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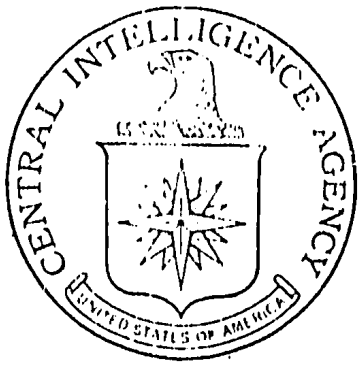

SCIENTIFIC INFORMATION REPORT

Number 2

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Prepared by

Foreign Documents Division
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2430 E. St., N. W., Washington 25, D.C.

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 disseminated as an aid to United States Government research.

SCIENTIFIC INFORMATION REPORT

Table of Contents

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I. ASTRONOMY

The Solar System

1. Sun Spots Studies

"Large-Scale Motions in Layer Below the Photosphere of the Sun," by V. Ye. Stepanov and M. A. Klyakotko, Izv, Krymsk. astrofiz, observ., 1956, 16, 80-99 (from Referativnyy Zhurnal -- Astronomiya i Geodeziya, No 10, Oct 57, Abstract No 8233)

From 1917 to 1934, 123 nonrecurrent spots from the Greenwich Observatory catalog were used for analysis. Attention was paid to the differential effect of rotation; motion along the group axis produced by mutual interaction of the group; latitudinal or meridional drift, the magnitude of which equals $0^{o}.05$ daily and large-scale motions with mean quadratic magnitude of $\pm$ 38 m/sec.

The results of studies did not solve the question whether the large-scale motions are elements of turbulence or of circulation, similar to that detected by R. S. Gnevysheva (Astron. Zh., 1941, 18, No 1, 26).

"Photometry of Solar Spots," by Ya. Ye. Mergentaler, Izv, Krymsk, astrofiz, observ., 1956, 16, 207-208 (from Referativnyy Zhurnal -- Astronomiya i Geodeziya, No 10, Oct 57, Abstract No 8234)

Preparations are being made for observations of a possible relation of photometric profiles of Solar spots to the phase of the 11-year cycle and to magnetic fields. For this purpose the Wroclaw Observatory is preparing the 30-cm horizontal reflector (focal length 11 meters, diameter of Sun's image 10 cm, and with additional optics 0.5 meters.) A photoelectric apparatus is being assembled.

"A Short Remark on Solar Spots," by L. Dezho, Izv, Krymsk, astrofiz, observ., 1956. 16, 208-209 (from Referativnyy Zhurnal -- Astronomiya i Geodeziya, No 10, Oct 57, Abstract No 8235)

The ratio of penumbra area P to the shadow area U is investigated. P/U is assumed to be an important characteristic of spots. Sharp maxima occur in the velocity distribution of P/U variations depending on growth or decrease of U. A conclusion is reached that the width of the penumbra is not proportional to the diameter of the shadow. This phenomenon of so-called eastern excess should be viewed from a new standpoint, because it cannot depend on the character of the spot development only.

2. Moon Shadow Observation During Solar Eclipse

"Observations of the Edge of the Lunar Shadow From An Airplane During the Total Eclipse of the Sun 30 June 1954," by V. T. Ter-Oganezov, Byul, Vses, astron, -geod. o-va. 1957, No 20, 9-11 (from Referativnyy Zhurnal -- Astronomiya i Geodeziya No 10, Oct 57, Abstract No 8018)

These observations facilitate corrections of the Lunar orbit elements. They were carried out near the shore of the Baltic sea near the city of Liyepaya. The observations were carried out from two hydroplanes flying toward the shadow along its edges at an altitude of 3,000 meters. The approaching Lunar shadow could be seen from the seaside 30 seconds before the passage over the plane. The boundary of the shadow and the penumbra covered a zone of 200 to 300 meters and could be well determined. It was established that the shadow shifted one kilometer northward with respect to the ephemerid which corresponds to 1.2 seconds late at a shift along the latitude and 0.8 seconds along the longitude. The writer suggests continued use of this method during future eclipses.

Astronomical Optics

3. Telescope Objective Design

"Design of a Double-Mirror Astronomic Objective With Four Reflectors," by L. V. Romanova, Raschet i Issledovaniye v Optichesk. Priborostr (Design and Investigation in Optical Instrument Building) Leningrad, Leningrad State University, 1956, pp 18-30 (from Referativnyy Zhurnal -- Astronomiya i Geodeziya, No 10, Oct 57, Abstract No 8362)

A double-mirror astronomic objective is designed. The light is twice reflected by each mirror (by the main concave and the secondary convex); it traverses a double-lens afocal correction system and gathers in the rear focal plane. The objective is corrected for the spherical aberration and coma. Parameters for an objective with a focal length of 2,400 mm and aperture ratio of 1 : 6 are computed. The diameters of the large and the small mirrors are respectively 400 and 200 mm, and the distance between them 380.8 mm. Graphs of residual aberration are presented. The vignette of the central part of the beam is projected by the secondary mirror on the objective.

4. Interference Filter System

"Double Interference Light Filters," by K. D. Sinel'nikov, I. N. Shklyarevskiy, and S. I. Damashka, Uch, zap, Kharkovsk, un-ta, 1955, 64, 145-146 (from Referativnyy Zhurnal -- Astronomiya i Geodeziya, No 10, Oct 57, Abstract No 8044)

A complicated double filter is described. It consists of an interference filter transparent in visible light for one small band, and a silvered glass plate attached to it in such a way as to form a wedge-shaped air gap. The rib of the wedge is set parallel to the slit of the spectrograph. The combined filter is illuminated by a parallel pencil of white light and the obtained interference picture is projected on the slit of the spectrograph by means of an achromatic lens. By moving the interference plates it is possible to chose such a thickness of the wedge as to make a line of equal chromatic order coincide with the maximum of the passing zone of a single interference filter. The replacement of the silver coating by a multilayer of dielectric and the use of powerful sources of light improves considerably the light power of the equipment.

Theoretical Astronomy

5. Triaxial Ellipsoid Libration Point Stability

"Concerning the Stability of Points of Libration in the Vicinity of a Rotating Gravitating Ellipsoid," by V. K. Abalakin, Byul, In-ta teor, astron. AN SSSR, 1957, 6, No 8, 543-549 (from Referativnyy Zhurnal -- Astronomiya i Geodeziya, No 10, Oct 57, Abstract No 7968)

In vicinity of a gravitating triaxial ellipsoid rotating around one of the axes there are points of relative equilibrium -- the points of libration, located on the extensions of the axes of an equatorial section. The problem of stability of these points is solved by means of characteristic indexes in first approximation. It was found that the points of libration located on the extension of the minor axis of the equatorial cross section are stable in first approximation; the points of libration located on the extension of the major axis of the equatorial cross section are unstable. In addition three families of periodic solutions were found in the vicinity of points of libration.

6. Expansion in Spherical Functions for Gravity Potential

"The Potential of Terrestrial Attraction," by I. D. Zhongolovich, Byul, In-ta teor, astron, AN SSSR, 1957, 6, No 8, 505-523 (from Referativnyy Zhurnal -- Astronomiya i Geodeziya, No 10, Oct 57, Abstract No 7972)

In a previous work by the author (Tr, In-ta teor, astron., 1952, 3) on the basis of many measurements of gravity (around 26,000 points) the expansion of gravity acceleration on the terrestrial surface was obtained in spherical functions up to the eighth order. This expansion of gravity acceleration is used for the computation of the expansion coefficients of the potential of terrestrial gravity in spherical functions, while in the expansion of the potential all terms of the second order relative to oblateness are retained.

The expansion series are given in the abstract, but are considered by the author to be only tentative.

II. BIOLOGY

Microbiology

7. Effects of Beta-Emitters on the Multiplication and Size of Tubercle Bacteria

"The Effect of Beta-Emitters on the Development of Tubercle Bacteria," by Ye. N. Sokurova, Institute of Microbiology, Academy of Sciences USSR; Moscow, Mikrobiologiya, Vol 26, No 4, Jul/Aug 57, pp 444-449

The addition of small amounts of a mixture of beta-emitters (solution of uranium-235 fragments stored for about a year) to the nutrient media of tubercle bacteria resulted in an increase of the bacterial biomass.

Tubercle bacteria are more susceptible to beta-radiations when cultivated on agar than when cultivated in liquid nutrient media. Maximum stimulation exerted by beta radioactivity amounts to 1-2 millicuries per liter of nutrient media in agar cultures, as compared with 5 millicuries in liquid cultures.

Prolonged cultivation of bacteria in the presence of beta-emitters indicates that the stimulating effect is limited to the first days of cultivation.

The authors think that the stimulation of bacterial development by beta-emitters is linked, first of all, to the acceleration of cell division, and hence to the decreased average size of the cell. Inhibition of bacterial development by radiation is usually accompanied by increased average size of cell.

8. Vitamin B_{12} Formation by Cultures of Actinomyces

"Formation of Vitamin B_{12} by Cultures of Actinomyces -- Producers of Antibiotics," by Ye. I. Surikova and L. A. Popova, All-Union Scientific Research Institute of Antibiotics (VNIIA); Moscow, Mikrobiologiya, Vol 26, No 4, Jul/Aug 57, pp 432-437

Actinomyces, besides forming antibiotics, possess the capacity to synthesize other important and valuable substances, among which is vitamin B_{12}. In the present research two cultures of actinomyces were used, i.e., Actinomyces globisporus streptomycini of strain LS-1 and Actinomyces aureofaciens of strain LS-536.

The author draws the following conclusions:

1. In the presence of cobalt salts (0.5-1.3 gamma/ml) vitamin B_{12} is formed by cultures of Act. aureofaciens through the biosynthesis of biomycin (aureomycin), and by Act. globisporus streptomycini through the biosynthesis of streptomycin.

2. Optimum concentration of cobalt nitrate stimulating the process of biosynthesis of the vitamin and not affecting the formation of the antibiotics is 0.05 mg % for biomycin and 0.10-0.15 mg % for the biosynthesis of streptomycin.

