigen of their precipitinogenic properties. Formalinization completely destroyed the precipitinogenic properties of the whole antigen and the polysaccharide extracted from it. Acetylation did not disrupt the precipitinogenic properties of either the polysaccharide or the whole antigen.

"The data obtained make it possible to conclude that the amino groups are not responsible for the specific interaction of the indicated precipitinogens and the antibodies of the brucellar sera; the absence of these groups, blocking them, or complete destruction does not deprive the brucellar antigens being investigated of specific precipitinogenic properties."

65. Characteristics of Protein Fractions of Antiplague Serum

"The Problem of the Therapeutic and Prophylactic Characteristics of Different Protein Fractions of Antiplague Serum," by L. Ye. Khundanov, P. A. Shershnev, Ye. D. Shkurko, A. P. Kalmykova, A. A. Tokareva, Ye. I. Lyaskovskaya, and V. Ya. Mikhaleva, Irkutsk Scientific Research Institute; Moscow, Zhurnal Mikrobiologii, Epidemiologii i Immunobiologii, Vol 29, No 7, Jul 58,

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"The purpose of this research was to study the prophylactic and therapeutic characteristics of different protein fractions of antiplague serum (whole globulin, beta- and gamma-globulin) under experimental conditions.

"The aforementioned fractions were obtained by precipitating the globulins and isolating gamma globulins with neutral salts, and by precipitating the globulins and isolating beta- and gamma-globulins with ethyl alcohol in the cold. In all, 15 series of gamma globulins, 4 series of beta globulins, and 8 series of whole globulins were studied.

"Quantitative investigations of the fractional content of the proteins showed that whole globulins and gamma globulins contained a considerable amount of gamma globulins -- 59% in the first case and 70% in the second. The content of the beta-globulin fraction in preparations of whole globulins precipitated with neutral salts was decreased in some

cases and increased in others; in the alcohol-water method, its content was increased to a considerable extent; the content of the alpha globulin fraction was decreased in all the preparations obtained, with the exception of one series of gamma globulins and one series of whole globulins; the content of the albumin fraction was decreased in all the preparations. Data obtained showed that preparations of whole globulins and gamma globulins differed advantageously in their content of immunologically active protein fractions from beta globulins and the natural series of sera. As for completeness of purification of natural sera from ballast proteins (albumins and alpha globulins) and the physical nature of the preparations (presence of opalescence and precipitation during storage), the alcohol-water method of fractionation was found to be more ideal.

"Experimental study of different protein fractions, performed on more than 1,400 animals, showed that gamma-globulin fractions had a distinct prophylactic effect on white mice: on introduction at the same time as or 24 hours following infection, they protected 50-73% of the animals depending on the dose of the preparation introduced; under the same experimental conditions, the beta-globulin fractions protected 5-30% of the animals; and the corresponding natural sera, 26-51%. The survival rate of mice was 75% in testing of the therapeutic properties of nine series of gamma globulins; these animals died at an average of 3.6 days later than controls. In tests of five series of general globulin, the survival rate was 73% and life was prolonged for 5.3 days; whereas in tests of nine series of natural serum, the survival rate was 63% and the length of life was 2.4 days.

"The investigations carried out resulted in the following conclusions:

"1. Protein fractions of antiplague serum (beta- and gamma-globulin and whole globulin) introduced into the organisms of experimental animals susceptible to plague had a prophylactic and therapeutic effect which was most pronounced in the gamma-globulin fraction.

"2. The effectiveness of natural serum and its protein fractions is directly related to the content of gamma- and partly beta-globulin fractions -- the higher the content of these fractions, the more effective the serum.

"3. The alcohol-water method of fractionation in the cold is better than the salt method for purification of natural serum from ballast proteins (albumins and alpha globulins) and for the concentration of immunologically active fractions (gamma- and beta-globulins)."

66. Method of Disinfecting Antibacterial Bandaging Materials With Gamma Rays Perfected

"Antibacterial Bandaging Materials" (unsigned article); Moscow,
Meditsinskiy Rabotnik, 18 Jul 58, p 4

> "For many years, scientists have been searching for substances which could be used to impregnate bandaging materials and would prevent wound supperation and to partially treat already infected wounds. The Division of Antiepidemic Defense of the Central Scientific Research Disinfection Institute has succeeded in discovering such substances. These proved to be the natural and synthetic antibiotics, streptomycin, biomycin, penicillin, synthomycin, levomycetin, and mixtures of synthomycin with furacillin and brilliant green.
>
> "Bandaging materials impregnated with these preparations displayed bacteriostatic action against a number of wound complicating pathogens; however, the substances were also found to decompose during steam sterilization.
>
> "To preserve the antibacterial properties of the materials, the Division of Antiepidemic Defense in conjunction with the Central Scientific Research Institute of the Cotton Fabric Industry have used a method of cold sterilization which employs gamma irradiation to sterilize the bandaging materials impregnated with antibiotics. It has been demonstrated that bandaging material inoculated with anthracoid spores and potato bacillus which are highly resistant to steam were completely inactivated by a dose of 1.5-2.0 million roentgens. The impregnated material remained antibacterial following this procedure.
>
> "During this year, work will be started on the design of a production-scale apparatus for cold sterilization of bandaging material with gamma irradiation. This will make possible the future initiation of the manufacture of bandaging material impregnated with antibiotics."

67. Aerosol Therapy for Chronic Lung Conditions

"Therapeutic Aerosols," by Prof B. Votchal, Znaniye-Sila, No 2,
Feb 58, p 27

The All-Union Scientific Research Institute of Medical Instruments and Equipment has produced both stationary and portable models of a Universal Aerosol Inhalator designed by engineers A. Persl'mutor, V. Abramov, P. Kapkov, and Z. Pelevina, according to this article.

Working on compressed air, this device dispenses an aerosol of one to 3 micron size particles of various drugs and antibiotics. The aerosol is inspired by the patient, who regulates the supply of the drug with a control lever.

The author claims that this method of treatment is more effective than subcutaneous or intramuscular administration since the therapeutic agent acts directly on the affected area, and more effective than per-orally administered powders, tablets, or mixtures since it bypasses the destructive action of the gastric juices. Finally, the dose required is less because of the direct action of the agent.

Aerosol therapy has proved to be especially efficacious in the treatment of bronchial asthma, pneumoscleroses, chronic bronchitis, and lung abscesses. Its complete painlessness makes it invaluable in the treating of children.

68. <u>Cobalt Organic and Inorganic Compounds Exert Favorable Effects on Iron, Hemoglobin, Erythrocytes, and Reticulocytes of Blood in Hemorrhagic Anemias</u>

"The Influence of Mineral and Organic Compounds of Cobalt and Nickel on the Regeneration of Formed Elements of Blood in Experimental Anemias Caused by Blood Loss," by N. B. Nasel'skiy, in the collection <u>Mikroelementy v S. Kh. i Meditsine</u> (Trace Elements in Agriculture and Medicine); Riga, A. N. Latvian SSR, 1956, 597-602 (from <u>Referativnyy Zhurnal -- Khimiya, Biologicheskaya Khimiya</u>, No 13, 10 Jul 58, Abstract No 16894)

"Research was conducted on rabbits subjected to hemorrhage and then administered $CoCl_2$ (one mg metallic Co per kg of body weight), organic cobalt, or inorganic compounds of Ni. It was shown that the lysate of cobalt accelerates the regeneration of hemoglobin and restores iron concentration, while $CoCl_2$ acts chiefly to speed the regeneration of erythrocytes. Cobalt exerts no effect on the regeneration of reticulocytes. No effect due to nickel was evident in hemoglobin although Ni did cause a certain acceleration of the regeneration of erythrocytes and reticulocytes."

69. Protein-Vitamin Preparation No 22 Aids in Biosynthesis of Blood
    Plasma Proteins and Hemoglobin Formation

    "Materials on the Biological Characteristics of Protein-Vitamin
    Concentrates. 1. The Influence of Protein-Vitamin Preparation
    22 on the Biosynthesis of Plasma Proteins of Blood. 2. Re-
    lationship Between the Chemical Composition of Protein-Vitamin
    Preparation 22 and Its Stimulating Effect on Hemoglobin Forma-
    tion. 3. The Lipogenic Property of Protein-Vitamin Prepara-
    tion No 22," by Z. P. Karmanova, Tr. In-ta Eksperim. Med. A. N.
    Latv. SSR (Works of the Institute of Experimental Medicine of
    the Academy of Sciences Latvian SSR), 1957, 14, 15-20; 21-28;
    29-34; (from Referativnyy Zhurnal -- Khimiya, Biologicheskaya
    Khimiya, No 14, 25 Jul 58, Abstract No 18670)

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"Feeding albino rats with white bread made from highly refined flour
led to the development of hypoproteinemia characterized by hypoalbuminemia.
Enriching the diet with 10% protein-vitamin preparation 22 easily reversed
the hypoproteinemia, increased protein content in the liver, and normal-
ized the albumin content of the blood proteins. The chemical composition
of preparation 22 is as follows (in percent):

Dry residue -- 39.6;   Proteins -- 12.3;   Fats and lipids -- 7.26;

Free sugar -- 6.49;   Total reducing substances -- 13.65; Ash -- 5.48;

    Vitamins in mg % :   Ascorbic acid -- 29.6;   Carotin -- 8.1;

Vitamin PP -- 8.10;

    Amino acid content is as follows (in % amino acid N to total N):

Arginine -- 3.84;   Histidine -- 5.10;   Tryptophane -- 2.24;

Tyrosine -- 4.27;   Methionine -- 2.30;   Cystine -- 2.33.

    "It was shown that preparation 22 has a stimulating effect on the
hemopoietic system of rats with alimentary anemia. By normalizing the
content of blood hemoglobin, preparation 22 promotes reduced consumption
of hepatic iron and the accumulation of ascorbic acid in the liver.

    "White bread enriched with 5% of preparation 22 intensifies lipo-
genesis, and fat biosynthesis in the experimental animal rises to 216.3%.
Enriching bread with 10% of preparation 22 raises fat biogenesis to 319.6%
as compared with the normal."

Physiology

70. Physiological Research at Peking University During 1956-57

"Report of Scientific Research by Department of Human and Animal Physiology of Peking University During 1956 Academic Year," by Chao I-ping; Peiping, Sheng-li K'o-hsueh Chin-chan (Advances in Physiological Sciences), Vol 1, No 4, 1957, pp 417-420

This article presents a summary of original research undertaken by the teachers and students of the Department of Human and Animal Physiology of Peking University during the 1956 academic year. Individuals and their specific research projects in the following five areas of interest are mentioned: problems of inhibition, physiological research using analyzers, influence of cerebral cortex on digestive functions, and the idioelectro-activity of the ventral cord of certain insects.

Public Health, Sanitation, and Hygiene

71. Air-Samplers Discussed

"Devices for Investigating the Microflora of the Air," by Kh. L. Galikeyev, Moldavian Department of the All-Union Scientific Society of Microbiologists, Epidemiologists, and Infectionists imeni I. I. Mechnikov, Sbornik Nauchnykh Rabot (Collection of Scientific Works), Kishinev, 2, 1957, pp 19-27 (from Meditsinskiy Referativnyy Zhurnal, Section 4, No 2, Feb 58, pp 35-36)

"Devices for the investigation of the microflora of the air are divided into two types according to their physical principles of action, i.e., sedimentation (Koch, Koval'skiy, Matveyev, et al) and aspiration (Keldysh, D'yakonov, Shafir, Wells, Rechmenskiy, Krotov, et al). A detailed description of the principle of action of each device is given. In addition to indicated methods of investigation, others are proposed, such as filtration of air through paper and nitrocellulose filters. The paper filters are rinsed with sterile water and cultures of the suspension obtained are grown on culture media. After filtration, the nitrocellulose filters are placed directly on a culture medium (Milyavskaya). Rechmenskiy developed an original design for a device -- a siphon bacterial sampler, based on the principle of trapping the microorganisms in drops of liquid in the form of an aerosol. The device is simple, cheap, permits the investigation of large volumes of air, and traps all phases of bacterial aeroplankton. Lekish, Holliday, and Taylor in 1946 described an electropricipitator possessing great sensitivity. Precipitation of the microorganisms out of the air occurred directly onto the surface of a culture medium located in Petri dishes, on the the electrode plates. The use of the electroprecipitator is limited because of the necessity for a high-voltage current supply."