3. The vitamin B_{12} obtained from the culture fluid proved to be the genuine vitamin B_{12} when assayed by chromatographic analysis and by specific hemopoietic tests.

4. The vitamin B_{12} precursor, 5,6-dimethylbenzimidazol, does not stimulate vitamin B_{12} biosynthesis under analogous experimental conditions.

5. The formation of vitamin B_{12} through the biosynthesis of biomycin and streptomycin proceeds parallel to the accumulation of the antibiotics. It is therefore possible to produce antibiotics and vitamin B_{12} simultaneously in the course of fermentation.

6. Vitamin B_{12} is the product of intracellular synthesis and diffuses into the medium because of changes in the permeability of cell membranes.

9. Czechoslovak Academy Conference on Protection of Industrial Products Against Biological Damage

"Protection of Industrial Products Against Biological Damage," by Emma Vintrova, Prague, Vestnik Ceskoslovenske Akademie Ved, No 7/8, Sep 57, pp 354-355

On 7 and 8 May 1957, the Czechoslovak Academy of Sciences held a conference in Liblice on the subject of "Protection of Industrial Products Against Biological Damage," i.e., against damage by bacteria, mold, etc, under the auspices of the Institute of Biology and the Secretariat for the State Research.

The author briefly lists various contributors to the conference and the six points of the adopted resolution: (1) the coordination of basic and applied research with the Institute of Biology of the Czechoslovak Academy of Sciences performing basic research and the "G. V. Akimov" Research Institute for the Protection of Materials performing applied

research; (2) the inclusion into a unified state plan for research on the problem of "corrosion and natural conditions," which includes biological corrosion as one of the problems of standard economic significance, and the formation of a coordination group between the Secretariat of the State Research Plan and the Czechoslovak Academy of Sciences; (3) concentration of research activity on questions connected with water installations, equipment buried in the ground, and the protection of principal export products; (4) the expansion of present research in metals and inorganic materials and the further development of research in the field of protection of wood, plastic materials (also glues and resins), hides, textiles, insulation materials, lacquers, and packaging material; (5) the further development of research on materials which are harmful to biological agents (pesticides) and not injurious to health; and (6) the improvement of the forms of scientific and technical cooperation between the USSR and the People's Democracies.

Radiobiology

10. Hygienic Evaluation of Radioactive Strontium as a Contaminant

"Hygienic Evaluation of Radioactive Strontium as a Factor in Contamination of the External Environment," by A. N. Marey Moscow, Meditsinskaya Radiologiya, Vol 2, No 5, Sep/Oct 57, pp 89-95

The author discusses the law of migration of radioactive strontium (Sr^{90}) in the air, open water reservoirs, soil, plants, animals, and man. Various biological cycles for Sr^{90} migration are reviewed. The significance of sedimentation of Sr^{90} in various bodies of water, and migration to plankton, fish, and then to people, especially when these are dependent on sea food, are analyzed. Milk and vegetables are described as the chief source for contamination (cooked food loses much of its Sr^{90} through cooking).

The author recommends that measures be taken to stop further contamination of the external environment with radioactive strontium and that a more thorough approach be adopted to the quantitative evaluation of the possible effects of radioactive strontium on the health of man and animals.

11. Indirect Protective Effect of Carbon Monoxide Against Ionizing Radiation

"The Influence of X Rays on Hemopoietic Organs of Animals Protected by Carbon Monoxide," by N. F. Barakina; Moscow, Doklady Akademii Nauk SSSR, Vol 114, No 2, 11 May 57, pp 285-288

This research was aimed at studying the effects of ionizing radiation on hemopoietic organs when an organism is protected by carbon monoxide and at determining the degree of radiosensitivity of various cellular elements of the myeloid and lymphoid series.

Full-grown albino mice of both sexes were irradiated by lethal doses of 700, 1,000, and 5,000 r. Control animals were not protected, but experimental ones were placed in an atmosphere containing 0.25-0.5%, by volume, carbon monoxide.

Results indicate that only 2.3% of the controls subjected to 700 r survived, as compared with 87% in the protected animals, and none of the controls subjected to 1,000 r survived, as compared to 35% survival of the animals protected by carbon monoxide. All animals, controls and experimental, subjected to 5,000 r perished. The following is the order for decreasing radio-sensitivity of various elements: basophile erythroblasts, hemocytoblasts, promyelocytes, polychromatophile erythroblasts, myelocytes, metamyelocytes, normoblasts, mature leukocytes, and megakaryocytes.

Destructive changes were evident in the bone marrow of control animals subjected to 700 and 1,000 r within an hour, as compared with after 4 hours in the experimental ones. Restoration processes started sooner in the protected animals than in the controls.

The author thinks that the average duration of the life of irradiated animals coincides with the period at which the number of cellular elements of the bone marrow and of the spleen is at its minimum. In unprotected animals that period arrived on the 8th day, at which time the number of cellular elements was 7% of the original; in cases of experimental animals signs of restoration were evident before this period set in.

The author concludes that the protective effect of CO is an indirect one, and is due to the fact that at the moment of irradiation the organism develops a hypoxic condition owing to the formation of significant quantities of carboxyhemoglobin.

12. Irradiation Deranges Salt-Water Function of Adrenal Cortex

"Certain Data on the Functional Condition of Adrenal Cortex Under Radiation Effects," by Ye. B. Pavlova and A. Ye. Rabkina, Division of Morphology (chief, Prof Ye. I. Tarakanov) and Radiation Laboratory (chief, D. E. Grodznenskiy), All-Union Institute of Experimental Endocrinology (director, Prof Ye. A. Vasyukova): Moscow, Problemy Endokrinologii i Gormonoterapii, Vol 3, No 4, Jul/Aug 57, pp 3-9

The purpose of this research was to study the functional condition of the adrenal cortex in animals irradiated by minimum lethal doses of general X-ray irradiation. Water ingestion in 125 rats was used to assay adrenal functional activity.

By comparing results of normal and irradiated animals, the following conclusions can be drawn: (1) Animals subjected to water ingestion 2 days after irradiation exhibit water retention and reduced diuresis, (2) reduced diuresis continues during the third and fourth days after irradiation, and (3) the administration of 5 mg of desoxycorticosterone acetate enhances diuresis but does not fully normalize it.

The authors conclude that irradiation deranges the salt-water function of adrenal cortex.

13. Histotoxic Hypoxia From CO and KCN Proved Devoid of Protective Effects Against Ionizing Radiation

"Concerning the Absence of Protective Influence of Histotoxic Hypoxia During the Action of Ionizing Radiation," by E. Ya. Grayevskiy and M. M. Konstantinova, Institute of Animal Morphology imeni A. N. Severtsov, Academy of Sciences USSR: Moscow Doklady Akademii Nauk SSSR, Vol 114, No 2, 11 May 57, pp 289-292

The aim of this research was to clarify the contradictory results of the protective effects of histotoxic hypoxia on irradiation reactions of organisms.

Tests were conducted on E. coli cultures in meat-peptone agar, subjected to doses of 500-900 r/min, and total doses varied between one and 20kr. E. coli bacteria were placed in 1/500 M KCN solution, one hour before and all during irradiation, and other bacteria were placed in an atmosphere of 95% CO for 5-10 minutes and all during irradiation. Additional similar tests using CO and KCN were conducted on albino mice.

Results indicate that neither CO nor KCN change the radiosensitivity of E. coli, nor do they exert any favorable effect on its multiplication rate. Judging from these results and also by reviewing the theory, it is difficult to anticipate any protective effects of histotoxic hypoxia in radiation sickness. In histotoxic hypoxia, contrary to anoxic, circulatory, and anemic hypoxia, available oxygen is not decreased, but on the contrary it is even increased. The latter situation may explain the tendency toward increased injurious effects of irradiation under the effects of CO and KCN which were evident in these experiments, although one should not exclude the possibility of summation effects.

The authors conclude that oxidative processes proceeding in an organism after irradiation must follow some path other than the normal biological oxidative processes.

14. Applications of Ionizing Radiation in Production of Bacterial Preparations

"Application of Ionizing Radiation in the Production of Bacterial Preparations," by V. L. Troitskiy, Institute of Epidemiology and Microbiology imeni N. F. Gamaley, Academy of Medical Sciences USSR: Moscow, Meditsinskaya Radiologiya, Vol 2, No 5, Sep/Oct 57, pp 80-88

Experimental data obtained indicate the possibility of using radioactive irradiation in the industrial production of bacterial preparations. The source of this irradiation was an experimental gamma-irradiator which consisted of a set of preparations of radioactive cobalt (Co^{60}), with a total activity of 5,000 c (8,000 gm equivalent of Ra).

The following methods of application of irradiation in the production of bacterial preparations were suggested: (1) preparations of killed corpuscular and chemical vaccines (antigenic complexes), (2) cold sterilization of vaccines and anatoxins, (3) cold sterilization of nutritive media, and (4) cold sterilization of wastes of bacterial industry, thus making these wastes harmless.

15. Conference on Radiobiology Held at Moscow State University

"Intervuz Conference on Radiobiology," by V. I. Korogodin and P. G. Polikarpov; Moscow, Meditsinskaya Radiologiya, Vol 2, No 3, May/Jun 57, pp 91-95

The authors describe an intervuz conference (vuz -- higher educational institution) held 25-28 February 1957 at the Moscow State University to discuss problems related to biochemical and physicochemical effects of radiation. The conference was held to attract the attention of peripheral higher educational institutions to research in radiation by exchange of research information and coordination of scientific research work. More than 800 delegates from various institutions and organizations of the Soviet Union were present.

The opening address was presented by Prof B. N. Tarusov, chief of the Chair of Biophysics, Moscow State University. The author defined the general status and the prospects for the development of radiation biophysics due to increasing application of atomic energy in various fields. Among the topics reviewed were the study of the mechanism of radiobiologic reactions, protective effects of various agents, establishment of safe dose, establishment of the target theory, study of the formation of aqueous-phase radicals with greatest biological effectiveness, and the theory of indirect reaction.

Prof A. M. Kuzin (Institute of Biophysics) reported on theories of radiation biochemistry. Evidence was presented of the presence of chain reactions in nucleoproteins, nucleic acids, etc., leading to the formation of radiotoxins at various stages of radiation injury.

Prof M. N. Meysel' (Institute of Microbiology) reported on the effects of ionizing radiation on various cell structures. His results indicate that the mitochondria and nucleoproteins are most sensitive to the effects of ionizing radiation.

N. P. Dubinin, Corresponding Member of the Academy of Sciences USSR, reported on ionizing radiation and heredity. He stressed the fact that the new branch of science, i.e., radiation genetics, requires the training of personnel adequately prepared in the fields of genetics, chemistry, physics, and mathematics.

Great interest was demonstrated in a group of reports by Ye. V. Burlakova, V. G. Dzantiyev, K. I. Zhuravlev, G. B. Sergeyev, and Prof N. M. Emanuel' on the subject of effects of irradiation of fats and chain oxidation reactions in lipids during the development of radiation injuries. It was suggested that the effect of ionizing radiation is partly connected with the disturbance of the natural inhibitors of oxidation. Two types of chain reactions are described.

A number of reports were devoted to kinetics of radiation sequelae.

V. I. Korogodin (Moscow State University) talked on postradiation changes in yeast.

Yu. A. Kriger (Moscow State University), together with Ye. S. Yelkhovska, reported on research conducted on the physicochemical properties and the structure of erythrocytes after gamma radiation.

The problems of blood coagulation, autolysis, and hemorrhage were discussed in many reports.

Prof B. A. Kudryashov and his co-workers reported on the mechanism of hemorrhagic syndrome in radiation injuries caused by external radiation and also by the administration (internally) of radioactive isotopes. It was shown that the chief cause of disturbed blood coagulation was the insufficiency of prothrombokinase in irradiated animals.

V. N. Benevolenskiy discussed hemolysis arising in tissues of animals irradiated by ionizing radiation. It was shown that hemolysis of irradiated tissues was similar to hemolysis during autolysis of liver of unirradiated animals.

L. L. Khamayde produced evidence that the hemolytic activity of mice liver after the introduction of solutions of uranium fission products appeared significantly sooner and was more intense than the hemolysis caused by introducing an analogous dose of radioactive cesium.

Prof M. V. Kirzon and M. G. Pshennikova (Moscow State University) presented research details on the effects of X rays on nerve-muscle preparations in frogs. The authors admit the possibility of the existence of nonimpulse influences radiating through the interneural synapses of the central nervous system.

A. F. Ivanitskaya (Institute of Animal Morphology) reported on the effect of ionizing radiation on hemopoietic organs. The author demonstrated his tissue culture studies by microfilms.

E. G. Lomovska and F. B. Shapiro reported on the means of protecting, from ionizing radiation of embryos at various stages of pregnancy.

The conference adjourned after hearing a number of reports on the use of ionizing radiation in the Soviet economy.

16. Uptake by Plants of Radioactive Fission Products and Their Accumulation in Crops Following Application of Lime, Humus, and Potash Fertilizers

"Entrance Into Plants of Radioactive Fission Products and Their Accumulation in Crops Following the Addition to the Soil of Lime, Compost, and Potassium Fertilizers," by I. V. Gulyakin, Doctor of Biological Sciences, and Ye. V. Yudintseva, Candidate of Biological Sciences; Moscow, Izvestiya Timiryazevskoy Sel'skokhozyaystvennoy Akademii, No 2, 1957, pp 121-140

Various tests on the uptake of radioactive fission products by plants and their accumulation in the crops with the addition of lime, humus, and potash to the soil indicate the following: (1) the accumulation in plants of fission products decreases on the addition of lime and humus to sod-podzol soil; (2) the accumulation in crops of fission products is greatly decreased by increased doses of lime and by combining lime and humus; (3) potash applied to soil decreases uptake by plants of fission products, especially of radioactive cesium; lime decreases the accumulation of radioactive strontium in plants; (4) under the effect of lime and humus, the accumulation of fission products is decreased more in crops of the legume family than in crops of the grass family; and (5) fission products of $Sr^{90} + Y^{90}$ entering into plants from the soil are not in a condition of radioactive equilibrium; more radioactive strontium is accumulated than yttrium; lime and potash do not affect the equilibrium condition of $Sr^{90} + Y^{90}$ in plants.

[For additional information on radiobiology, see Item No 79.]

III. CHEMISTRY

Analytical Chemistry

[See Item No 32.]

Corrosion, Protection From Corrosion

[See Item No 9.]

Fuel Chemistry and Technology

17. USSR Work on Chain Reactions, the Kinetics of Combustion and Explosions, and the Initiation of Oxidation Reactions With the Aid of Gaseous Compounds and Penetrating Radiation

"Principal Trends in the Development of Soviet Chemical Science," by I. L. Knunyants; Moscow, Khimicheskaya Nauka; Promyshlennost', Vol 2, No 5, Nov 57, pp 538-569

Among the achievements of physical chemists in interpreting chemical processes, the theory of branched chain reactions is undoubtedly one of the most important advances made in our time. The creation of this theory, which has been thoroughly confirmed by experimental results, made it possible not only to discover relationships pertaining to complex chemical phenomena, but also to find ways of controlling these phenomena. The development of this theory is to the credit of Academician N. N. Semenov. The ideas in regard to chain reactions caused by the formation of intermediate active centers which later become carriers of chains were very imperfect and limited prior to the work done by Semenov.

Investigations by Bodenstein and Nernst, who discovered the first nonbranched chain reaction, namely that between hydrogen and chlorine, were limited only to this particular reaction. There were no attempts to formulate a theory which is generally applicable and consequently the work in question cannot be regarded as a formulation of a chain theory of chemical processes.

As distinguished from Bodenstein and Nernst, who considered that in some cases after the reaction of an active center with a molecule of the initial substance a new active particle with identical properties is regenerated, Semenov and his pupils proved convincingly that there are chain processes in which subsequent to the reaction of an active center with the molecule of the initial substance, several active particles rather than one are formed.

On the basis of the extensive experimental data accumulated by Semenov and his school, a theory of branched and nonbranched chain reactions was developed. Further elaboration of work on the subject demonstrated that the mechanism of the majority of reactions which take place in the gas phase, and also of a large proportion of liquid phase reactions, is of the chain type and based on the presence of free atoms and radicals.

The theory of chain reactions forms the scientific basis for many technological processes which are of great importance in industry; for instance, the synthesis of rubber, the production of synthetic fibers and plastics, the cracking of petroleum, the oxidation of hydrocarbons, halogenation reactions, etc.

In addition to developing the theory of branched chains, Semenov and his school introduced concepts in regard to the disappearance of radicals which propagate the chains. This phenomena is due to the termination of chains at the walls of reaction vessels and within the volume of the reacting mixture. The breaking of chains at the walls of the reaction vessel makes it possible to understand the existence of the so-called lower limit and of the critical diameter of the vessel. These are concepts which have been introduced by Semenov on the basis of phenomena that were observed in the investigation of the interaction between phosphorus vapor and oxygen. From this standpoint, research on the effect of metal rods introduced into reaction vessels is of great interest. These rods have an effect on the chain combustion of hydrogen which is in complete accordance with the concepts in regard to the termination of chains.

In speaking about the most important trends of work done by Semenov and members of his school, the theory of slow branched chain reactions which they formulated must be pointed out specifically, i.e., the so-called chain reactions with degenerate branchings. This theory is of exceptional practical importance in a number of processes, specifically in the important process of the oxidation of hydrocarbons.

The theory of thermal ignition which was also developed by Semenov must be particularly emphasized. This theory explains the transition from a slow reaction to an explosion in those numerous cases when the ignition is not due to the chain nature of the process, but is brought about by a progressive increase in the temperature of the system caused by the exothermic character of the reaction. On the basis of this theory Y. B. Zel'dovich and D. A. Frank-Kamenetskiy developed at the Institute of Chemical Physics, Academy of Sciences USSR, theories pertaining to the spread of flames and the detonation of gases. These theories make it possible to solve problems connected with the application of these phenomena in the industry.

Speaking of Semenov's school, the major importance of the new field of science created by it must be mentioned, namely, the chemistry of free radicals. One of Semenov's pupils, V. N. Kondrat'yev, Corresponding Member Academy of Sciences USSR, heads work on the investigation of free radicals and of their quantitative characteristics.

To understand the actual mechanism of complex chemical processes in every detail, one must master methods which make it possible to identify active intermediate compounds, primarily free radicals. In the middle 1930s, V. N. Kondrat'yev developed a very ingenious method of linear absorption spectra which enabled him to raise the sensitivity of the spectroscopic method by one order of magnitude. With the aid of this method, he could detect the OH radical in individual zones of different oxidation processes and flames and also measure the concentration of this radical. These investigations showed that the concentration of OH radicals present during combustion may exceed the equilibrium concentration by factors amounting to millions. This finding is the most direct and convincing proof of the basic concepts of the modern theory of chain processes created by Semenov and his collaborators.

In subsequent work done by V. N. Kondrat'yev, L. I. Avramenko, and M. S. Ziskin, the interactions of OH radicals with different molecules were investigated and the velocity constants of these reactions measured.

In 1944-1946, Kondrat'yev developed a new method for detecting increased concentrations of hydrogen atoms in rarefied flames. This method is based on the employment of the selectivity effect involved in the recombination of hydrogen atoms at some surfaces. The results obtained in the research in question were in quantitative agreement with theoretical calculations carried out on the basis of the chain theory. The concentrations of atoms in rarefied flames proved to be equivalent to pressures amounting to several millimeters of mercury.

The mass-spectrometric investigation of elementary processes and intermediate products, which was begun by Kondrat'yev in 1923 and was further developed in Kondrat'yev's laboratory before World War II by Eltenton, is being continued at present by one of Kondrat'yev's pupils, i.e., V. L. Tal'roze. Tal'roze together with his collaborators established that there is practically no true energy of activation in reactions between ions and molecules. It was demonstrated in the work in question that the energy which is evolved in an elementary ionic-molecular process originally remains tied up in the form of energy of excitation of particles of the products. These phenomena are essential for the understanding of the mechanism of a number of reactions in which ions participate, particularly reactions in radiation chemistry. As a result of work that has been done in this field, a new mass-spectrometric method has been developed for the determination of the energy characteristics of molecules and a direct method has been found for the first time by means of which one can determine the affinity of saturated molecules to protons.