72. Methods for Determining Harmful Substances in the Air

"Opredeleniye Vrednykh Veshchestv v Vozdukhe," (Determination of Harmful Substances in the Air), by O. D. Khalizovaya, Moscow, Medgiz, 57 (from Meditsinskiy Referativnyy Zhurnal, Series 4, No 3, Mar 58, p 40)

"A description of methods for determining harmful substances in the air of industrial enterprises is given. Methods of testing are proposed for laboratories and industry, and recommendations are made for wide application by sanitary physicians and industrial sanitation chemists. The following methods are described: spectrographic method for determining beryllium and its compounds, lead, zinc, thallium and germanium; luminescent method for determining beryllium and its compounds; polarographic method for determining thallium; quinoline method for determining 1, 2-dichlorethane; methods of determining (chemical and colorimetric) thallium, small amounts of hydrazine, vapors of certain alkyl-arylchlorsilanes, divinyl, 2,4-toluylenediisocyanite, streptomycin, hexachlorane, chlorindane, hydrogen peroxide, dimethylamine, dimethylformamide, monoethanolamine vapors (aminoethyl alcohol, beta-oxyethylamine), ethylene oxides such as components of "kartoks"; chromatographic method of determining benzene, toluol, and xylol; determining with the aid of titrometric gas-analysor carbon monoxide and methane; the determination of lead in the presence of iron and barium. It is recommended that automatic gas analyzors be instituted for testing mercury and arsine."

73. Methods of Investigating Atmospheric Microflora

"Methods of Investigation Microflora of Atmospheric Air," by G. F. Pollak, Voprosy Diagnostiki i Profilaktiki Nekotorykh Infektsionnykh Zabolevaniy i Sanitarnoy Mikrobiologii (Problems of Diagnosing and Preventing Certain Infectious Diseases and Sanitary Microbiology), Alma-Ata, 1957, pp 63-66, (from Meditsinskiy Referativnyy Zhurnal, Series 4 No 3, Mar 58, p 40)

"Instructional material on the methodology of investigating the microflora of atmospheric air, a description of the necessary nutrient media, the sedimentation method of investigation, counting the number of microorganisms in the air, and a plan for a journal in which to record the results of sanitary-bacteriological investigations are given."

74. Industrial Production of Polymer Materials for the Preparation of Individual Protective Gear Praised

"Polymer Materials for the Preparation of Protective Means" (unsigned article); Moscow, Meditsinskiy Rabotnik, No 52, 1 July 58, p 4

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"Polymer Materials as source of raw material for preparing means of individual protection from acids, alkalies, and radioactive and other harmful substances have very real significance.

"The majority of work in this direction has been done by one of the scientific research institutes of the Ministry of Health USSR, in cooperation with institutes of the chemical industry. The use of a new filter material, FP, which is prepared from ultrafine synthetic polymer fibers which have an electrostatic charge, makes it possible to prepare various ventilation, analytical, and respiratory filters. These filters have a very high capacity for collecting minutely dispersed radioactive aerosols and any toxic dust under various industrial conditions.

"At this same institute, based on the use of polyvinyl chloride and polyethylene, a number of soft film materials which can be thoroughly cleansed of radioactive contamination have been created. From these synthetic substances various means of individual protection, such as pneumatic costumes, special footwear, aprons, sleeves, and robes that are necessary for work with radioactive substances, and inorganic acids and alkalies, have been prepared.

At present, for protective clothing, use is made of tissues made from synthetic fibers of the type of "ftorlon, lavsan, khlorin", and others, which have been developed in cooperation with scientists of other institutes. These fabrics are noted for their good acid resistance, the fact that they can be washed clean from radioactive substance, and that they are hygienic and durable."

75. <u>Use of Ultrasonic Waves and Small Doses of Disinfectants for Water</u>
<u>Purification</u>

"The Disinfection of Drinking Water by the Combined Action
of Ultrasonic Waves and Small Doses of Disinfectants," by
L. I. El'piner, Central Scientific Research Laboratory of
Hygiene and Sanitation for Water Transport and Chair of
Communal Hygiene of First Moscow Order of Lenin Medical
Institute imeni I. M. Sechenov; Moscow, <u>Gigiyena i Sani-</u>
<u>tariya</u>, No 7, Jul 58, pp 26-29

This paper presents the results of work involving the disinfection of
drinking water by the bactericidal effect of ultrasonic waves and small
doses of disinfectants (chlorine and hydrogen peroxide). B. coli were in-
troduced into the water, samples of which where subsequently exposed to
the ultrasonic waves for various lengths of time. Data indicate that com-
plete disinfection was obtained with exposure times of 10-15 minutes,
while the addition of small amounts of disinfectants reduced this exposure
time. Two schematic drawings of the apparatuses used and two data tables
and a graph are given. The apparatuses utilize magnetostriction and quartz
as a wave source. The rate of disinfection was found to be a function of
rate of water flow, time of exposition, and depth of the water layer in the
apparatus.

76. <u>Assessment of Complex Meteorological Indexes Affecting the Body</u>

"Assessment of the Complex Indexes of Various Meteoro-
logical Factors Affecting the Body," by M. S. Goromo-
sov, Candidate of Medical Sciences, Institute of General
and Communal Hygiene imeni A. N. Sysin, Academy of Medi-
cal Science USSR; Moscow, <u>Gigiyena i Sanitariya</u>, No 7,
Jul 58, pp 66-71

After reviewing the research (mostly British and American from the mid-
1920s to 1955) concerning the gross evaluation of the effect of various
meteorological factors which act on the body, the author concludes that none
of the instruments suggested nor methods for determining calorimetric ranges
and indexes permits a well-defined evaluation of the over-all action of
various meteorological factors involving the thermal condition and well-
being of humans.

Therefore, as experience from postwar investigations indicates, during
the hygienic investigation of the effect of microclimatic factors on humans
in dwellings, it is necessary to begin with a simultaneous calculation and
comparison of the instrument measurements of every meteorological factor
together with data concerning the physiological reaction of the body to the
changes in the meteorological conditions and the sanitary condition of the

atmospheric medium. The complexity and great methodical difficulties involved in solving this problem, which surpass the difficulties involved in the task of normalizing the meteorological factors of an industrial atmosphere, lies in the fact that the action of meteorological factors found under dwelling conditions are necessarily confined to a comparatively narrow range with regard to the character and intensity of the physiological reaction of the human body, which by its very physiological nature is not adapted to excessive prolonged and intensive strains, i.e., a functional condition which does not require some sort of compensating mechanism for conspicuous and prolonged strain.

Reactions to such weak action mediums found in dwellings are difficult to perceive and require special investigations, precision apparatuses, and in most cases the construction of installations for producing and regulating proper conditions (meteorological chambers, test dwelling houses).

The entire problem may be resolved more appropriately by the complex utilization of statistical sanitary research along with experimental physiological observations of the reaction of the body to a medium and a simultaneous study of the physical peculiarities of the microclimate.

77. Czechoslovak Research on Disinfecting Biological Aerosols

"Chlorosulfonic Acid as a Means of Disinfecting Biological Aerosols in the Terrain," by Maj Stefan Dobrovic, MD, and Maj Frantisek Rehn, Doctor of Natural Sciences, both of the research department of the school of microbiology of the "Jan Ev. Purkyne" Military Medical Academy (Vojenska lekarska akademie Jana Ev. Purkyne); Prague, Vojenske Zdavotnicke Listy, Vol 28, No 4, 1958, pp 181-182

"In the scope of our research on the possibilities of disinfecting biological aerosols in the open air, we have turned our attention to chlorosulfonic acid, currently being used in laying smoke screens. With this material it is no problem to prepare a monodispersed, sufficiently concentrated aerosol which, according to theoretical assumptions, would also have a bactericidal effect. Furthermore, chlorosulfonic acid is relatively easy to obtain in large quantities. It also has its disadvantages, especially in its unfavorable action on materials, and it cannot be considered inert against the human organism. The seriousness of these negative aspects is directly related to the concentration and the length of action time, factors which would be taken into consideration in the event of its actual use.

"In our previous article, we presented the results of laboratory experiments, in which we investigated the bactericidal effect of various concentrations of chlorosulfonic acid smoke on bacterial models of Serratia marcescens and Bacillus subtilis.

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"The experiments were carried out in a simple apparatus, constructed of a direct sprayer for creating the bacterial aerosol, a generator of chlorosulfonic acid smoke, a homogenizer where bacterial and bactericidal aerosols would be mixed, exposure vessels which would permit the action of bactericidal aerosols on dispersed microorganisms for a certain limited period of time, and finally a "kapalinovy" (droplet) detector where samples of air were collected to determine the number of germs remaining after being submitted to the action of chlorosulfonic acid smoke. To prevent the rapid decrease of the acidity of the droplets in the detectors, resulting from the action of the strong acids in the bactericidal aerosol, which might nonspecifically affect the results of the detection, we placed a suction cup with from 0.25 to 0.3 percent ammonia in front of the detector. The ammonia fumes neutralized the acids in the tested air immediately before entering the detector.

"This apparatus permitted us to expose chlorosulfonic acid smoke on a model bacterial aerosol for a maximum period of 4 minutes. Samples of the air were collected in the droplet detector at a speed of 5 liters per minute and the liquid from the detector was injected into four agar plates in quantities of 5 cubic centimeters each. Both bacterial models were dispersed in bouillon. In the experiments with Bacillus subtilis we used spores of these microbes obtained by heating a culture to 60 degrees centigrade for 30 minutes. The intensity of sporulation was checked by microscope. The concentration of chlorosulfonic acid in the air during individual experiments was calculated from the ratio of the quantity of air that had passed through the apparatus during the experiment to the weight of the acid remaining after the experiment. All experiments were made at temperatures from 18 to 20 degrees centigrade and with relative humidity fluctuating between 70 and 80 percent.

"The results of the experiments with both bacterial models are apparent from the tables.

Table 1. Effect of Chlorosulfonic Acid Smoke on Serratia marcescens

Mg of Chlorosulfonic Acid per Liter of Air	No of Germs per Liter of Air	Action Time (min)	Germs After Action (per liter)	Percentage of Effectiveness
0.93	50,000	2	0	100
0.60	25,000	2	0	100
0.52	3,800	2	0	100
0.21	1,000	1	24	97.6
0.21	1,000	2	0	100

Averages of 27 experiments.

Table 2. Effect of Chlorosulfonic Acid Smoke on Bacillus subtilis

Mg of Chlorosulfonic Acid per Liter of Air	No of Germs per Liter of Air	Action Time (min)	Germs After Action (per liter)	Percentage of Effectiveness
7.5	1,110	4	554	50
3.1	420	4	104	75
2.5	390	4	82	79
2.0	193	4	41	78.8

Averages of 16 experiments.

"The results showed first of all the relatively favorable value of concentrations of chlorosulfonic acid smoke, which in one minute are able to completely liquidate nonsporulating germs in the atmosphere. The concentration of bacterial aerosols used in the experiment is much greater than the quantity of microorganisms which would have to be considered in the open air. We did not investigate more closely the effect on the human organism of the minimal effective concentration of 0.21 milligram of chlorosulfonic acid per liter of air. Judging from the fact that the smoke of this concentration was hardly visible in the atmosphere and that one minute exposure was sufficient for complete effectiveness, we assume that the unfavorable effect on the human organism would not be considerable. It is obvious that a toxicologist will have to say the final word on this matter.

"The experiments with the sporulate were less successful. Although the chlorosulfonic acid smoke concentration was higher (2 milligrams per liter of air) and the exposure period was longer, only 80% effectiveness was achieved.

"Comparing the results of the experiments, we may say that there is a basis for liquidating nonsporulating microorganisms in the air with chlorosulfonic acid smoke. The destruction of sporulating microbes by means of chlorosulfonic acid smoke does not appear to be satisfactorily solved.

"Final conclusion on the quality of this method of disinfection will follow from additional experiments in laboratories and in the open air, and in cooperation with the appropriate technicians."

Radiology

78. Six Points Outlined in the Use of Antibiotics in Radiation Sickness

"Antibiotics in Radiation Sickness," by R. Petrov and
V. Rogozkin, Candidates of Medical Sciences; Moscow,
Meditsinskiy Rabotnik, No 51, 27 Jun 58, p 3

Following a general discussion of radiation sickness, its complica-
tions and therapy, the authors outline the following six guides in the
use of antibiotics in the treatment of radiation sickness:

1. Antibiotics must be administered as soon as possible after ir-
radiation. No delay should occur, although infectious complications of
radiation sickness do not appear before the end of the first to the third
week, and increased permeability of intestinal walls is not evident before
the second to the third day after irradiation.