In the most recent work done by Tal'roze the development has been initiated of a method proposed by him for obtaining mass-spectra of complex molecules devoid of splinter ions. This is achieved by recharging. The method in question opens up new possibilities for the mass-spectrometric analysis of mixtures of organic substances, particularly as far as the determination of free radicals is concerned.

Research done by N. M. Emanuel' has played an important role in the experimental confirmation of some of the main precepts of the chain theory and also in the development of new principles for controlling chain chemical reactions. Together with Semenov, Emanuel' developed a kinetic method for the investigation of intermediate products of branched chain reactions without isolating these products or determining their chemical nature. By using the kinetic method, the chain theory of the induction period was experimentally proven for the first time in 1940. It was shown that during the induction period a process of the accumulation of active intermediate products takes place.

Subsequently in Emanuel's work a confirmation was found for one of the principal conclusions of the chain theory, i.e., that large concentrations of active centers consisting of free atoms and radicals arise during the course of branched chain reactions. It was established that during the slow branched chain reaction of the oxidation of hydrogen sulfide, up to 20% of the initial hydrogen sulfide are oxidized with the formation of the biradical sulfur monoxide (SO). Special experiments which included addition of sulfur monoxide synthesized in an electric discharge proved that SO is the principal intermediate product of the oxidation of hydrogen sulfide. The data obtained in the work described together with the results of Kondrat'yev's spectroscopic work proved that there are concentrations exceeding the equilibrium concentration of free atoms and radicals in the zone of rarefied flames during chain ignition. The results obtained made it possible to interpret both rapid and slow branched chain processes from the same point of view.

Since the work done by Academician A. N. Bakh on the role played by peroxides in processes of slow oxidation, the reaction of the oxidation of aldehydes attracted the attention of investigators because of the formation of high concentrations of intermediate hydroperoxides in it. In investigating the kinetics of the oxidation of acetaldehyde, N. M. Emanuel' discovered the pronounced step-wise (stage) character of the process. In the first stage, there is oxidation of aldehyde with molecular oxygen to a hydroperoxide, whereupon oxidation with oxygen ceases, notwithstanding the presence in the system of acetaldehyde that is capable of being oxidized. In the second stage, there is oxidation of the acetaldehyde with hydroperoxide without participation of molecular oxygen. This change in the chemical mechanism during the course of the reaction, which is surprising in the light of commonly held ideas on the subject, made it possible to advance a concept in regard to macroscopic stages which are separated in time and to propose new methods for the control of processes of chemical transformation.

A sharp transition from the slow oxidation of aldehydes to explosion at a lower temperature was discovered. This transition takes place as a result of the cooling of the reaction mixture and its reheating, whereupon the temperature of spontaneous ignition drops by more than 100°. It was found that this phenomenon is due to the existence of two isomeric forms of hydroperoxides of aliphatic acyls which undergo reversible mutual transformation when the temperature is changed.

In the course of the investigation of the oxidation of propane in the presence of HBr acting as a catalyst new phenomena pertaining to limits were discovered. The process of the formation of the final product of the reaction, viz. acetone, terminates long before the initial substances (propane and oxygen) have been used up. It was established that at the initial moment of the reaction a rapid, self-inhibiting reaction between propane, oxygen, and HBr takes place, which leads to the formation of small quantities of an intermediate substance (e.g., HBrO). This intermediate substance then decomposes slowly, generating radicals (e.g., OH and Br) which initiate chains of great or small lengths that lead to the formation of acetone.

The process of the formation of acetone during the reaction ceases when the intermediate substance has been used up completely, although the initial substances may be present in the system in adequate quantities. This step-wise course of complex chain reactions involving macroscopic stages, which arises in the presence of homogeneous catalysts, was confirmed in many other cases (e.g., the oxidation of ethane in the presence of hydrogen bromide, the oxidation of propane in the presence of nitrogen oxides or of NOCl, etc.).

The macroscopic stages are clearly distinguishable in processes of the oxidation of liquid hydrocarbons when this oxidation is initiated by the addition of salts of cations having a variable valency. Together with work on noncatalyzed reactions of the oxidation of hydrocarbons, the investigations in question represent a substantial contribution to the formulation of a scientific basis for the oxidative conversion of petroleum hydrocarbons.

Macroscopic stages are the sum total of elementary processes which lead to the formation of molecular intermediate products or final products. These stages are more readily susceptible to investigation than the elementary processes. The existence of macroscopic stages separated in time makes it possible to conduct many processes under conditions that change during the course of the reaction as one macroscopic stage merges into another. The application of the principle in question makes it possible to carry out effectively a number of reactions. Of great interest is the proposal in regard to the artificial creation of macroscopic initiating stages during the early period of the development of slow branched chain reactions.

Taking advantage of the remarkable property of branched chain mechanisms to undergo spontaneous propagation, N. M. Emanuel' proposed the new principle of initiating chain reactions of the oxidation of liquid hydrocarbons and other organic substances by the short-lived action of gaseous initiators (N O_2, O_3, Cl_2, HBr, etc.) or of penetrating radiation. When this method is applied, the initiating effect is not exerted during the whole course of the reaction, but only during the initial period of its development. The branched chain process must only be pushed: it advances further spontaneously as a result of chain branching. The principle of initiation with gaseous substances was successfully applied in stimulating processes of the oxidation of n-decane, n-hexadecane, n-butane, paraffin wax, cyclohexane, benzene, diphenyl ethane, ethyl benzene, and other hydrocarbons in the liquid phase. Of particular importance is the discovery of the possibility of oxidizing liquefied n-butane at temperatures and pressures close to the critical. In this type of oxidation, there is a high degree of conversion of the butane into acetic and methyl ethyl ketone. Similarly, by using gas initiation, it was possible to demonstrate the possibility of the liquid phase oxidation of benzene into phenol at temperatures within the range of 250-270° (i.e., in the vicinity of the critical temperature).

The stimulating action exerted by radiation (gamma radiation) on oxidation was demonstrated on the example of the oxidation of paraffin wax.

Thus, the problem in regard to the transfer of many gaseous phase oxidations from high temperature gas-phase oxidation (which results in a high degree of combustion that is useless from the standpoint of the production of valuable chemical products) to mild low-temperature oxidation based on the employment of gas initiation or of a brief exposure to penetrating radiation has become urgent. Application of the new principle of influencing oxidation processes and controlling their course has already yielded results that are of importance from the practical standpoint. The principles and methods in question are not restricted to branched chain reactions (specifically oxidation reactions of the branched chain type). Their application must lead to valuable results as far as nonbranched chain processes and reactions of the radical type are concerned.

18. Combustion of Droplets of Fuel in a Turbulent Stream

"Turbulent Diffusion and the Burning of Atomized Fuel in a Stream," by V. Ya. Basevich, Institute of Chemical Physics, Academy of Sciences USSR; Moscow, Zhurnal Fizicheskoy Khimii, Vol 31, No 7, Jul 57, pp 1619-1627

The nature of heat and mass transfer to the reaction zone of a burning droplet of fuel in a turbulent stream is subjected to theoretical treatment. The conclusion is made that the rate of combustion of the droplet is little dependent on the type of transfer (molecular diffusion and heat conductivity or turbulent exchange). The ratios between the rates of combustion of droplets and of vaporized fuel in a stream of atomized liquid fuel are considered for different types of diffusion. On the basis of the treatment given to the problem the assumption in regard to molecular diffusion of substance to the burning droplet in a turbulent stream is found to be invalid. The conclusion is reached that the rate of combustion of a previously vaporized portion of the fuel stream, forming a combustionless fuel-air mixture, may be explained only by turbulent diffusion of the fuel vapors to the burning droplets.

19. A Photometric Method for the Determination of the Degree of Dispersion of Liquid Fuel in Fuel-Air Mixtures

"A Photometric Method for the Determination of the Number and Dimensions of Droplets of Dispersed Fuel in a Stream," by V. Ya. Basevich, Institute of Chemical Physics, Academy of Sciences USSR; Moscow, Pribory i Tekhnika Eksperimenta No 6, Nov-Dec 57, pp 81-91

The process of combustion of a fuel suspended in the form of droplets in the air is substantially determined by the degree of dispersion of the fuel. The most common methods for estimating the quality of dispersion are based on examination of traces made by the droplets and on measurement of the dimensions of solid spheres formed as a result of the injection of paraffin wax. These methods are not suitable for determining the number and dimensions of droplets immediately in front of the combustion zone, if some evaporation has taken place. In this case, the microphotographic method, which requires a lot of work and does not assure direct observation during the experiment, may be applied.

A direct method is described by means of which one may check quantitatively and characterize the state of the liquid phase in fuel-air mixtures at any point in front of a flame both as far as the number of droplets and their dimensions are concerned. This method is based on reflection of light during the flight of a droplet through a light bundle and recording of light impulses with the aid of a photolelectronic multiplier and a cathode ray oscillograph or a counter arrangement.

[SIR Note: According to a photograph and caption in the 3 January 1958 issue of Promyshlenno-Ekonomicheskaya Gazeta, G. Yekimov, an aspirant in one of the laboratories of the Chair of Heat Physics at Leningrad Polytechnic Institute imeni M. I. Kalinin is engaged in the study of fuel combustion in jet engines by studying the physics of combustion of a single droplet of fuel.]