2. Antibiotics must be administered to victims of irradiation over
a long period.

3. The authors recommend the cyclic use of antibiotics rather than
the continuous use of any one. For example, biomycin used cyclically with
streptomycin produces 15% fewer cases-showing symptoms of decreased appe-
tite and hemorrhagic syndrome in radiation sickness than the uninterrupted
use of either of these two antibiotics.

4. Since the chief sources of infectious complications in radiation
sickness are in the intestinal tract and in the respiratory passages, it
is necessary to use antibiotics by mouth and by inhalation, in addition
to intramuscular, intravenous, and subcutaneous use of antibiotics.

5. Care should be exercised in the use of antibiotics, especially
levomycin and streptomycin, in combination with other therapeutic agents
(for example, antihistamine and antihemorrhagic preparations and vitamins),
lest such therapy produce rather than prevent a hemorrhagic syndrome.

6. In many cases the state of immunity of the organism determines
the course and the outcome of radiation sickness, and is an early index of
the worsening of the victim's condition. Determining bactericidal activity
of the skin, according to N. N. Klemparskaya, and determining blood leukocyte
phagocytic activity seem very important in the prognosis of the course of
radiation sickness, and the selection of the correct and adequate use of
antibiotics.

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79. Therapeutic Effect of Cysteineamine in Radiation Sickness and in Chemical Poisoning, and Its Effect on Carotid Simus Studied

"The Effect of Cysteineamine on the Chemoreception of the Carotid Ganglion," by G. I. Smorodintseva, Division of Experimental Therapy of the Central Scientific Research Roentgeno-Radiological Institute of Ministry of Health USSR; Moscow, Meditsinskaya Radiologiya, Vol 3, No 3, May/Jun 58, pp 15-21

Since it is known that cysteineamine exerts great changes in respiration and blood pressure, the author attempted to study its effect on the chemoreceptor apparatus, i.e., the carotid sinus which is very sensitive to any chemical changes in the blood. Tests were conducted on cats (60) and dogs (570). Cysteineamine doses used varied from 30 to 200 mg/kg body weight, and backgrounds included radiation sickness, poisoning by cyanide, cytisine, etc.

Kymographic tracings indicate changes in reaction to acetylcholine, cytisine, and cyanide after administration of cysteineamine, the effect of cyteineamine on respiration, and the effect of thiourea and hyposulfide to acetylcholine, cytisine, and cyanide.

Results indicate that a mercamine hydrochloride preparation of cysteineamine administered intraperitoneally 10-15 minutes before the irradiation of mice has definite protective effects in raising tl survival rate from 5% in the controls to 70% in the treated experimental animals.

Cysteineamine introduced intravenously exerts a sharp hypotensive reaction, causes changes in respiration, and intensifies the reactivity of the sino-carotid zone to typical chemical stimulants.

The perfusion of the isolated sinus by cysteineamine causes the stimulation of respiration and a rise in blood pressure.

Combining cysteineamine with cytisine, and thiourea with cytisine increased the protective effect of cysteineamine, i.e., to 87.5 and 73.4% repectively, as compared to 5% survival in the control, while the combined effect of cysteineamine plus cyanide resulted in 89% survival.

The author concludes that the study of the effect of cysteineamine on the vascular reaction has definite prospects for discovering methods of increasing its protective effects.

80. Hemorrhagic Syndrome in The Clinical Picture of Radiation Sickness of Dogs Injured by Polonium

"Hemorrhagic Syndrome in the Clinical Picture of Radiation Sickness in Dogs Injured by Polonium," by S. M. Mikhaylovich; Moscow, Meditsinskaya Radiologiya, Vol 3, No 3, May/Jun 58, pp 9-14

The aim of this research was to study the hemorrhagic syndrome in cases where radioactive substances had penetrated into organisms. Tests were conducted on dogs.

The author makes the following conclusions:

1. The subcutaneous introduction of polonium to dogs leads to the development of radiation sickness with the appearance of a hemorrhagic syndrome characterized by disturbed processes of blood coagulation, thrombocytopenia, decreased blood prothrombin, increased permeability of skin capillaries and decreased strength, of walls of blood vessels.

2. The clinical picture of the injury which is characterized by loss of weight, anorexia, disturbances in the gastrointestinal tract (vomiting, liquid stools, often bloody), and the appearance of a hemorrhagic syndrome (numerous subcutaneous hemorrhages, epistaxis, and rectal bleeding agree with the well-known symptomatology described in literature.

3. It should be noted that changes in certain indexes of the hemorrhagic syndrome (blood coagulation, vascular permeability) arise sooner than clinical symptoms of hemorrhagic diathesis.

81. Autolysis in Denervated Spleen and Muscles of Irradiated Organisms Increased

"Concerning Nervous Regulation of Autolysis in Irradiated Organisms," by Z. B. Tokarskaya, Biochemical Division (head, Prof S. Ye. Manoylov) of Central Scientific Research Roentgeno-Radiological Institute of Ministry of Health USSR; Moscow, Meditsinskaya Radiologiya, Vol 3, No 3, May/Jun 58, pp 26-29

The aim of this research was to study the effect of nervous regulation of autolysis by comparing the amount of amino acids in homogenates of various tissues after the irradiation of animals, after the denervation of certain organs, and after the combined effect of irradiation and denervation. The tests were conducted on rabbits, the irradiation dose used was 1,300 r, and the organs denervated were the spleen, the liver, the kidneys, and the muscles. A table and a set of diagrams explain experimental data. The article is followed by an English abstract.

Results indicate that 2 weeks after denervation (this time is allowed for tissue healing) there is increased autolysis in the spleen (32%), in the liver (36%), in the kidneys (24%), and in the muscles (36%). All figures are compared with the normal of 100%.

Increased autolysis in the denervated and irradiated spleen and muscles was much greater than in the case of irradiation only (autolysis in spleen of irradiated animals was 147%, but in denervated spleen of irradiated animals it rose to 211%; autolysis in irradiated muscles was 172%, but in denervated muscles of irradiated animals it rose to 296%). Autolysis in denervated liver and kidneys of irradiated animals was almost equal to autolysis in the intact liver and kidneys of irradiated animals.

The author considers that similar changes occur which raise the level of autolysis both after denervation and after irradiation and are due to the absence of newal regulation which maintain the processes of assimilation and dissimilation at necessary levels for the organism, thereby resulting in an increase in dystrophic processes in the tissues. Furthermore, the author thinks that since the disturbance of normal regulation of metabolism resulting from irradiation contributes to the creation of dystrophic changes in the organism, radiation injury may be characterized or described as a neurodystrophic process.

82. The Effect of Ionizing Radiation on Oxidative Processes in Mucous Membranes of the Stomach, Small Intestines, Liver, and Brain Studied

"The Influence of Radioactive Phosphorus on Oxidative Processes of an Organism," by V. V. Rudakov, Chair of Biochemistry (Prof G. Ye. Vladimirov, Corresponding Member of the Academy of Medical Sciences USSR), of the Military-Medical Order of Lenin Academy imeni S. M. Kirov; Moscow, Meditsinskaya Radiologiya, Vol 3, No 3, May/Jun 58, pp 21-25

The aim of this research was to study the effect of various doses of radioactive phosphorus (P-32) on the oxidative processes of the mucous membranes of the stomach, the small intestines, the liver, and of the cerebral cortex.

Radioactive phosphorus in the form of Na_2HPO_4 was administered to cats first at the rate of 1.1 to 1.3 millicuries/kg, and then at 3 to 3.3 millicuries / kg. Five tables represent the effect of radioactive phosphorus on different enzymes.

Results indicate that the slight radioactivity of P-32 (1.1-1.3 millicuries / kg introduced orally to cats in the absence of radiation syndrome causes a small increase (8 to 12%) of oxygen absorption in the liver, the mucous membrane of the stomach, of the small intestine, and in the brain tissue.

Great radioactivity of P-32(3-3.3 millicuries/kg) during the period of pronounced symptoms of radiation sickness, decreases oxygen absorption in the liver, & in the mucous membrane of the stomach and small intestine, but no changes occur in oxygen absorptionly brain tissue.

During the peak of radiation sickness, the activity of succinic dehydrogenase is decreased in the liver and in the mucous membrane of the small intestines, and the activity of cytochrome oxidase is also decreased in the liver, the mucous membranes of small intestines and of the stomach, but the activity of these enzymes is not changed in the brain tissue.

Oxidative phosphoryllation during radiation sickness caused by P-32 is decreased in the cerebral cortex and in the mucous membrane of the stomach and small intestines.

83. <u>Functional Condition of Hypothalamic Area in General Massive X-Ray Irradiation Studied</u>

"Changes of Character of Certain Vegetative Reactions in Connection with the Effect of Ionizing Radiation," by N. P. Smirnova; Moscow, <u>Meditsinskaya Radiologiya</u>, Vol 3, No 3, May/Jun 58, pp 3-9

The aim of this research was to study the functional condition of the hypothalamic region during general massive X-ray irradiation. The method was based on the vascular reaction of rabbits' ears to electrical stimulation of the hypothalamus.

Tests were conducted on non-narcotized rabbits, into whose hypothalamic region chronic implantation of electrodes measured temperature changes.

Tests prove the following:

1. Rabbits react to the electrical stimulation of the hypothalamic region with vascular and general motor reactions.

2. The vascular reaction arising due to the stimulation of the hypothalamus in some rabbits is expressed in the form of constriction, while in others (tested during spring months), it is expressed by dilation or diphasic vascular reactions.

3. After the general irradiation by doses of 800 or 1,000 r, the threshold of vascular reactions and the nature of general motor reactions is unchanged.

4. The vascular reaction in rabbits which react essentially with vascular constriction is changed after irradiation.

5. The humoral factor plays an undisputed part in the transmission of stimulation from the hypothalamic region to the constrictive elements of the vascular walls.

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84. **Weight and Mortality Studies of Mice Irradiated by Lethal X-Ray Doses**

"Certain Observations on Mice Subjected to Irradiation by Lethal Doses of X-Rays," by Zh. Lambrev, and Zh. Zlatarev, Chair of Biology (Head, Prof Doctor Zh. Lambrev) and the Chair of Roentgenology with Radiology (Head, Docent K. Vlakhov) of the Higher Medical Institute imeni I. P. Pavlov (Plovdiv); Moscow, Meditsin- skaya Radiologiya. Vol 3, No 3, May/Jun 58, pp 30-34

The aim of this research was to investigate whether or not the factors of sex, weight, biogenetic stimulation, and subcutaneous grafting of the spleen had any effect on the course of radiation sickness. Tests were run on mice and rabbits. X-ray radiation doses used were large (500 r).

Results indicate that female mice had a greater tolerance to radiation than males. After irradiation, the weight of the animals decreased quickly, especially in animals that perished as early as the 6th day. Weight loss was slower in those that lived as long as 25 days or more. The percent of weight loss did not depend on the original weight, although thinner animals died sooner than fatter ones. Extract of human placenta, processed according to Filatov and administered subcutaneously did not increase the tolerance nor aid in maintaining the weight. Subcutaneous implantation of splenic tissue did not decrease mortality rate and did not aid in maintaining weight.

85. **Conference on Medical Radiology in Transcaucasia Discusses Radiation Sickness, Therapy, Prophylaxis, etc.**

Trudy Pervoy Zakavkazskoy Konferentsii po Med. Radiologii (Works of the First Transcaucasian Conference on Medical Radiology) 1956, Moscow; (from Meditsinskiy Referativnyy Zhurnal, No 5, May 1957, pp 61-68)

The following items are abstracts of reports presented at the First
Transcaucasian Conference on Medical Radiology:

> 1. "Sanitary-Hygienic Labor Conditions While Working with Radioactive Isotopes," by G. Z. Pitskhelauri, G. M. Gambashidze, and G. F. Druz'ko, pages 224-229, presents general information concerning hygienic conditions while working with radioactive isotopes, and measures for the protection of the population from radioactive radiation. In addition, the authors present results of sanitary-hygienic examinations of working conditions and accident prevention at various laboratories of the city of Tbilisi, where work with radioactive isotopes proceeds.

2. "Clinical Management and Therapy of Radiation Sickness," by V. K. Zhgenti, A. A. Kvaliashvili, Ye. M. Semenskaya, Sh. R. Topuriya, and Ye. N. Tsverava, pages 7-12, presents experimental results on 29 dogs with acute radiation sickness caused by radiation with various doses of X-rays (2,000, 600, and 400 r). Clinical data, hematological and histological studies are presented. Therapy by vitamins, antibiotics, and fractional blood transfusion eases the course of the disease and lengthens life.