20. Effect of Pressure on the Flame-Out in a Stream

"Concerning the Effect of Pressure on the Lower Concentration Limit of Flame-Out in a Stream," by M. A. Peshkin; Moscow, Zhurnal Fizicheskoy Khimii, Vol 31, No 12, Dec 57, pp 2757-2758

On the basis of theoretical considerations it is concluded that the extension of the lower concentration limit of flame-out toward poorer mixtures at increased pressures, which is observed experimentally and occurs in the combustion chambers of gas turbines and jet engines, can be explained starting with elementary concepts pertaining to the thermal mechanism of ignition of the fresh mixture by combustion products. The relationship underlying the phenomenon in question can be expressed by the equation

$$\frac{\alpha_1}{\alpha_2} = \left(\frac{P_1}{P_2}\right)^n$$

where α is the coefficient of air excess in the combustible mixture, P the pressure, and n an index which varies depending on the design of the nozzle, the shape of the combustion chamber, and other factors. Flame-out occurs when the mixture becomes poorer and α increases, so that the temperature of the combustion products drops with the result that the quantity of heat transmitted by them reaches a definite minimum at which further ignition of the fresh mixture becomes impossible.

[For additional information on fuel chemistry and technology, see Item No 42.]

21. Industrial Processes for the Conversion of Natural Gas, Production of Hydrogen and Ammonia, and Petrochemical Synthesis With the Use of Oxygen

"Forty Years of the Production of Inorganic Fertilizers; I. The Nitrogen Fertilizer Industry," by L. A. Kostandov; Moscow, Khimicheskaya Promyshlennost', No 7, Oct-Nov 57, pp 422-426

As a result of the discovery of extensive natural gas occurrences in North Caucasus, on the Middle Volga and in the Trans-Volga region, in the Urals, and in a number of other regions, natural gas will become the most important raw material of the nitrogen industry within the next few years.

In connection with the development of processes for the conversion of gas, including casing-head gas, it became possible for the synthetic ammonia industry to follow the gas pipelines as they are extended into regions where ammonia and products of the conversion of ammonia are consumed. This is of great importance in the USSR because of the large territory of the country.

The use of natural gas leads to a considerable reduction in the cost of ammonia, a reduction of the capital investment per unit of capacity, and an increase in the productivity of labor.

The importance of acetylene as a starting material for the production of synthetic organic products is generally known. The combined use of natural gas for the production of both a nitrogen-hydrogen mixture and of acetylene leads to a further reduction in the cost of ammonia and will make it possible to lower considerably the capital investment per unit of capacity as far as the production of both ammonia and acetylene is concerned.

At the State Institute of Applied Chemistry a method has been developed for the low-temperature oxidation of the hydrocarbons of casing-head gases with oxygen to aldehydes and methanol followed by a conversion of the residual gases into a nitrogen-hydrogen mixture for the production of ammonia.

The application of oxygen is characteristic for the processes of gas conversion. As a result there will be a considerable surplus of nitrogen at nitrogen product plants. One of the most advantageous ways of utilizing large quantities of nitrogen is washing the gas with liquid nitrogen. If this process is applied, one may dispense with the construction of purification departments in which carbon monoxide is eliminated from the gas under a pressure of 120-300 atmospheres. Construction of these departments requires a large capital investment and the cost of operating

them is high. Washing of the gas with liquid nitrogen assures the production of a pure gas and thus simplifies and improves its conversion into ammonia. The process in question is being applied at the Chirchik Combine.

One of the tasks of investigators will be finding ways to lower the cost of hydrogen. One must take into consideration that the conversion of methane requires the creation of several additional sequences of technological processes involving the conversion of carbon monoxide with the formation of CO_2 and after this purification of the gas from CO_2 and from the residual, unconverted carbon monoxide.

One must find new methods for the conversion of gases so that a maximum yield of hydrogen is achieved, new possibilities of the production of hydrogen are developed, and the capital investment is reduced.

The synthesis of ammonia is conducted in the USSR nitrogen industry under different pressures ranging from 300 atmospheres to 700 atmospheres. High-pressure processes play only a small part in the synthesis of ammonia and are not very promising as far as their future application is concerned. Subsequent development of ammonia synthesis at a medium pressure (325 atmospheres) is foreseen.

During more than 40 years there have been no radical changes in the industrial synthesis of ammonia as far as the technology of the process and the equipment used are concerned. Development of a process for the synthesis of ammonia at low pressures with the application of ultrasound waves or of some other form of energy would be of definite interest. Research and experimental work on the subject are being conducted at present.

22. Production of Hydrogen and of Ammonia From Natural Gas Rather Than Cracking Gas Recommended

"On Ways of the Development of Petrochemistry," by P. A. Smirnov, State Planning Institute of Petroleum Plants (Giprocneftezavod); Moscow, Khimiya i Tekhnologiya Topliva i Masel, No 6, Jun 57, pp 12-16

The by-product gases of modern petroleum conversion plants contain a considerable amount of hydrogen sulfide, because sulfur-containing crudes from eastern regions are converted in the majority of cases. For that reason one may organize at these plants a production of sulfur or of sulfuric acid derived from the hydrogen sulfide that is obtained by the purification of plant gases or originates from the desulfurizing hydrogenation of diesel fuel.

In connection with the desulfurization of diesel fuels by hydrogenation until the residual sulfur content has been brought down to the 0.2% required by the standard, one must organize at petroleum conversion plants a production of hydrogen in excess of the quantity furnished by catalytic reforming. The additional quantity of hydrogen can be obtained either by separating it from the hydrogen-methane fraction or by converting this fraction.

One of the characteristics of the material balance at USSR petroleum conversion plants will be the absence of any portions of the hydrogen-methane fraction that are available for conversion, so that the production of ammonia and of fertilizers at these plants will be out of the question. This must be realized by designers of plants, although the production of ammonia at petroleum conversion plants is still frequently advocated.

The production of hydrogen as a commodity appears advisable to a minor extent only wherever purification of diesel fuel from sulfur is carried out within the limits set by the availability of waste gas derived from catalytic reforming, or nonsulfurous crudes are converted.

In the first case the purification of diesel fuels cannot be brought to a point where the residual content of sulfur amounts to 0.2%. In view of the fact that the demands of the chemical branches of production for hydrogen and methane conflict with the improvement of the quality of diesel fuel, these demands must be set aside as incompatible with the needs of the fuel industry.

In the production of ammonia and fertilizers one must be guided by the principle of using casing-head and natural gas. The demand for many chemical products including ammonia, nitric acid, methanol and other carbinols, acetylene, acrylonitrile, and acetaldehyde can be satisfied in this manner. It is best to organize the production of ammonia and of the other products mentioned in localities to which casing-head gas or natural gas can be supplied through pipelines and at which sources of power and construction facilities are already available.

23. Enrichment of Germanium in Heavy Coal-Tar By-Product of Coking

"Germanium in 'Fusses'," by N. P. Diyev and V. I. Davydov; Moscow, Zhurnal Prikladnoy Khimii, Vol 30, No 11, Nov 57, pp 1685-1687

The distillation of "fusses" (by-products of coke-chemical production which consist of a mixture of finely divided coke and coal tar that is carried over into the gas conduits) established that there is a significant enrichment of germanium in the fraction boiling at 200-400°.

Nuclear Chemistry and Technology

24. The Solubilities of Uranyl and Thorium Selenites Determined

"On Uranyl and Thorium Selenites," by Ye. I. Krylov and V. G. Chukhlantsev, Ural Polytechnic Institute imeni S. M. Kirov; (Sverdlovsk), Moscow, Zhurnal Analiticheskoy Khimii, Vol 12, No 4, Jul-Aug 57, pp 451-456

The p_H range was determined in which uranyl and thorium selenites precipitate from sulfuric acid and nitric acid solutions. The solubility products of these two selenites at 20° were determined and found to be 3.8×10^{-11} and 1.35×10^{-20}, respectively.

25. Oxalate Complexes of Trivalent Plutonium

"Investigation of the Conditions of Formation and Stability of Oxalate Complex Compounds of Pu (III) in Aqueous Solutions," by A. D. Gel'man, N. N. Matorina, and A. I. Moskvin, Institute of Physical Chemistry, Academy of Sciences USSR; Moscow, Doklady Akademii Nauk SSSR, Vol 117, No 1, 1 Nov 57, pp 88-91

The composition and dissociation constants of the ions $[Pu(C_2O_4)_2]^-$, $[Pu(C_2O_4)_2]^{3-}$, and $[Pu(C_2O_4)_4]^{5-}$ were determined.

26. Reduction of Neptunium to a Trivalent State With Rongalite

"Concerning the Problem of the Preparation of Trivalent Neptunium," by A. D. Gel'man and M. P. Mefod'yeva, Institute of Physical Chemistry, Academy of Sciences USSR; Moscow, Doklady Akademii Nauk SSSR, Vol 117, No 2, 11 Nov 57, pp 225-226

The conditions under which tetravalent neptunium is reduced to trivalent neptunium by rongalite were investigated. Spectrophotometric identification of the valency states of neptunium and spectrophotometric measurement of the degree of reduction by means of an SF-4 apparatus showed that the reduction proceeds more completely in hydrochloric acid solutions than nitric acid solutions and also that addition of hydrazine or reduction in a nitrogen atmosphere increases the completeness of the reduction.

27. USSR Work on the Use of Luminescence Methods and of Other Physical Methods of Analysis in Geochemical Investigations

"Methods of Geochemical Investigation Abroad," by V. V. Shcherbina; Moscow, Zapiski Vsesoyuznogo Mineralogicheskogo Obshchestva, Vol 86, No 2, Apr 57, pp 294-300

[SIR Note: Although this article reviews developments outside of the USSR, comparisons are drawn between work done in that country and work done elsewhere, so that a considerable amount of information is also given on USSR work in the field of geochemical methods of investigation. According to a footnote in the Russian periodical, papers in the field of geochemistry and related fields published in the periodical literature as well as reports given at the 20th International Geological Congress in 1956 and the Geneva Conference on Peaceful Uses of Nuclear Energy in 1955 were used in compiling the article. The author of the article participated in the Geneva Conference on Peaceful Uses of Nuclear Energy.]

Spectrochemical analysis and X-ray analysis are of importance because they enable one to distinguish with certainty between elements which have very similar chemical properties (e. g., rare earths, niobium and tantalum, rubidium and cesium) and also to determine elements the presence of which is masked by much larger amounts of other elements close to them in chemical properties (e. g., gallium in aluminum minerals, rhenium in molybdenites, germanium in silicates, and hafnium in zircons). These methods are used extensively at USSR research institutes and laboratories.

Luminescence methods are used extensively in the determination of small quantities of uranium. This type of application was demonstrated at a US exhibit in Geneva. They are also employed in the investigation of bitumens.

The application of luminescence methods has reached a high level of development in the USSR: a luminescence microscope and luminescence spectroscope have been designed and methods of this type to be used in the investigation of bitumens have been developed (V. G. Melkov and V. N. Florovskaya).

In addition to optical procedures one should consider the spectrophotometric method, which makes it possible to determine in solutions, when accompanied by other substances, the element which is of interest. The determination is made on the basis of absorption spectra which cover not only the visible range, but extend into the ultraviolet and even the infrared region. Originally this method was used for the determination of rare-earth elements. It is also applied at present for the determination of other elements which are difficult to separate or which cannot be determined easily by chemical methods.

The spectrophotometric method is used in the USSR by A. P. Vinogradov and I. P. Alimarin (Sovremennyye Metody Analiza [Present-Day Methods of Analysis], 1956) for the determination of beryllium (with a precision reaching ±0.5% at sensitivities down to 0.25 micrograms), titanium (with a precision of ±0.5% at 60-80 micrograms of Ti), zirconium and hafnium (with a precision reaching 2%), niobium, tantalum, rare earths, and some other elements.

Polarographic methods, which can be applied under field conditions, are of particular value for the simultaneous determination of several elements in mixtures or of elements the chemical determination of which presents difficulties (e. g., gallium, scandium, rhenium, niobium and the rare-earth elements). The method of oscillographic polargraphy, which is more sensitive and more highly selective than classical polarography, has been developed to a considerable extent in the USSR. Work on the subject is being done at the Institute of Geochemistry and Analytical Chemistry, Academy of Sciences USSR.

28. The Geochemistry of Uranium

"Concerning the Forms in Which Uranium Occurs in Rocks," by V. I. Gerasimovskiy; Moscow, Atomnaya Energiya, Vol 3, No 12, Dec 57, pp 525-529

The problem in regard to the forms in which uranium occurs in rocks is of importance for the clarification of the conditions under which uranium deposits originate. This problem was first treated in work done by V. I. Vernadskiy. Extensive investigations done during recent years by USSR and foreign scientists confirmed Vernadskiy's ideas on the subject and established with greater certainty that uranium occurs in rocks in the following forms: (1) uranium minerals, (2) isomorphous admixtures of uranium contained in the crystal lattices of nonuranium minerals, and (3) dispersed uranium adsorbed on minerals and rocks (or absorbed by them) or dissolved in water contained in the rocks.

29. The Technological Status of the Production of Extremely Pure Metals in the USSR

"Metals and Semiconductor Elements of High Purity," by Prof N. N. Murach, Moscow Institute of Nonferrous Metals and Gold imeni M. I. Kalinin, Priroda, Vol 46, No 12, Dec 57, pp 21-26

The significance of metals of high purity for nuclear technology, electronics, high-speed aviation, and rocket techniques is pointed out. The applications of metals of a high degree of purity in nuclear technology and as semiconductor materials are discussed in detail. The cross sections of the capture of thermal electrons by gadolinium, samarium, cadmium, boron, lithium, silver, cobalt, manganese, natural uranium, vanadium, nickel, copper, iron, calcium, and aluminum are listed together with the permissible limits of concentration of these elements (with the exception of uranium) in uranium to be used as nuclear fuel (Table 3, p 23, based on data published by G. Wirts in Zeitschrift fuer Metallkunde, Vol 47, No 5, 1956, pp 281-288). The status of the production of pure metals and other elements of a high degree of purity in the USSR is illustrated as follows in the table reproduced below:

Table 4 (p 24). Characterization of the Development of the Production and Degrees of Purity (in %) of Some Nonferrous and Rare Metals in the USSR

Produced Industrially						
Al	Ge	Au	Cu	Hg	Pb	Ag
99.996	99.99	99.99	99.993	99.999	99.992	99.99

Produced on a Semi-Industrial Scale

W	Bi	Mo	Ni	Pt	Ti	Zn
99.99	99.95	99.99	99.99	99.99	99.98	99.99

Produced on a Laboratory Scale and Large Laboratory Scale

Ba	V	Cd	La	Mg	Nb	Sn	Ta	Ce	Zr
99.9	99.9	99.99	99.93	99.98	99.98	99.99	99.24	99.98	99.98

Technological Methods of Production Are in the Development Stage

Ba	V	Bi	Ga	In	Cd	Co	Si	Li
99.98	99.98	99.99	99.99	99.99	99.993	99.98	99.99	99.99

La	Re	Pb	Sr	Sb	Tl	Ta	Te	Co
99.98	99.98	99.996	99.99	99.99	99.99	99.98	99.99	99.98

It is stated that the construction of reaction engines (jet and rocket engines) requires refractory alloys that are stable at temperatures of 900-1,200° C: these alloys can be obtained only by using metals of high purity, including rare metals. The fact that metals which were formerly considered brittle (e. g., manganese, chromium, and vanadium) become ductile when they are sufficiently pure is pointed out. As an example of practical applications of the ductility of pure metals work on manganese in the US is mentioned (reference is apparently made to experimental work done at the US Bureau of Mines). The opinion is expressed that rolled chromium sheets will be available soon. As far as vanadium is concerned, it is stated that, in view of the availability of huge deposits of vanadium in the USSR, the possibilities of using this relatively lightweight (sp. gravity = 5.8) and high-melting (m. pt. = 1,700° C) metal are particularly attractive.

The last section of the article (pp 24-26) deals with methods for the purification of metals. In this section distillation, solvent extraction, ion-exchange chromatography, thermal decomposition of iodides, and zone melting are discussed. The relative advantages and disadvantages of these methods are pointed out and specific applications (e. g., industrial production of zirconium from zirconium iodide in the US) mentioned.

[For additional information on nuclear chemistry and technology, see Items No 35 and 43.]

Organic Chemistry

30. Dialkylamides of Triaroxyphosphazosulfonic Acids Synthesized

"Dialkylamides of Triaroxyphosphazosulfonic Acids and Aromatic Esters of N,N-Dialkysulfamide-N'-phosphoric Acids," by A. V. Kirsanov and Z. D. Nekrasova, Dnepropetrovsk Metallurgical Institute, Moscow, Zhurnal Obshchey Khimii, Vol 27, No 12, Dec 57, pp 3241-3248

The authors describe the preparation of a number of dialkylamides of triaroxyphosphazosulfonic acids and diaryl esters of N,N-dialkylsulfamide-N'-phosphoric acids. The diemethyl and diethyl amides of triaroxyphosphazosulfonic acids were prepared by the action of trichlorophosphazosulfonic acid dimethylamide and trichlorophosphazosulfonic acid diethylamide on sodium arylates:

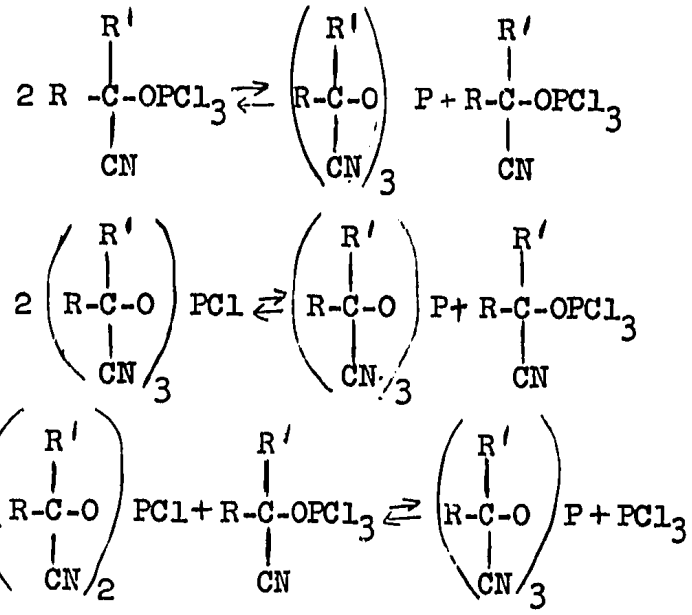
$$R_2NSO_2N{=}PCl_3 + 3\ NaOAr \rightarrow 3NaCl + R_2NSO_2N{=}P(OAr)_3.$$

31. Cyano-Substituted Dialkylphosphites

"Concerning Cyano-Substituted Dialkylphosphites," by Gil'm Kamay, Ye. V. Kuznetsov, and R. K. Valetdinov, Kazan Chemicotechnological Institute imeni S. M. Kirov; Moscow, Doklady Akademii Nauk SSSR, Vol 116, No 6, 1957, pp 965-968

"Acid cyano-substituted esters of phosphorous acid have still not been described in the literature. There is no doubt that introduction of a cyano group into a molecule of a dialkylphosphite should drastically change its properties. It is with these purposes in mind that we investigated the reactions between equimolecular quantities of certain α-cyanohydrins and phosphorus trichloride. We learned that the given reaction occurs with the formation of a mixture of products, namely: the acid chlorides of α-cyanoalkyl-, di-α-cyanoalkylphosphorous acids and tri-α-cyanoalkylphosphites. The formation of these substances can be explained with the following consecutively occurring reactions:

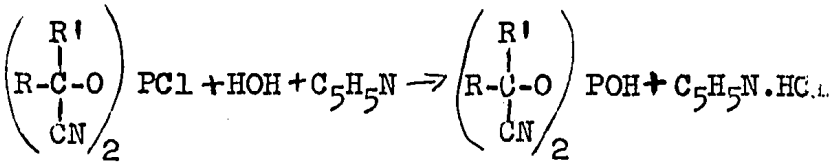
$$R\text{-}\underset{\displaystyle CN}{\overset{\displaystyle R'}{\underset{|}{\overset{|}{C}}}}\text{-}OH + PCl_3 \rightleftarrows R\text{-}\underset{\displaystyle CN}{\overset{\displaystyle R'}{\underset{|}{\overset{|}{C}}}}\text{-}OPCl_3 + HCl$$



The most interesting fact in this complex system of reactions is that the formed tri-α-cyanoalkylphosphite does not hinder transformation into di-α-cyanoalkylphosphorous acid by the well-known Arbuzov rearrangement even under such severe conditions as high temperature, high concentration of reagents, and unbound hydrogen chloride [1] [numbers in brackets refer to appended bibliography]. As a result of many fractional distillations of the α-cyanohydrin-phosphorous trichloride reaction mixture, we succeeded in separating the following α-cyano-substituted phosphites and their acid chlorides (Table 1) [below].