3. "Changes in Blood, Hemopoietic Organs, and in Certain Biochemical Indices in Experimental Radiation Sickness," by V. A. Finardzhyan, S. A. Papoyan, K. A. Kyandaryan, I. G. Demirchoglyan, and S. G. Shukuryan, pages 151-157, report that the irradiation of the brain of rabbits by large doses of gamma rays (55,000 r) produces both qualitative and quantitative changes in blood cellular elements, and that pronounced aplastic processes are developed in hemopoietic organs. In addition, it was noted that the activity of catalase and of carbonic acid anhydrase was inhibited.

4. "Prophylaxis of Radiation Sickness under Experimental Conditions," by L. F. Semenov, and Ye. A. Prokudina, pages 12-17, report that tests on about 3,000 white mice using more that 40 different compounds, indicate that the most effective therapy was due to a combination of adrenalin with acetylcholine. The authors consider that the combination of adrenalin with acetylcholine surpasses that of the strongest protective sulfur-containing compounds, i.e., cysteine, and cystineamine.

5. "Autoinfection in Radiation Sickness and Its Therapy," by P. N. Kiselev, V. N. Sivertseva, and P. A. Buzin, pages 67-74, state that results of many experiments on animals (albino mice) subjected to various X-ray doses indicate that bacteremia in animals subjected to general irradiation (above 300 r) is a constant symptom, and as a rule disappears on the 16 to 17th day after irradiation. No bacteremia is observed if radiation doses are less than 300 r. Use of antibiotics, especially streptomycin, decreases lethality to animals by 40 to 45%. The authors consider that along with the use of antibiotics, it is advisable to use agents which decrease tissue permeability, for example vitamin P, rutin, hyaluronic acid, and other, as well as the transfusion of leukocyte mass, the use of properdine to prevent infectious and autoinfectious processes.

6. "Morphogenesis of Acute Radiation Sickness," by L. V. Funshteyn, pages 144-147, presents results of irradiation of various experimental animals by various doses (1,500 to 5,000 r) of X-rays, and gamma rays (500-2,000 r) using Co-60, P-32, Sr-89 and Sr-90, Ag-110 and Cs-137.

7. "Use of Radioactive Isotopes for Treating Malignant Neoplasms," by A. V. Kozlova, pages 279-287, discusses the results of therapy by radioactive isotopes of gold and phosphorus on 45 patients suffering from malignant neoplasms of various organs. The author considers that the use of radioactive colloidal gold has future prospects and should be further studied.

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86. Book for Semiprofessional Medical Personnel on Radiation Sickness

Review of Luchevaya Bolezn', (Radiation Sickness) by L. A.
Kachur, V. A. Petrov, M. N. Pobedinskiy, and L. F. Semenov,
Medgiz, 1956, 94 pages; Moscow, Fel'dsher i Akusherka, No 3,
Mar 58, page 60

The authors of this book, a manual for semiprofessional medical per-
sonnel, consider that the development of industry connected with the use
of atomic energy, and the use of radioactive compounds in medicine and in
other branches of science expose people to large doses of ionizing radia-
tion, and makes it necessary for medical people to be well acquainted with
the medical prophylaxis and therapy of radiation injuries and means of pro-
tecting organisms from radiation injuries.

The book is subdivided into three major parts, as follows:

1. Radioactivity; which presents brief but comprehensive discussions
on the nature of radioactivity, physical bases of dosimetry, and protection
from atomic explosions (contamination of water, food products, and the de-
contamination of the victim).

2. Acute Radiation Sickness, which discusses the classification of
radiation sickness, its etiology, pathogenesis, and the clinical picture
of the various forms of radiation sickness. This chapter concludes by
presenting both the prophylactic and the therapeutic measures appropriate
to the patient in acute radiation sickness.

3. Chronic Radiation Injuries, which considers the causes that lead
to chronic injuries, the clinical picture of various stages of chronic
radiation sickness, local chronic pathological processes, etc.

This part also considers the problems of diagnosis and prophylaxis
and therapy of chronic injuries of the various stages.

The reviewer (Ya. Braude-Khar'kov) of the book recommends that it be
used as a manual for the course on medical radiology for medical students.

UNCLASSIFIED SCIENTIFIC INFORMATION
REPORT

87. Book on Pathological Physiology of Acute Radiation Sickness

Review of Patologicheskaya Fiziologiya Ostroy Luchevoy Bolezni
(Pathological Physiology of Acute Radiation Sickness) edited by
Prof P. D. Gorizontov, Corresponding Member of the Academy of
Medical Sciences USSR, Medgiz, 1958, 375 pages; Moscow, Meditsin-

CPYRGHT   skiy Rabotnik, No 45, 6 Jun 58, p 4

> "This book presenting experimental material on the biological effects
> of external ionizing radiations, discusses certain problems in the patho-
> genesis of radiation sickness. The different chapters explain changes in
> the nervous system, toxemia, biochemical indices, hemorrhagic diathesis,
> the blood system, the reactivity of the organism during acute radiation
> sickness, and details of the effects of fast and slow neutrons."

88. Chinese in Leningrad Discusses Effects of Radiation on Infections

"The Effect of Radioactive Substances on Immunity," by Yuan
Chi-pin (宛　　吉　　祗), Leningrad Institute for
the Advanced Training of Physicians; Peiping, Chung-hua Fang-
she-hsueh Tsa-chih (Chinese Journal of Radiology), Vol 6,
No 2, pp 141-145

Following a brief summary of the literature, the author presents the
details of biological experiments undertaken to observe how varying degrees
of radiation and radiation sickness, administered or induced before and
after experimental infection, influence the processes of paratyphoid and
diphtheria infection, antibiotic therapy, and the immune response in rabbits
and guinea pigs.

The observations were made while the author was studying at the
Leningrad Institute for the Advanced Training of Physicians.

Surgery

89. <u>Original Surgical Techniques of Prof Boris Vasil'yevich Petrovskiy</u>

"By Untried Methods," by V. Petrova; Moscow, <u>Meditsinskiy
Rabotnik</u>, No 54, 8 July 58, p 2

Prof Boris Vasil'yevich Petrovskiy is described as the inventor of
many original techniques in hospital, clinical, and battle-field surgery.
The following are some of his original methods of surgical operations:

1. A flap of the diaphragm, at its stalk, is substituted for an in-
jured esophagus, resulting in normal function of the latter. In cardio-
spasms, he suggests dissection of the muscular layer of the constricted
part of the esophagus down to the mucous membrane, and then suturing a
flap of the diaphragm onto the defective tissue. He has successfully used
flaps of the diaphragm in the surgery of other diseased organs of the tho-
racic cavity. He recommends the use of polyvinyl alcohol plastic for re-
placing the diaphragm.

2. According to a new method developed by Prof Petrovskiy, in the
case of patients in severe shock due to hemorrhage, blood transfusion is
performed directly into the aorta. "This is a most effective antishock
method and deserves further study and use at clinics."

3. Mention is made of a special operation on a young child afflicted
with both patent ductus arteriosus, and constriction of the neck of the
aorta. The operation was successful, and the boy was restored to health.

4. Another surgical accomplishment has to do with treating acquired
cardiac defects, especially mitral insufficiency. The operation described
consists of laying a supportive semipouch-like suture on the fibrous ring
of the mitral valve. This method has advantages because it is simpler
than the former methods, and less risky, for the operation is done on out-
side of the cardiac cavity. Prof Petrovskiy has also performed operations
on the so-called armored heart, and has used direct intervention on the
pulmonary artery, thus bringing hope to patients with Fallot's tetrad. In
such cases, the constricted part of the pulmonary artery is cut and then
enlarged.

The article mentions Prof Petrovskiy's close scientific associates
and some of his professional affiliations. A photograph accompanies the
article.

<u>Toxicology and Pharmacology</u>

90. <u>The Pharmacological Activity of Some Organophosphorus Compounds</u>

"The Structure and Pharmacological Activity of Certain Organo-phosphorus Compounds," by I. A. Frankov, Sb. <u>Nauchn. Rabot. Minskiy Med. In-t.</u> (Scientific Works of the <u>Minsk Medical In-stitute</u>), 1957, No 18, pp 78-98; (from <u>Referativnyy Zhurnal Khimiya, Biologicheskaya Khimiya</u>, No 12, 25 Jun 58, Abstract No 15973, by A. Travin)

CPYRGHT

"The solubility, stability of water solutions, and pharmacological properties of organophosphorus compounds, $(R'O)_2PONR^2R^3$ (I), where R' = an alkyl, R^2 and R^3 = H or a hydrocarbon radical, $(C_2H_5O)_2PON(R')PO(R^2)$ OC_2H_5 (II) where R' = an alkyl and R^2 = a hydrocarbon or an alkoxy radical, $(R'O)_2PON(CH_3)PR'_2$ (III), where R' = an alkoxy radical, $(C_2H_5O)_2$ $PON(CH_3)$--R--$N(CH_3)$ $(PO)OC_2H_5)_2$ (IV), where R = CO, CH_2 or S, $ClCH_2CH_2(R'CH_2CH_2O(PO=O=PO)OC_2H_5-$ $OCHC_2H_2R^2$ (V), where R' = H or Cl, and $(C_2H_4O(POCH)CCl_3(OPO(OR')_2$ (VI),

where R' = an alkyl, were investigated. When R^2 = H and R^3 = CH_2CH_2Cl,

the toxicity and anticholinesterase activity of (I) increases simultane-ously with an increase in the molecular weight of R'. Analogus tendencies were observed in type (II) compounds with an increase in the molecular weight of R^2 (R^2 = an alkoxy group) and in type (VI) compounds with an increase in the molecular weight of R'. Compounds with branched hydro-carbon radicals in a complex ester group are less toxic than with normal radicals.

The direct attachment of a hydrocarbon radical to the P atom, such as in type (II) compounds (R^2 = C_2H_5), or the presence of an unsaturated radical in a complex ester group, such as in type (II) compounds (R^2 = $OCH=CCl_2$), produces a marked decrease in the toxicity and activity of the preparation. Type (I) monoalkylamides (especially when R^2 = H, R^3 = $CH_2COOC_2H_5$) possess stronger anticholinesterase activity than dialkylamides.

At the same time, the presence of an ester group on the nitrogen, such as in compound (I) where R^1 = R^2 = C_2H_5, R^3 = $CH_2COOC_2H_5$, or R^1 = C_2H_5, R^2 = $CH_2COOC_2H_5$, as well as dialkylphosphoric or dialkylphosphorous acid, such as in compound (III) where R^1 = C_2H_5O or iso-C_3H_7, produces a marked in-crease in the cholinesterase activity. Type (VI) preparations, where R = CO, are highly toxic and posses intense anticholinesterase action. Exchanging the CO group for an atom of S and a CH_2 group results in a marked decrease in toxicity and activity. The presence of one atom of C

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In the alkoxy radicals, such as in type (V) compounds where $R^1 = R^2 = H$, has little effect on the biological properties of the compounds; the introduction of a second atom of Cl, such as in type (V) compounds where $R^1 = Cl$, $R^2 = H$ or $R^1 = H$, $R^2 = Cl$, lowers the toxicity threefold. Certain of these described compounds, especially (I) where $R^1 = R^2 = C_2H_5$, $R^3 = CH_2CH = CH_2$, posse theraputic activity with experimental paralysis and paresis. Their rehabilitory action on the nervous system is not connected with their capacity to block cholinesterase."

91. Structure and Pharmacological Action of Cholinolytic, Cholinomimetic and Anticholinesterase Substances

"The Relation Between Chemical Structure and Pharmacological Action of Some Cholinolytic, Cholinomimetic, and Anticholinesterase Substances," by E. V. Zeymal', M. Ya. Mikhel'son, and R. S. Rybolovlev, Fiziol. Rol' Atsetilkholine i Izyskaniye Novykh Lekarst. Veshchestv. (The Physiological Role of Acetylcholine and The Search for New Medicines), Leningrad, 57, pp 424-441; (from Referativnyy Zhurnal Khimiya, Biologicheskaya Khimiya, No 14, 25 Jul 58, Abstract No 18765, by A. Travin)

"Experimental data are presented concerning the distribution, between the toluol and water phase, of diphazine (diethylaminoacetyl-N-phenothiazine) (I), -methyl-(I), pentaphen, arpenal (diethylaminopropylamide of diphenylacetic acid), isosystox, arecoline, nicotine and their quaternary salts. On the basis of these data and literary material concerning the pharmacological activity of the above-mentioned compounds, a general rule is formulated that the conversion from tertiary amines to their quaternary compounds or from preparations with bivalent sulfur to sulfonium compounds produces an increase in the peripheral action of the compound while decreasing the central action."