"The isolated acid chlorides of α-cyanoalkyl- and di-α-cyanoalkylphosphorous acids are colorless liquids that smoke in moist air.

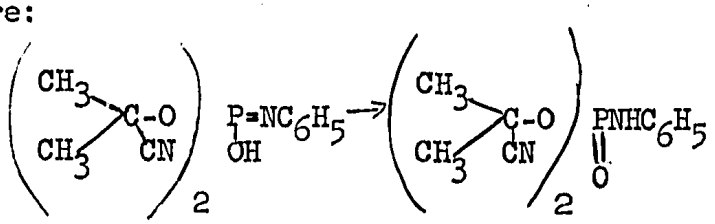
"Next, we studied the saponification of di-α-cyanoalkylphosphorous acid chlorides under various conditions. As a result of the experiments, we established that saponification of the acid chlorides with precise amounts of water in an ether medium and in the presence of pyridine takes place with the formation of acid cyano-substituted esters of phosphorous acid as follows:



In this manner the following di-α-cyanoalkylphosphorous acids were prepared (Table 2). The isolated di-α-cyanoalkylphosphorous acids are colorless liquids with a faint odor. In contrast to ordinary dialkylphosphorous acids, their dicyanosubstituted analogs behave in a manner similar to that of phosphorus trichloride derivatives.

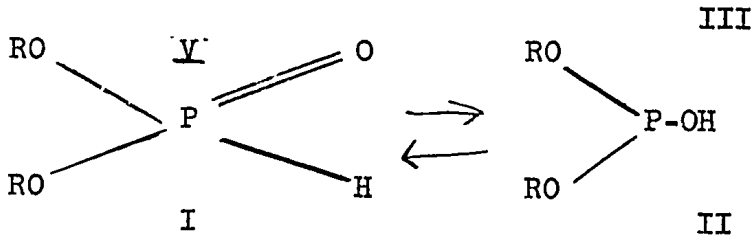
"When equimolecular quantities of di-α-cyanoalkylphosphite are mixed with cuprous chloride, a characteristic rise in temperature is noticed. Further heating is 115° completely melts the cuprous chloride and a vitrious noncrystallizing mass is formed.

"There acids react with phenyl azide liberating nitrogen. Thus, when 1.43 grams of di-α-cyanoisopropyl phosphite reacts with 0.70 gram of phenyl azide in an ether solution, a faint evolution of nitrogen bubbles is observed. After 4 days, crystals in the form of long needles appeared. Later, the crystals were filtered out and dried. Melting point 87°. On the basis of nitrogen and phosphorus analysis, the substance has the following structure:



Here it should be noted that di-α-cyanoalkylphosphites, containing secondary radicals, react with phenyl azide much more energetically and evolve nitrogen.

"While studying the structure of phosphorous acid and its esters, A. Ye. Arbuzov in 1950 came to the conclusion that all of its middle esters are built on trivalent phosphorus, while phosphorous acid itself and its acid esters contain pentavalent phosphorus [2]. Even at that time, A. Ye. Arbuzov expressed the opinion that it was possible that phosphorous acid and its acid esters exist in tautomeric form.



According to his opinion, structure I has the free form of phosphorous acid. In solution, it can exist in tautomeric form II [3]. Physicochemical investigations [4-6] in recent years brilliantly confirmed A. Ye. Arbuzov's conclusions made over 50 years ago on the pentavalency of phosphorus in acid esters of phosphorous acid and on the probability of their tautomerism.

"The chemical properties of di-α-cyanoalkylphosphites indicate that apparently the tautomeric equilibrium is shifted to the side of the trivalent form of phosphorus. Thus the position of the tautomeric equilibrium of acid esters of phosphorous acid depends also on the nature of the

radicals, as M. Kabachnik stated earlier [7]. The presence of di-1-cyanoalkyl radicals in the acid esters of phosphorous acid studied by us help in shifting the tautomeric equilibrium to the trivalent phosphorus side.

"Next, we established that di-1-cyanoalkylphosphorous acids with secondary cyano-containing radicals also develop properties of mixed esters of phosphorous acid. On heating they readily undergo intermolecular rearrangement, exchanging a hydroxyl group for a corresponding radical:

$$2\ (R\text{-}\underset{\displaystyle CN}{\underset{|}{C}}HO)_2\ POH \rightarrow (R\text{-}\underset{\displaystyle CN}{\underset{|}{C}}HO)_3\ P + R\text{-}\underset{\displaystyle CN}{\underset{|}{C}}HOPO_2H_2$$

However, di-1-cyanoisopropylphosphorous acid, containing a tertiary radical, practically does not display this property.

Table 1

Formula	Boiling Point in °C/mm Hg	d_4^{20}	n_D^{20}	MR_D Calculated	MR_D Found
$CH_3\text{-}\underset{\displaystyle CN}{\underset{|}{C}}HO\ PCl_2$	67-68/11	1.3359	1.4805	36.13	36.59
$(CH_3\text{-}\underset{\displaystyle CN}{\underset{|}{C}}HO)_2PCl$	140-142/10	1.1844	1.4575	46.21	47.42
$(CH_3\text{-}\underset{\displaystyle CN}{\underset{|}{C}}HO)_3P$	152-154/2	1.1188	1.4470	56.29	57.55
$\begin{matrix} CH_3 \\ CH_3 \end{matrix}\!\!>\!\underset{\displaystyle CN}{\underset{|}{C}}\!-\!O\!-\!PCl_3$	78-80/11	1.2760	1.4773	40.75	41.20
$\left(\begin{matrix} CH_3 \\ CH_3 \end{matrix}\!\!>\!\underset{\displaystyle CN}{\underset{|}{C}}\!-\!O\right)_2\!PCl$	139-140/11	1.1417	1.4557	55.44	55.65
$\left(\begin{matrix} CH_3 \\ CH_3 \end{matrix}\!\!>\!\underset{\displaystyle CN}{\underset{|}{C}}\!-\!O\right)_3\!P$	153-154/4	1.0749	1.4462	70.14	40.21

Formula	Boiling Point in °C/mm Hg	d_4^{20}	n_D^{20}	MR_D Calculated	MR_D Found
$CH_3-CH_2-CH(CN)OPCl_2$	78-79/8	1.2868	1.4800	40.75	41.05
$(CH_3-CH_2-CH(CN)O)_2PCl$	152-155/11	1.1470	1.4612	55.44	56.06
$(CH_3-CH_2-CH(CN)O)_3P$	162-164/2	1.0810	1.4515	70.14	70.62
$CH_3-CH(CH_3)-CH(CN)O\,PCl_2$	83-84/8	1.2410	1.4780	45.36	45.60
$(CH_3-CH(CH_3)-CH(CN)O)_2PCl$	127-128/3	1.1089	1.4620	64.68	65.09
$(CH_3-CH(CH_3)-CH(CN)O)_3P$	163-164/2	1.0475	1.4545	83.99	84.14
$CH_3-CH_2-CH_2-CH(CN)O\,PCl_2$	92-94/10	1.2295	1.4765	45.36	45.90
$(CH_3-CH_2-CH_2-CH(CN)O)_2PCl$	138-140/3	1.1176	1.4630	64.68	64.71
$(CH_3-CH_2CH_2-CH(CN)O)_3P$	168-169/2	1.0433	1.4530	83.99	84.26
$CH_3-CH(CH_3)-CH_2-CH(CN)O\,PCl$	95-96/10	1.2020	1.4770	49.98	50.29

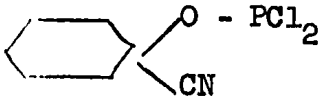
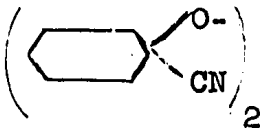
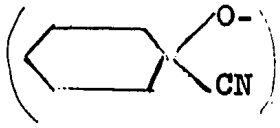
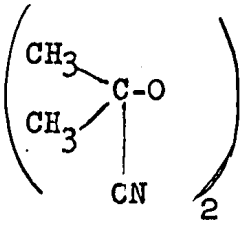
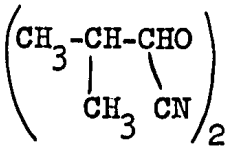
Formula	Boiling Point in °C/mm Hg	d_4^{20}	n_D^{20}	MR_D Calculated	MR_D Found
$(CH_3-\underset{CH_3}{CH}-CH_2-\underset{CN}{CHO})_2PCl$	138-140/1	1.0808	1.4623	73.81	73.94
$(CH_3-\underset{CH_3}{CH}-CH_2-\underset{CN}{CHO})_3P$	182-185/2	1.0138	1.4550	97.85	98.24
	124-125/10	1.2818	1.5118	52.40	52.91
	203-207/10	1.1810	1.5050	78.75	78.94
	melting point 75°				

Table 2

Formula	Boiling Point in °C/mm Hg	d_4^{20}	n_D^{20}	MR_D Calculated	MR_D Found
$(CH_3-\underset{CN}{CHO})_2POH$	112-115/0.2	1.1605	1.4400	41.74	42.11
	118-120/0.2	1.1128	1.4420	51.85	51.35
	123-124/0.2	1.0903	1.4460	61.08	59.68

Formula	Boiling Point in °C/mm Hg	d_4^{20}	n_D^{20}	MR_D Calculated	MR_D Found
$(CH_3-CH_2-CH_2CHO)_2POH$ CN	134-135/0.2	1.0846	1.4486	61.08	60.32
$(CH_3-CH(CH_3)-CH_2CHO)_2POH$ CN	133-135/0.1	1.0529	1.4505	70.32	69.45
$ClCH_2-CH_2O$ CH_3-CO CH_3	115-117/0.5	1.2964	1.4622	45.63	44.67

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"2. A. Ye. Arbuzov, O Stroyenii Fosforistoy Kisloty i yeye Proizvodnykh (On the Structure of Phosphorous Acid and Its Derivatives), Selected Works, Academy of Sciences USSR, 1952, page 41.