92. Relation Between Biological Activity and Structure of Choline Esters

"The Relation Between Structure and Activity of Aminoalkyl-esters of Dicarboxylic Acides of the Aliphatic Series (Di-acetylcholines and Their Related Compounds)," by R. S. Rybol-ovlev, Fiziol. Rol' Atsetilkholina i Izyskaniye Novykh Lekarstv. Veshchestv. (The Physiological Role of Acetyl-choline and the Search for New Medicines), Leningrad, 57, pp 332-337; (from Referativnyy Zhurnal Khimiya, Biologiche-skaya Khimiya, No 13, Jul 58, Abstract No 17347, by A. Travin)

"It was shown that choline esters and their related compounds ROOC $(CH_2)_p COOR'$, where $R = R' = CH_2CH_2N(CH_3)_3$. J, $p = 0$--8 (I), $R = R' = CH_2CH_2N(CH_3)_2C_2H_5$. J, $CH_2CH_2N(C_2H_5)_2CH_3$. J or $CH_2CH_2N(C_2H_5)_3$. J, $p = 2$ or 8 (II), $R = CH_2CH_2N(CH_3)_3$. J, $R' = CH_3$, C_2H_5, $p\text{-}C_3H_7$, $iso\text{-}C_3H_7$, $n\text{-}C_4H_9$, $iso\text{-}C_5H_{11}$ or cyclohexyl, $p = 2, 5, 6, 7$, or 8, posses selective action on n-cholinoreactives systems producing respiratory stimulation, pressor effect and blocking of neuromuscular transmission. The dependec between the structure of the compounds and their biological activity was shown: (1) (I) posses the most expressed curariform properties -- maximum action was observed when $p = 2$; with conversion to higher and lower homo-logs, the curariform action decreases; (2) the stimulatory action of (I) increases from the lower homologues to the higher and attains a maximum when $p = 6$; (3) the partial or complete exchange of the CH_3 radicals for C_2H_5 radicals in the ammonium groups of (I)(as well as in (II)) produces a lowering of the curariform action; (4) the conversion from bis-ammonium compounds to monoammonium (as in type (III) compounds) also produces a decrease in the biological activity."

93. Cerebral and Muscular Cholinesterase Inhibition

"The Inhibition of Cerebral and Muscular Cholinesterase in White Mice by the Action of Isomercaptophos and Its Methyl-sulfomethylate," by Ya. S. Smusin, Fiziol. Rol' Atsetilkholina i Izyskaniye Novikh Lekarstv. Veshchestv. (The Physiological Role of Acetylcholine and the Search for New Medicines), Lenin-grad, 57, pp 153-158; (from Referativnyy Zhurnal Khimiya, Bio-logicheskaya Khimiya, No 12, 25 Jun 58, Abstract No 15975, by

V. Rozengart)

"A comparative investigation of the toxicity and anticholinesterase activity of isosystox and its methylsulfomethylate, which contains a tricovalent (carrying a positive charge) atom of sulfur, was conducted. LD_{50} of isosystox for mice is 6.7 mg/kg; of methylsulfomethylate, 0.057 mg/kg, i.e., the later is 118 times as toxic as the former. Due to the

> effect of isosystox, cerebral and muscular cholinesterase is depressed
> uniformly while at the same time, the introduction of methylsulfomethy-
> late produces a marked depression in the activity of the muscular enzyme
> with only slight inhibition of cerebral cholinesterase."

Miscellaneous

94. Public Health Plans of the Sanitary Epidemiological Service for
1959-1965

"The Principal Trends in the Prospective Plan for the Develop-
ment of Public Health for 1959-1965, Especially the Sanitary
Epidemiological Service," by Yu. D. Lebedev, the Main State
Sanitary Inspectorate of the Ministry of Health USSR; Moscow,
Gigiyena i Sanitariya, No 7, Jul 58, pp 9-16

In line with the decisions of the 20th Congress of the CPSU and the
report of N. Krushchev at the Jubilee Session of the Supreme Soviet in
November 1957, and in line with the decisions of the Central Committee of
the Communist Party, according to the article, the Ministry of Health
USSR has presented a series of tasks to the organs of public health and
to the medical workers collectives to raise the level of domestic health
during 1959-1965.

The more important of these tasks include the following:

1. A further rise in the general sanitary conditions of the country,
a marked lowering of the incidence of infectious and parasitic disease,
and the liquidation of a significant number of these diseases.

2. A significant and systematic lowering of the incidence of dis-
eases which play a significant part in the disease picture and mortality
rate among the populace, and a lowering of their mortality.

3. A further steady lowering of mortality among children.

4. The consolidation of the health and physical development of the
growing generation, having as a goal the efficient prophylaxis of diseases
which originate during youth.

5. The lowering of temporary disability and incapacity among workers.

Further, the main stress of the effort of the sanitary epidemiological
service should be focused on the liquidation and lowering of the incidence
of typhoid fever, which should be cut in half by 1965; epidemic hepatitis;

malaria; diptheria; poliomyelitis, the vaccine of which should be administered to 80% of the children between 6 months and 14 years of age; influenza in connection with the new type of virus which attained what might be called pandemic proportions in 1957; as well as tuberculosis and a whole series of local diseases such as tularemia and tick-borne encephalitis.

In addition, further recommendations call for the sanitary epidemiological service to attain the following basic goals by 1965; one epidemiologist for every 25,000 people in urban and rural localities; one sanitary physician for every 40,000 people in an urban area; one industrial sanitation position for every 14,000 workers; one food sanitation position for every 30,000 people in an urban population; one position for school sanitation for every 12,000 students in an urban area and on position for every 28,000 students in a rural area; and a physician bacteriologist for every 35,000 people.

The plan also calls for the opening of sanitary bacteriological laboratories in 848 sanitary epidemiological stations and in the sanitary epidemiological departments of various hospitals which presently have no laboratories at all. Laboratories already in operation should be continuously equipped with the latest and most modern equipment.

This report was presented to the Third Plenary Session of the All Union Scientific Society for Hygienists, which was held in Moscow between 19 and 21 February 1958.

95. Jubilee Session of Institute of Epidemiology and Microbiology imeni Gamaleya

"Jubilee Session of Institute of Epidemiology and Microbiology imeni Gamaleya, Academy of Medical Sciences USSR, Dedicated to the 40th Anniversary of the Great October Socialist Revolution," by V. V. Anan'in; Moscow, Vestnik Akademii Meditsinskikh Nauk SSSR, No 3, Mar 58, pp 68-75

The Jubilee Session of the Institute of Epidemiology and Microbiology imeni N. F. Gamaleya was held on 21-22 November 1957. Twenty one reports were given concerning results of scientific research work of the institute since its inception in 1946. Some 308 persons, representing 34 scientific research and practical scientific organizations from Moscow, Leningrad, Gor'kiy, Rostov-na-Donu and other cities as well as the Ministry of Health USSR, Academy of Sciences USSR, and the Minister of Health USSR, M. V. Kovrigina and members of the Presidium of Academy of Sciences USSR participated in the work of the session.

The session was opened with a report by Prof S. N. Muromtsev, direc-tor of the Institute of Epidemiology and Microbiology imeni Gamalaya and Active Member, All-Union Academy of Agricultural Sciences imeni Lenin. According to Muromtsev, the Institute of Epidemiology and Microbiology imeni Gamaleya is the largest scientific establishment in the Soviet Union which does research in the fields of epidemiology and microbiology. At present, the institute has a staff consisting of 9 Active and Correspond-ing members of the Academy of Medical Sciences, 33 Doctors of Sciences and 153 Candidates of Sciences.

The scientific and productive activities of the institute in the field of epidemiology, microbiology, and immunology are varied and encom-pass nine important problems in these fields. Five of these problems are: (1) variability of pathogenic microorganisms and bacteriophages (work directed by Prof V. D. Timakov); (2) natural foci of diseases (work under the direction of Prof P. A. Petrishcheva); (3) immunity (work under the direction of Prof L. A. Zil'ber); (4) the scientific fundamentals of the production of vaccine and sera (work under the direc-tion of Prof G. V. Vygodchikov); and (5) enteric infections (work under the direction of Prof A. F. Bilibin). In addition, the institute develops methods for the production of bacterial preparations, renders consulta-tive and organizational assistance to organs of public health in deciding antiepidemic problems, and trains cadre for scientific and practical work in its fields.

The following reports were given: Prof V. D. Timakov reported on research conducted at the institute on variations in microorganisms; Prof P. A. Petrishcheva reported on problems concerning natural foci of diseases in man; Prof M. P. Naumov reported on the role of warm-blooded mammals in natural foci of diseases; Prof T. Ye. Boldyrev, Corresponding Member Academy of Medical Sciences USSR, N. A. Yakhnina, L. A. Favorova, and I. I. Shatrov reported on problems of the epidemiology of enteric infectious diseases in the work of the Division of Epidemiology of the institute; Prof L. A. Zil'ber on "New Facts Concerning the Immunology and Etiology of Tumors"; Prof V. L. Troitskiy reported on the study of the effect of ionizing radiation on infections and immunity; Prof Kh. Kh. Planel'es on "Problems of Infectious Pathology and Experimental Therapy"; Prof M. A. Morozov, Active Member Academy of Medical Sciences USSR, on "Methods of Viruscopy and Its Use in Microbiology"; M. K. Krontovskaya reported on problems of rickettsiosis and the prophylaxis of rickettsial infectious diseases; Prof G. V. Vygodchikov, Active Member of Academy of Sciences USSR, on "The Fundamental Principles of Active Immunization of Combined Preparations"; V. D. Gekker, Doctor of Medical Sciences reported on the role of individual components of microbial cells of bacteria of the enteric group; I. M. Lyampert, Candidate of Medical Sciences, reported on research on streptococcal infections; P. V. Pavlov, Candidate Medical Sci-ences, on "Investigations Effective Preparations for the Specific Prophy-laxis of Acute Infections in Children"; N. I. Kovaleva on "Laws Concerning

the Multiplication of Bacteria of the Enteric - Typhoid Group in Synthetic Media in Deep Cultures With Aeration;" A. V. Beylinson reported on improvements in methods of preparing therapeutic sera at the Institute of Epidemiology and Microbiology imeni Gamaleya; Prof P. A. Vershilova on "The Live Vaccine Problem and the Work of the Institute in This Field During the Past Ten Years"; K. Ye. Dolinov, Candidate of Medical Sciences, on "Drying as a Method of Preserving Biological Preparations"; N. P. Ploskirev on "Dry Media for the Diagnosis of Microorganisms"; I. N. Vinogradova on "Research Conducted by the Institute in the Field of Preparing Liquid Nutrient Media"; Yu. I. Milenushkin, R. I. Belkin, and A. A. Yefremenko, Members of the Cabinet of History of Microbiology and Epidemiology, reported on the work done by the cabinet during the past years; and V. V. Anan'in, deputy director for scientific affairs of the Institute of Epidemiology and Microbiology imeni Gamalaya, gave the concluding report of the session.

96. **30th Anniversary of Institute of Experimental Pathology and Therapy**

"On the Results of the Expanded Session of the Bureau of the Department of Medical and Biological Sciences, Academy of Medical Sciences USSR, dedicated to the 30th Anniversary of Sukhumi Medical and Biological Station," by Prof S. Ye. Karandayev, Scientific Secretary, Department of Medical and Biological Sciences, Academy of Medical Sciences USSR; Moscow, Vestnik Akademii Meditsinskikh Nauk SSSR, No 6, Jun 58, p 89

The Sukhumi Medical and Biological Station, currently renamed the Institute of Experimental Pathology and Therapy, Academy of Medical Sciences USSR, was organized in 1927. Its primary function was to carry on experimental work on problems of higher nervous activity, but gradually the station shifted its research to the solution of other problems. Today the institute conducts extensive experimental work on the physiology, biochemistry, and experimental therapy of the cardiovascular system, the pathology of monkeys, and the etiology and pathogenesis of malignant neoplasms. The institute has over 850 monkeys for experimental work. At present, the institute employes 229 persons of whom 27 are scientific workers. The institute has fully equipped laboratories for conducting any experimental work in its field.

97. **Institute of Heart Surgery To Be Opened in Leningrad**

"The Heart Is Treated by Surgeons," by V. Markov, Pravda, Correspondent; Moscow, Pravda, 30 Jul 58, p 4

A Scientific Research Institute of Heart Surgery (Nauchno-Issledovatel'-skiy Institut Serdechnoy Khirurgii) has been opened in Leningrad. The institute has a Division of Sanitation, an Experimental Division, and a Clinical Division, plus the following laboratories: roengentology, electrocardiography, gas exchange, geochemical, clinical, and prosthesis of blood vessels.

The institute will conduct research on improving the so-called "Dry Heart" operation, on developing new methods of surgical treatment of miocardical infurctions, and on improving methods of preoperative preparation.

98. Research Themes of the Ministry of Health RSFSR for 1958

"Chronicle and Information"; Moscow, Gigiyena i Sanitariya, No 7, Jul 58, p 95

The Moscow Scientific Research Institute of Sanitation and Hygiene imeni F. F. Erisman of the Ministry of Health RSFSR has published Information Bulletins No 16, 17, and 18 for 1958.

Information Bulletin No 16 deals with the problems involving the clinical picture and therapy of occupational poisons and diseases.

Information Bulletin No 17 deals with the problems of determining small quantities of harmful substances in the atmosphere: chlorine, sulfur fumes, hydrogen sulfide, carbon bisulfide, sulfuric acid fumes, nitrogen dioxide, arsenous oxide, lead, mercury, manganese, oxides of carbon, hydrocarbons, benzene, phenol, acrolein, aldehydes, and ketones; soot and dusts.

Information Bulletin No 18 contains the composite plan of the scientific-hygiene themes of the Ministry of Health RSFSR for 1958. The composite plan includes 684 scientific themes concerning the following leading problems:

Labor hygiene and the prophylaxis of occupational diseases -- 284 themes

Problems in radiation hygiene -- 102 themes.

Water hygiene and the sanitary protection of reservoirs -- 99 themes

Hygiene for Children and adolescents -- 57 themes

The rational use of food for separate groups of the population and the prophylaxis of alimentary diseases -- 55 themes

The hygienic basis for planning, organization, and construction -- 44 themes

The sanitary protection of atmospheric air -- 43 themes

In addition, the plan calls for 10 textbooks and manuals.

The composite plan includes the scientific themes of 86 various hygienic establishments of the RSFSR, representing institutes of labor hygiene, sanitary hygiene, 63 hygiene chairs in medical institutes, hygiene chairs of the institutes for the advanced training of physicians, departments of hygiene of epidemiological institutes, microbiology and hygeinc, and the sanitary epidemiological stations located in Moscow, Kuybyshev, and Chelyabinsk.

99. Rapid Growth of Medical Industry in Bulgaria

"Growth of Medical Industry in Bulgaria," (unsigned article); Moscow, Meditsinskiy Rabotnik, No 52, Jul 58, p 1

"Sofia -- Although the medical industry is one of the youngest branches of the Bulgarian public health program, it has already achieved significant successes. During the first year of its existence, it oriented itself towards the development of all branches of the medical industry for which the country had the raw materials, for example the production of antibiotics, chemopharmaceutics, photo-chemicals, and other organic preparations, as well as medical equipment and instrumentation. In 1954, the construction of a large penicillin factory was a significant accomplishment. Recently, besides penicillin and biomycin, the factory has been manufacturing streptomycin, vitamin B_{12}, and penicillin-procaine."

"In addition, large amounts of antituberculosis drugs, such as phthivazidum, rimifon, tubigal, and others are being produced. Recently, production has been concentrated on glutamic acid, rutin, ergoamine, cytisine, progival, pepsin, peptone, cortin, and insulin, and others. During the last 5 years, the volume of production of the Bulgarian medical industry has been enlarged by 282%, and at present 1,300 different types of drugs are listed. Every year Bulgaria increases its foreign exports to Egypt, Greece, Turkey, India, Burma, Iran, and other countries."

100. Czechoslovak Scientists Attend Moscow Polio Conference

"Joint Work -- Joint Victory," (unsigned article); Prague, Obrana Lidu, 20 Jul 58, p 5

A scientific conference was held in Moscow, from 19 to 21 June, on poliomyelitis and similar illnesses caused by enteric viruses. The conference was attended by leading scientific workers from various places in the USSR and several satellite countries (China, Bulgaria, Rumania, East Germany, Hungary, and Yugoslovakia). The Czechoslovak representatives were the virologists, Dr Slonin and Dr Zacek, and the chief hygienist of the Czechoslovak Republic, Docent Dr Skovranek.

VII.   METALLURGY

101.   <u>Nickel-Niobium and Nickel-Tantalum Intermetallic Compounds</u>

"The Crystal Structure of the Compounds Ni_3 Nb and Ni_3 Ta"
by Ye. N. Pylyayeva, Ye. I. Gladyshevskiy and P. I. Krip-
yakevich, Institute of Metallurgy imeni A. A. Baykov, Acad-
emy of Sciences USSR, and L'vov State University imeni I.
Franko; Moscow, <u>Zhurnal Neorganicheskoy Khimii</u>, Vol 3, No 7,
Jul 58, pp 1626-1631.

By applying X-ray analysis, the intermetallic compounds Ni_3Nb
and Ni_3Ta, as well as nine ternary alloys of the series Ni_3 Nb-Ni_3 Ta,
which had been annealed for 200 hours at 1200°, were subjected to in-
vestigation. It was established that the two intermetallic compounds
form an uninterrupted series of solid solutions. Crystallographic data
and lattice constants have been determined. The results of the measure-
ments are presented in the form of extensive tables accompanying the
text of the article.

102.   <u>A New Method for the Chemical Investigation of Very Small Volumes
       of Matter</u>

"Point Analysis" by Prof I. Borovskiy, Doctor of Physicomathe-
matical Sciences; Moscow, <u>Promyshlenno-Ekonomicheskaya Gazeta,</u>
Vol 3, No 87 (387), 23 Jul 58, p 4, columns 1-6).

Theoretical and experimental research have shown that the majority
of the most important properties of materials depend on processes which
take place in extremely small volumes of these materials. The linear
dimensions of these volumes range from hundredth parts of a micron to
several tens of microns. No satisfactory method for the investigation
of the chemical composition of microscopic volumes in this range was
available until A. Guinier and R. Castain in France (1951) and inde-
pendently of them the author of this article (I. Borovskiy) in the USSR
developed an X-ray method of analysis which makes it possible to determine
quantitatively the local chemical composition in sections of alloys, min-
erals, and inorganic and organic substances with respect to all elements
from lithium to uranium in such a manner that the distribution of all
the elements found to be present can be determined in any direction along
a section by ascertaining their concentrations at "points" with a locali-
zation of 0.1-0.2 microns.

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A narrow bundle of electrons is passed through the section at a dif-
ference of potential between the cathode and anode ranging from tens of
thousands of volts to hundreds of thousands of volts. Because of the great
energy of the electrons, they excite X-rays with characteristic frequen-
cies within microvolumes of 5-10 cubic microns. The excited radiation is
separated into a spectrum by means of a curved crystal which serves both
as a prism and a cylindrical focussing mirror. The identity of the ele-
ments present is established on the basis of the wave length, while the
intensity of the line corresponds to the number of atoms of the element
in the volume being irradiated. An arrangement by means of which the
section can be scanned in any desired direction has been devised. A
continuous curve is recorded for the element being determined, showing
changes in concentration.

The Laboratory of Physical Methods of Investigation, Institute of
Metallurgy imeni A. A. Baykov, Academy of Sciences USSR, has developed a
number of experimental installations for the microvolume X-ray determina-
tion in alloys of the elements from magnesium to uranium (atomic numbers
12-92). One of these installations, RSASh-2, is at present in the stage
of industrial development preceding production. By using the RSASh-2
apparatus, one can determine the elements from iron to molybdenum (atomic
numbers 26-42) and from hafnium to uranium (atomic numbers 72-92) with a
sensitivity of 0.01-0.4% and local sensitivity of 10^{-15} - 10^{-12} gram (lo-
calization 1-3 microns). The results are recorded by a mechanical counter
or in the form of concentration curves on the tape of an automatically
recording electronic potentiometer.

During recent years many scientific investigations have been carried
out with the aid of the RSASh-2 apparatus. In the course of these inves-
tigations a method has been developed for the determination of constitu-
tional diagrams of binary systems on the basis of data obtained by testing
two to four samples of the alloy. The formation of some new intermetallic
compounds not known hitherto has been established in certain systems (data
on this are particularly important in the case of system consisting of
high-melting metals). Coefficients of diffusion in the solid state have
been determined and the effect of the orderly arrangement of atoms in
solid solutions on the coefficient of mutual diffusion has been investi-
gated. The distribution of impurities along grain boundaries in castings
has been studied. Work has been done on the distribution of elements in
the seams formed by gas-flame brazing of heat-resistant alloys. On the
basis of the results obtained, recommendations could be made in regard to
the composition of heat-resistant brazing materials. Furthermore, re-
search has been done on the cutting edges of tools made of hard alloys.

The device RSASh-39 is now being developed which will be suitable for
the determination of lighter elements.

The precise analysis of industrially employed materials by a method of the type described is of importance, because practically all of the 92 elements of the periodic system and some transuranium elements are used in the industry at present. The chemical composition of the majority of materials used in the industry is extremely complex. A greater number of materials of high purity is used every year. Two to 20 elements enter into the composition of heat-resistant alloys and alloys which have to stand great mechanical stresses. The grains of alloys of this type are usually highly diverse as far as their elemental (chemical) composition and crystal-line structure are concerned; the alloys in question are multicomponent and heterophasic in nature.

VIII. PHYSICS

Atomic and Molecular Physics

103. **East German Institute Studies Cathode Fall Area of Glow Discharges**

"The Potential and Field-Strength Distribution in the Cathode Fall Area of Glow Discharges," by G. Brederlow, Institute of Gas-Discharge Physics, Greifswald; Leipzig, Annalen der Physik, Vol 1, No 6/8, 1958, pp 359-376

The potential distribution in the cathode-fall area of normal and abnormal He, Ne, A, H_2, and N_2-discharges was determined by means of a glowing cathode, and the field strength distribution in the axis of the discharge was determined through differentiation of the potential curves. The results of the measurements are compared with those of the theory of motion given by Warren (Physic. Rev., 98, 1955, p 1658), and it is found that the latter theory correctly describes the conditions which prevail in the first half of the cathode fall area between the plasma boundary and the cathode. In the immediate vicinity of the cathode however, there are deviations, (rapid rise of field strength and, with it, of the space-charge density) which this article attempts to explain on the basis of a formation of molecular ions in the vicinity of the cathode.

Nuclear Physics

104. East German Condensation of Unpublished Soviet Work

"Problems of the Theory of Dispersion Relations," by N. N. Bogolyubov, B. V. Medvedev, and M. K. Polivanov, Joint Institute for Nuclear Research, Dubna; Berlin, Fortschritte der Physik, Vol 6, No 4/5, 1958, pp 169-245

This work, which is to be published in complete form by Gostekhizdat, was compiled because, in the wealth of literature on dispersion relations, no reliable method of deriving these relations has been forthcoming, nor have the physical bases required for the derivation of the dispersion relations been established. The problem is considered, in the final analysis, a matter of the degree to which these relations are connected with the present scheme of the quantum field theory.

The work is devoted to both of the above-mentioned problems. In Section 2, the basic principles are formulated, which, in the opinion of the authors, should be taken over by the conventional theory to make the derivation of the dispersion relations possible. The formulation of the theory is considered to be arbitrary; for example, it is not considered necessary to establish the explicit form of the Lagrange function, nor to fall back on Hamilton formalism. The main approach is the derivations of variations of the scattering matrix with respect to the fields of real particles, the so-called radiation operators. In Section 3 certain general relationships between such operators are set up, the study of which is closely connected with the Green functions for real particles.

In sections 4 and 5, a new proof is given of the well-known spectral representations of Kaellen and Lehmann, which has the advantage that no divergent expressions occur, not even for intermediate states.

Sections 6 and 7 are devoted to the derivation and confirmation of the dispersion relations, and Section 8 deals with the application of these relations to certain concrete cases.

105. Chinese Research in Nuclear Physics

"Radius of Nuclear Charge Distribution and Nuclear Binding Energy," by Tseng Chin-yen (曾   謹   言), Department of Physics, Peking University; Peiping, Wu-li Hsueh-pao, (Acta Physica Sinica), Vol 13, No 5, 1957, pp 357-364

The author analyzes the "latest" experimental results in high energy electron scattering and X-ray spectra of mu-mesons, pointing out that the radius of nuclear charge distribution, R_p, is very nearly proportional to the cube root of the atomic number, Z, rather than to the cube root of the mass number, A. He shows that a newly proposed formula, $R_p = r_{op}z^{1/3} = 1.60 \times 10^{-13}cm \cdot z^{1/3}$, in which r_{op} is the radius of nuclear charge distribution constant, yields more satisfactory results.

On the above assumption, he proposes a modification of the widely accepted, semiempirical Bethe-Weizsacker formula for nuclear binding energy. The change is made in the Coulomb energy team so that it is represented by

$$\frac{3}{5} \frac{z^2e^2}{r_{op}z^{1/3}} = a_3' z^{5/3} \quad \text{rather than by}$$

$a_3 z^2/A^{1/3}$, and the new formula is

$$M(A,z) = zM_H + NM_n - a_1'A + a_2'A^{2/3} - a_3'z^{5/3} + a_4'(N-z)^2/A$$

or

$$B(A,z) = a_1'A - a_2'A^{2/3} - a_3'z^{5/3} a_4'(N - z)^2/A.$$

Data are presented to show that nuclear binding energies calculated by the new formula are in better agreement with experimental results and that the mass numbers of the most beta-stable nuclei are also correctly predicated in the new formula.

"Coincidences Caused by Compton Backscattering of Gamma Rays,"
by Hsu Yung-ch'ang (徐　永　昌) and Cheng Lin-sheng (郑
林　生), Institute of Physics, Academia Sinica; Peiping,
Wu-li Hsueh-pao (Acta Physica Sinica), Vol 14, No 2, 1958,
pp 114-120.

This article presents a self-built dual-coincidence circuit which
the authors used to observe the annihilation coincidence of small compo-
nent positron rays emitted by Zn^{65}. In thier experiments they noted the
coincidence of 0.2 Mev gamma rays in the absence of a light gate; how-
ever, no such component was demonstrated when a lead light gate was used.
This led them to conclusions in disagreement with those of Cohn and Kur-
batov (Physical Review, Vol 78, 1950), regarding the source of 0.21 Mev
gamma rays found in Zn^{65}. The authors hold that the 0.2 Mev gamma
rays are due to the Compton backscattering of strong component 1.12 Mev
gamma rays of Zn^{65} and bring out theoretical and experimental data to
support their view. They found that the coincidence rate of collimated
annihilation radiations gave the percentage of positron decay of Zn^{65}
per total disintegration as $(1.5_6 \pm 0.1_6)$ percent.

A circuit diagram of the pulse-measuring device used by the authors
is given with an explanation of its special features. It has a resolv-
ing time of 1.4×10^{-7} seconds and is supposedly an improvement over the
ordinary Rossi circuit.

[SIR Note: When the Chinese scientific periodical, Yuan-tzu-neng
(Atomic Energy), was initiated in Peiping in November 1956, the editors
declared that eventually it would carry the contributions of Chinese
scientists in this field. As yet, no original Chinese work has appeared
in this journal which is being published monthly. However, Chinese re-
ports on nuclear physics research occasionally appear in other journals
such as Wu-li Hsueh-pao (Acta Physica Sinica), the English-language
Science Record, and Scientia Sinica. Most of the papers have been con-
cerned with theoretical nuclear physics. Experimental work appears to
have been limited to the physics of elementary particles.]

106. Data On Dresden Research Reactor

"The Research Reactor Dresden," by G. Flach, Dresden; Berlin,
Energietechnik, No 6, Jun 58, pp 242-247

The article gives, in addition to several photographs and detailed
description, the following data on the reactor which was put into opera-
tion on 16 December 1957:

Type: thermal, heterogeneous, WWR-S

Fuel: 10-percent enriched uranium

Construction: aluminum and stainless steel

Moderator, coolant, and reflector: distilled water

Output: 2,000 kw max

Neutron flux: average $1 \cdot 10^{13}$ per cm^2 per sec

              maximum $2 \cdot 10^{13}$ per cm^2 per sec

Charge: critical mass   3.2 kg U^{235}

               first charge   4.6 kg U^{235}

               maximum charge   6 kg U^{235}

Active zone: 0.5 m diameter x 0.5 m

Distillate throughput in first cycle: max 1,000 m^3/h

Temperature difference of the input
and output water in the first cycle: about 2 deg at 2,000 kw

Average cooling water temperature in the first cycle: 35° C

Maximum surface temperature at rod shells: 95° C

Throughput of deaerator cycle: about 180 m^3/h

Throughput in filter cycle: about 10 m^3/h

Throughput and temperature difference
in second cycle for 2,000 kw: about 5 deg for a max 400 m^3/h

107. Milne Problem and Anisotropy

"The Milne Problem In the Case of Anisotropic Scattering (Application to Thermal Neutrons)," by D. Lyons, Institute of Nuclear Physics, Zeuthen-Miersdorf; Leipzig, Annalen der Physik, Vol 1, No 6/8, 1958, pp 400-423

The article reconsiders the Milne problem and shows that the "Standard problem" (G. Placzek and W. Seidel, Physic, Rev., 72, 1947, p 550) can be solved in good approximation without special analytical aids (such as the theory of functions), but only anisotropy is assumed for an elementary act of scattering. The density distribution at the edge of the medium is developed in accordance with exponential integrals. This method also provides a trivial proof of the Hopf-Bronstein relationship. The reason is found for the fact that the treatment in the case of isotropic scattering is so extraordinarily complicated.

108. Effects of Plasma Fields on Electron Beam

"On Plasma Investigations With an Electron-Beam Sonde of Small Diameter," by M. von Ardenne, S. Schiller and H. Westmeyer, Manfred von Ardenne Research Institute, Dresden; Berlin, Experimentelle Technik der Physik, Vol 6, No 2, 1958, pp 49-62

The somewhat complex plasma of the model of a unoplasmatron ion source with an artificially imposed cathode fall was investigated with the aid of an electron beam of very small diameter used as a probe. The beam was produced by a 35-kv precision oscilloscope, which as mounted together with a gas-discharge chamber and camera attachment in a special apparatus. The values of the plasma field strength in the space between the cathode fall area and anode were determined on the basis of the displacement of the discharge in relation to the electron beam.

It was found that the change of configuration of the focused spot is caused almost entirely by plasma oscillation fields. The scattering angles caused by oscillation fields were on the order of 10^{-3}-10^{-2}; by comparison, the theoretical scattering angles estimated for Coulomb scattering for the same discharge is on the order of 10^{-6} to 10^{-5}. Therefore, the influence of the fields built up by plasma oscillations on the beam is stronger than the influence of the Coulomb microfield by a factor of 1,000. The authors recommend that the nature of plasma states be further analyzed and drawn into the general plasma theory, as was suggested earlier by Gabor (Proc. Roy. Soc., A 213, 1952, 73).

On the basis of regularities observed in a plotting of the dependence of the axial ratio of the focused beam configuration on the corresponding gradient of the field strength, the authors present the following theorem:

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"In a plasma, the orientation of the plasma-oscillation fields in the direction of the field intensity is all the more pronounced, the greater the value of the field-intensity gradient in the plasma areas concerned."

The development of the apparatus and the research work were sponsored by the Office for Nuclear Research and Nuclear Engineering (Amt fuer Kernforschung und Kerntechnik), Berlin.

Theoretical Physics

109. Pachner Presents Equations of Motion for His Field Theory

"The Equations of Motion of Unified Field Theory in the Lowest Approximation," by J. Pachner, Physics Institute of the Advanced Technical School, Prague; Leipzig, Annalen der Physik, Vol 1, No 6/8, 1958, pp 351-358

In earlier works (Annalen der Physik, 19, 353, 1957; 20, 368, 1957; 1, 112, 1958) the author developed a new form of unified field theory starting with a heterogeneous Hamiltonian. In this theory, the physical interpretation of the individual geometric fields is especially simple. The theory contains the Maxwell equations unchanged. The strict basic spherisymmetrical solution of the field equations leads to the relationships to be expected within the general theory of relativity. This article presents a derivation of the equations of motion directly from the field equations. These equations, which are derived in the lowest approximation, are considered to have the correct form, since they contain not only the Newtonian force, but also the Coulomb force.

The results of the investigation presented in this article, as well as those in a preceding work (Annalen der Physik, 1, 112, 1958), have the expected form, except for the fact that one constant is supposed to have a different numerical value. Only through the derivation of the equations of motion of a test particle from the field equation is an explanation of this contradiction considered possible.

110. Motion of Material Point in Relativistic Mechanics

"The Hodograph of the Motion of a Material Point in Relativistic
Mechanics," by M. Zaganescu, Faculty of Mathematics and Physics,
Timisoara, Rumania; Leipzig, Annalen der Physik, Vol 1, No 6/8,
1958, pp 424-428

The hodograph equation is derived from the relativistic equations
of motion and applies only for two-dimensional motion. The equation is
of the Ricatti type. It is shown that the hodograph of a material point
which moves in a plane effected by a force with constant components is
equidistant from a straight line through the origin of the coordinates
of the velocity space.

111. Invariance of Lagrange Functions of Fields

"On the Invariance Properties of the Lagrange Functions of
Fields," by N. Mitskevich, Physics Faculty, Moscow State Uni-
versity; Leipzig, Annalen der Physik, Vol 1, No 6/8, 1958,
pp 319-333

The article first investigates the analytical form of the invariance
condition for functions of field variables and their first two derivatives.
These functions are identified with the physical Lagrange functions.

The obtained variables which are kept are then classified with the
aid of a new formulations of the Noether theorem.

Finally, a new type of uniform field theory is formulated for fields
with diminishing rest mass of the quanta.

112. De-electrification in High-Frequency Field

"On the Phenomenon of De-electrification in Small Conducting
Bodies in an Extended Electromagnetic High-Frequency Field,"
by H. Stolz, Institute of Theoretical Physics, Humboldt Uni-
versity, Berlin; Leipzig, Annalen der Physik, Vol 1, No 6/8,
1958, pp 334-343

The formula for the de-electrification field is carried over from
electrostatics to a case of a conducting body, the dimensions of which
and the depth of penetration of the skin effect into which are small in
comparison with the wave lengths of an electromagnetic high-frequency

field within and outside the body. The current density and the internal field are computed as dependent on the external field, with only partly specialized assumptions being made on the conductivity mechanism in the body. The results are discussed for a germanium body in a temperature range of 0-200° C and a wave length of the external field of 1.24 cm.

It is shown that it is possible, without making special assumptions in regard to the conductivity mechanism, to represent the losses in a small conducting sample body within an external high-frequency field by means of variables which, in principle, are readily accessible. The influence of the de-electrification is established, and it is found that this influence increases with decreasing dielectric constant and finally, at negative dielectric constant, reaches the point where the electromagnetic field no onger penetrates the body at all. A simple formula is given which makes it possible to evaluate the influence of the de-electrification on the measureable losses of a small test body in a cavity resonator, provided the de-electrification factory, conductivity, and dielectric constant are known for a given frequency.

Mechanics

113. Conditions Found For Sign-Definiteness of Solutions

"On the Construction of Lyapunov Functions From the Integrals of Equations for Perturbed Motion," by G. K. Pozharitskiy, Prikladnaya Matematika i Mekhanika, Vol 22, No 2, Mar-Apr 58, pp 145-154

Equations of perturbed motion

$$dx_i / dt = X_i(x_1, \ldots, x_n, t) \quad (i = 1, 2, \ldots, n),$$

admitting of $p \leqslant n$ first integrals,

$$U_1(x_1, \ldots, x_n, t), \ldots, U_p(x_1, \ldots, x_n, t)$$

are considered.

Necessary and sufficient conditions that a function $\psi(U_1, U_2, \ldots, U_p)$ be sign-definite are proved. It is noted that is such a function can be found, it will be possible to make certain assertions concerning stability of motion without resorting to consideration of other properties of the equations for the perturbed motion.

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CPYRGHT   The statements of the theorems follow:

> "For a sign-definite function $\varphi(U_1, \ldots, U_p)$ to exist, it is necessary and sufficient that the function
>
> $$\psi(U_1, \ldots, U_p) = U_1^2(x_1, \ldots, x_n, t) + \ldots + U_p^2(x_1, \ldots, x_n, t)$$
>
> be sign-definite."
>
> "The function $\psi(U_1, \ldots, U_p)$ will be sign-definite if and only if it is possible to find for at least one of the integrals, say $U_i(x_1, \ldots, x_n, t)$, a pair of sign-definite functions
>
> $$r_i(x_1^2 + \ldots + x_n^2), \qquad \rho_i(x_1^2 + \ldots + x_n^2)$$
>
> such that
>
> $$U_i^2(x_1, \ldots, x_n, t) > r_i$$
>
> when
>
> $$x_1^2 + \ldots + x_n^2 > 0$$
>
> and
>
> $$U_1^2 + \ldots + U_{i-1}^2 + U_{i+1}^2 + \ldots + U_p^2 < \rho_i(x_1^2 + \ldots + x_n^2)"$$

The practical value of these two theorems, it is claimed, is apparent when $U_1, \ldots, U_p$ are not explicit functions of time. In this case, in order that $\psi(U_1, \ldots, U_p)$ be sign-definite, it is necessary and sufficient that at least one of the functions $U_1^2(x_1, \ldots, x_n)$ take on only positive values at all points different from

$$x_1 = \ldots = x_n = 0$$

and satisfy the conditions

$$U_1(x_1, \ldots, x_n) = \ldots = U_{i-1}(x_1, \ldots, x_n) =$$
$$= U_{i+1}(x_1, \ldots, x_n) = \ldots = U_p(x_1, \ldots, x_n) = 0.$$

Several simplifications following from the above result are explained.

114. **Lyapunov Stability Criteria Shown Applicable to Systems With Time Lag**

"Stability in the First Approximation of Systems With Time Lag,"
by B. S. Razumizhin, Moscow; Moscow, Prikladnaya Matematika i
Mekhanika, Vol 22, No 2, Mar/Apr 58, pp 155-166

It is shown that Lyapunov's theorem on asymptotic stability for sys-
tems of differential equations of the first approximation are applicable
for systems with time lag. Certain sufficiency conditions for stability
in the first approximation are obtained for such systems.

The methods developed in the article are applied to a second-order
differential equation describing transition processes in certain automatic
control systems.

115. **Flow of Shock Wave Past an Arbitrary Profile Studied**

"Flow of a Shock Wave Past a Symmetric Profile," by O. M. Belot-
serkovskiy, Moscow; Moscow, Prikladnaya Matematika i Mekhanika,
Vol 22, No 2, Mar/Apr 58, pp 206-219

The flow of a shock wave past a plane body of arbitrary form or pro-
file and with axial symmetry is considered. A plane-parallel supersonic
flow of an ideal gas strikes the body at a zero attack angle and constant
velocity. The shape and position of the shock wave produced in front of
the body is assumed to be unkown. It is required to calculate the per-
turbed turbulent flow in a minimal region of influence, i.e., in the region
bounded by the shock wave, the axis of symmetry, the profile of the body,
and the first boundary characteristic between the wave and the body.

A numerical solution is given for the problem using the "integral
relations method" proposed by A. A. Dorodnitsyn ("A Method for the Numeri-
cal Solution of Certain Problems of Aerodynamics", Trudy Tret'yego Vse-
soyuznogo Matematicheskogo S'yezda, Vol 2, 1956). The method reduces the
integration of a system of nonlinear partial differential equations to the
numerical solution of a certain approximating system of ordinary differen-
tial equations. With the use of electronic computers, the integral rela-
tions method, it is claimed, makes it possible to obtain final results with
the necessary degree of accuracy for a problem in an exact representation.

Expressions for the angle between the lines of flow and the line of
constant velocity are derived for the general case and for the case of a
circular cylinder. The latter problem was worked out on the "BESM" high-
speed electronic calculator for Mach numbers 3, 4, and 5. Values for
velocity, pressure, and other parameters are tabulated.

116. <u>Construction of Lyapunov Functions For Equations With Variable Co-</u>
<u>efficients Described</u>

"On a Method for Constructing Lyapunov Functions for Linear
Systems With Variable Coefficients," by Ya. N. Roytenberg, Mos-
cow; Moscow, <u>Prikladnaya Matematika i Mekhanika</u>, Vol 22, No 2,
Mar/Apr 58, pp 167-172

A "powerful" method for constructing Lyapunov functions for systems
of linear differential equations with variable coefficients is described.
The treatment is an extension of the work of N. G. Chetayev (<u>Ustoychivost'</u>
<u>Dvizheniya</u> (Stability of Motion), 2nd Ed, GITTL, Moscow, 1955).

117. <u>Interaction of a Shock Wave With the Boundary Layer</u>

"Interaction of a Shock Wave With a Boundary Layer in the Region
of the Leading Edge of a Flat Plate at High Supersonic Speeds
Taking Radiation Into Account," by G. A. Kulonen, Leningrad State
University; Leningrad, <u>Vestnik Leningradskogo Universiteta</u>, No 7,
<u>Seriya Matematiki, Mekhaniki i Astronomii</u>, No 2, Apr-Jun 58,
pp 172-188

The interaction of a shock wave with a boundary layer by the leading
edge of a flat plate at high supersonic speeds is examined taking radia-
tion into account. It is proposed that the plate radiates and receives
heat according to the law $q = \sigma T^4$. The integral equation of the
momentum is used for solving the problem. Calculations are made for the
following cases: (1) h = 20 km, P_r = 0.71, M_1 = 10; (2) h = 20 km,
P_r = 0.71, M_1 = 15.

The effect of the radiation on the surface temperature of the flat
plate and other values are shown in comparison with an insulated surface.

The work represents a summary of diploma work completed by the author
under the supervision of Prof I. P. Ginzburg at Leningrad State University.

118. Buckling of Thin Films

"On the Nonlinear Theory of Thin Films," by N. .F. Morozov, Leningrad State University imeni A. A. Zhdanov; Moscow, Dok-lady Akademii Nauk SSSR, Vol 114, No 5, 11 Jun 57, pp 968-971

The article treats the essential solution to the problem of the buckling of thin films. The author departs from the work of D. A. Panov (Tr. TsAGI, 450, 1, 1939) and Friedrichs-Stoker (Am. J. Math., 63, No 4, 839, 1941), who presented a solution for the case of spherisymmetrically loaded films, as well as from the work of I. I. Vorovich (DAN, 105, No 1, 1955), who treated the question of inclined films, and presents a solution to the problem by means of other methods and for other boundary conditions.

It is found that, if the contour is sufficiently smooth, the biharmonic Green function G, together with its first derivatives, is uniformly continuous with a certain region.

119. Theoretical Study of Relaxation at East German Plastic Laboratory

"On the Theory of Relaxation. I. The Thermodynamic Fundamentals and Their Mathematical Solution," by S. Kaestner, Laboratory for Plastics, Berlin-Adlershof; Leipzig, Annalen der Physik, Vol 1, No 6/8, 1958, pp 377-399

The basic thermodynamic equations are first set up in a general form, which takes into account both pure relaxation and simultaneous effects of internal friction. A tensor representation in the space of the variables of state is used in the mathematical formulation of the theory; this approach proves to be valid also for the subsequent solution of the basic equations. The results are presented in table form, and their application to mechanical and dielectric relaxation is discussed.

Emphasis throughout is on the explanation of the mechanical and dielectric relaxation behavior of matter. The discussions, however, are treated in such a general manner that they also apply for other relaxation phenomena where no magnetic fields are in effect. The treatment is limited to homogeneous systems. It is also assumed that the deviation from thermodynamic equilibrium is always sufficiently small. The author arrives at a linear theory of relaxation in the tensor representation.

For the special case of mechanical relaxation without internal friction, the relationships derived here go over into the theory of pure relaxation of Meixner (Z. Naturforschg., 9a, 1954, p 654); if, on the other hand, mechanical isothermal processes are taken into account, there is agreement with the formulas given by Biot (J. Appl. Phys., 25, 1954, p 1385).

Throughout the article, the distinction is made between retardation (Verschiebungsrelaxation) and relaxation (Kraftrelaxation).

IX. MISCELLANEOUS

120. Selected Dissertations Defended in Doctoral and Candidate Examinations in Hungary in November-December 1957 and in the First Three Months of 1958

"Reports of the Scientific Qualifications Committee -- New doctors and candidates," (unsigned articles) Budapest, Magyar Tudomany

"New candidate -- November-December 1957," January-February 1958 issue, pp 57-58

Gyula Deak received a Candidate of Chemical Sciences degree on the basis of his dissertation, "A Study of Reactions Catalyzed by BF_3;" his opponents were Corresponding Member [of the Hungarian Academy of Sciences] Sandor Muller and Gyorgy Varsanyi, Candidate of Chemical Sciences.

"New candidates -- January 1958," March 1958 issue, pp 89-90

Adam Bosznay received a Candidate of Technical Sciences degree on the basis of his dissertation, "Concerning a Method for Determining the Specific Angular Frequency and the Induced Oscillation Ability of an Oscillating System With Several Degrees of Freedom and Concerning the Practical Application of This Method;" his opponents were Endre Reuss, Doctor of Technical Sciences and Jozsef Barta, Doctor of Technical Sciences.

Ede Kapuy received a Candidate of Physical Sciences degree on the basis of her dissertation, "An Approximation Method for Calculating the Electron Energy of Tetrahedral Hydride Molecules;" her opponents were Rezso Gaspar, Doctor of Physical Sciences and Tibor Hoffman, Doctor of Physical Sciences.

Pal Tetenyi received a Candidate of Chemical Sciences degree on the basis of his dissertation, "Kinetics of the Dehydrogenization of Alcohols and the Nature of the Metallic Catalyst," defended in the USSR.

"New doctor -- February 1958," April 1958 issue pp 142-143

Gyorgy Koranyi received a Doctor of Chemical Sciences degree on the basis of his dissertation, "The Effect of the Vapor of Metal Chlorides on the Surface Structure of Glass;" his opponents were Academician Aladar Buzagh, Bela Lengyel, Doctor of Chemical Sciences, and Bela Lanyi, Doctor of Chemical Sciences.

"New doctor and candidates -- March 1958," June 1958 issue, pp 237-238

Zoltan Bruckner received a Doctor of Chemical Sciences degree on the basis of his dissertation, "The Role of Surface-active Materials in the Regeneration of Rubber in an Aqueous Neutral Medium;" his opponents were Academician Zoltan Csuros, Academician Geza Schay, and Corresponding Member Sandor Muller.

Magdolna B. -Varga received Candidate of Biological Sciences degree on the basis of her dissertation, "Paper chromatography Investigation of Growth-Inhibiting Materials With Special Regard to the Formation of Pulpy Matter;" her opponents were Vilmos Frenyo, Candidate of Biological Sciences and Domokos Fejer, Candidate of Biological Sciences.

Emil Varga received a Candidate of Medical Sciences degree on the basis of his dissertation, "The Properties and Physiological Function of Myosin Choline-Esterase;" his opponents were Academician Kalman Lissak and Mrs Vilmos Szekessy, Candidate in Medical Sciences.

121. Recent Academia Sinica Developments

"New Briefs," (unsigned article), Peiping, K'o-hsueh T'ung-pao (Scientia), No 13, 1958, p 416

This article reports the following developments in the Academia Sinica:

The Institute of Physics has been renamed Institute of Atomic Energy, Academia Sinica (中 國 科 學 院 原 子 能 研 究 所).

The Kiangsu Branch of the Academia Sinica was established during an organizational meeting held in Nanking on 30 June 1958 and the Kiangsi Branch, during an organizational meeting held in Nan-ch'ang on 1 July 1958.

The Institute of Mining and Metallurgy (礦 冶 研 究 所), Academia Sinica, has been formally established on the basis of the Institute of Metallurgy and Ceramics (Ch'ang-sha Branch). The responsible person of the new institute are Chou Hsing-chien (周 行 建), director; Huang P'ei-yuan (黃 培 云) and Chang Hsing-fu (張 兴 富), deputy directors.

The Institute of Nationalities Research (民 族 研 究 所) was formally established during an organizational meeting in Peiping 23 June 1958. Director of the institute is Liu Ch'un (刘 春); deputy directors are Su K'o-ch'in (苏 克 謹), Weng Tu-chien (翁 独 健), Hsia K'ang-nung (夏 康 农), and Ya Han-chang (牙 含 章).

122. New Divisions Formed at Academia Sinica

"Preparatory Committee of Academia Sinica's Northwest Branch to Establish New Institutions," by Huang Wei; Peiping, K'o-hsueh T'ung-pao (Scientia), No 13, 1958, p 384

To meet the needs of industrial and agricultural developments in the northwest, the Academia Sinica has decided that during the Second Five-Year Plan, its Northwest Branch will establish four new but small-scale research divisions with major responsibilities as follows:

1. Division for Comprehensive Research on Power (動 力 綜 合 研 究 組): to study the utilization of solar energy, wind, and water energy.

2. Chemical Research Division (化 学 研 究 組): to collaborate with Lan-chou University in research on analysis and refining of rare metals and in research on salt lakes.

3. Forestry and Soil Research Division (林 業 土 壤 研 究 組): to conduct research on silviculture, pedology, botany, and sand stabilization in conjunction with the planting in Kansu Province of 2,000 kilometers of shelter belts and the conversion of 10 million mou into arable land.

4. Civil Engineering and Construction Division (土 木 建 築 研 究 組): to study civil engineering and construction problems encountered in basic construction work in the Northwest, including soil foundations and antiseismic structures.

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