"3. A. Ye. Arbuzov, ibid; pages 462-465.

"4. A. Ye. Arbuzov, M. I. Batuyev, V. S. Binogradova, Doklady Akademii Nauk SSSR, Vol 54, 603 (1946).

"5. A. Ye. Arbuzov, P. I. Rakov, Izv. AN SSSR, Otd. Khim. Nauk, 1950, 237.

"6. A. Ye. Arbuzov, V. S. Vinogradova, Izv. AN SSSR, Otd. Khim. Nauk, 1946, 617.

"7. M. I. Kabachnik, Sbornik, Khimiya i Premeneniye Fosfororganicheskikh Soyedineniy (Trudy Pervoy Konferentsii) (Chemistry and Application of Organophosphorus Compounds [Works of the First Conference]); Izv. AN SSSR, 1957, page 37.

Radiation Chemistry

32. Effects of Radiation on Explosive Substances

"The Effect of Irradiation With X Rays on the Thermal Decomposition of Barium Azide," by B. V. Yerofeyev and V. V. Sviridov, Sbornik Nauchnykh Rabot, Institut Khimii, AN BSSR (Collection of Scientific Publications, Institute of Chemistry, Academy of Sciences Belorussian SSR) No 5 (1), 1956, pp 113-129 (from Referativnyy Zhurnal--Khimiya, No 17, 10 Sep 57, Abstract No 57108 by L. Berezkina)

"The effect on the kinetics of the thermal decomposition of BN_6 at 114-146° and 126° of preliminary irradiation for one hour with X rays was investigated. The duration of the exposure of the compound to X rays was varied from 0.5 sec to 50 hours. Reduction of the length of the induction period ($\Delta\tau$) and acceleration of the reaction were observed in all cases after irradiation. The dependence between $\Delta\tau$ and the duration t of exposure to radiation was found to correspond to the equation

$$\Delta\tau = 60.0 + 13.8 \lg t$$

at values of t between 3 seconds and one hour. The effect of the radiation was found to be weaker for moist BN_6 and to be reduced in time after termination of the irradiation. It was established that the total energy of the thermal decomposition of barium azide diminishes after irradiation."

Radiochemistry

33. Applications of Radioactive Isotopes in Production Control, the Production of Inorganic Substances of a High Degree of Purity, Work on Nuclear Fuels and Splinter Elements, Etc.

"Problems of Analytical Chemistry at the All-Union Scientific Technical Conference on the Application of Radioactive and Stable Isotopes and of Radiation in the National Economy and Science," by Yu. A. Zolotov and Yu. V. Yakovlev; Moscow, Zhurnal Analiticheskoy Khimii, Vol 12, No 4, Jul-Aug 57, pp 570-571

"This conference, which was held at Moscow 4-12 April 1957, was organized by the Academy of Sciences USSR and the Chief Administration on the Utilization of Nuclear Energy, Council of Ministers USSR.

"The application of radioactive and stable isotopes in the solution of theoretical and practical problems of analytical chemistry was discussed at meetings of the Section of Analytical Chemistry and Production Control and to some extent at meetings of the Section of Radiochemistry. A sufficient amount of attention was paid to all principal aspects of the utilization of radioactive isotopes in analytical chemistry: their application in work on general problems and the practical application of such methods of present-day analytical chemistry as precipitation and coprecipitation, chromatographic separation, extraction, and spectrochemical analysis; in the development and perfection of new methods of analysis based on the measurement of the intensity of radiation, radioactivation analysis, isotope dilution, and radiometric titration; and finally in the solution of problems of an applied nature pertaining to the analysis of definite substances. A total of 12 reports was presented on all of these problems.

"Some theoretical problems pertaining to the purification of substances by crystallization and precipitation and also examples of the preparation of inorganic substances of high purity with the aid of radioactive tracers were discussed in a report by G. I. Gorshteyn and G. V. Abramova (All-Union Scientific Research Institute of Reagents and the "Krasnyy Khimik" [Red Chemist] Plant). The authors of this report presented data on the purification of reagents from nonisomorphous and isomorphous impurities. In the case of nonisomorphous impurities the concentration of the principal substances in the mother liquor is of primary importance; the lowered solubility of the salt of the macrocomponent contributes to a considerable degree to the elimination of impurities from the substance being purified. The applicability of the linear law of the distribution of isomorphous microcomponents (Khlopin's Law) was experimentally confirmed for aqueous salt solution systems of new types. Furthermore, it was established that the magnitude of the coefficient of distribution in many cases remains constant after transition from microconcentrations to rather extensive ranges of macroconcentrations in salt systems. The fact that the properties of the macrocomponent exert a significant influence on the character of the distribution of the microcomponent was also pointed out by V. I. Grebenshchikova (Radium Institute of the Academy of Sciences USSR), who participated in a discussion.

"V. R. Klokman (Radium Institute of the Academy of Sciences USSR) reported results of an investigation concerning the behavior of small quantities of substance as far as distribution between a melt and a solid phase is concerned. M. S. Merkulova (Moscow State University) reported on the investigation of the mechanism of introduction of ions of bivalent metals into the lattice of salts which crystallize in the same system of sodium chloride. I. G. Shafran (All-Union Scientific Research Institute of Reagents) presented a communication on the subject of the application of tracer atoms in the development of chemical methods for the analysis of impurities in reagents of high purity. This communication was presented during a discussion period.

"M. M. Senyavin (Institute of Geochemistry and Analytical Chemistry, Academy of Sciences USSR) gave a paper on the applications of radioactive isotopes in chromatography and the significance of this method. The application of radioactive isotopes made it possible to clarify a number of theoretical aspects of chromatographic separation (the dependence of the absorbed quantity of substance on its concentration, etc.) and furthermore has facilitated to a considerable extent observation of the course of chromatographic separation. Senyavin's report also reported results of investigations on the separation of pure cesium, the separation of sodium from potassium, and the determination of yttrium in mixtures of rare earth elements. In the last-mentioned separation an original combination of ion-exchange separation with a method of isotope dilution was applied.

"A report by A. K. Lavrukhina and F. I. Pavlotskaya (Institute of Geochemistry and Analytical Chemistry, Academy of Sciences USSR) presented results of work on the chromatographic separation of promethium from a mixture of uranium fission products. I. A. Korshunov (Gor'kiy State University) told during the discussion about the chromatographic separation of radioactive iron from radioactive cobalt. In the Section of Radiochemistry, T. V. Zimakov, A. G. Bykov, and I. A. Usacheva (Ministry of Chemical Industry) gave a paper on a new method for the analysis of some solutions containing products of the fission of uranium. This method is based on the capacity of charged ions to migrate under the action of an electric current along a paper strip moistened with the electrolyte; the method in question was designated as radioelectrochromatography by the authors of the paper.

"Extraction methods are now being applied to a significant extent in practical work done by analytical chemists and radiochemists. An extensive report on extraction processes and their importance in the isolation and purification of radioactive isotopes was made by V. M. Vdovenko Radium Institute of the Academy of Sciences USSR). Vdovenko emphasized the importance of theoretical problems pertaining to extration (e. g., those which have a bearing on the mechanism of the extraction, the selection of appropriate conditions, the effectiveness of the salting-out action, etc.) and furthermore described in general terms a number of frequently applied procedures including the masking of extraneous ions, re-extraction utilization of several valencies of the same element, etc. A. V. Nikolayev and N. M. Sinitsin presented a paper on the specific characteristics of ruthenium exhibited during the extraction of this element with tributyl phosphate.

"The application of tracer atoms made it possible to solve a number of important problems in the field of spectral analysis. One of the cardinal problems of spectral analysis is the investigation of a number of factors (the total composition, the effect of the the third component, etc.) on the course of the process of evaporation of elements from samples and on the excitation of atoms in the plasma of the arc. Employment of

radioactive tracers, as has been shown in a report by E. Ye. Vaynshteyn (Institute of Geochemistry and Analytical Chemistry, Academy of Sciences USSR), enables one to study the course of these processes individually and in this manner to select the conditions under which the analysis can be conducted so that the results are most precise. The application of radioactive isotopes is also of great importance in the development of spectral methods of analysis for the testing of materials of high purity. The report cited data on the degree of extraction of impurities during physical enrichment by evaporation combined with subsequent condensation of these impurities on a cooled electrode. A considerable amount of attention in Vaynshteyn's report was paid to a method for the determination of uranium by adding the U^{235} isotope. This method, which has been developed in the USSR, brings the precision of the determination to 1-2%.

"New methods for the quantitative determination of elements based on the intensity of radiation emitted by radioisotopes were described in a number of papers as well as in statements made during the discussions.

"Reports by I. P. Alimarin and Yu. V. Yakolev (Institute of Geochemistry and Analytical Chemistry, Academy of Sciences USSR) and O. Ye. Zvyagintsev and A. I. Kulak (Chemicotechnological Institute imeni V. I. Mendeleyev) dealt with one of the most sensitive methods of analytical chemistry, namely, radioactivation analysis, which makes it possible to determine as many as 66 elements when these are present in quantities amounting to 10^{-5} - 10^{-12} grams. The first of the two reports mentioned, which was of the review type, discussed the basic principles and advantages of the method and furthermore described work done by the authors of the report on the determination of Cu, Sb, As, and rare earth elements contained in amounts of the order of 10^{-7}% in metallic bismuth. The second report discussed results of the analysis of refined silver and cathodic nickel for Au, Pt, Pd, and Ir; and also of the determination of Cu, As, Te, Ni, and Co in antimony of high purity as well as of Co, Cu, Te, As, and Sb in gold. The content of the elements determined varied between 5×10^{-3} and 5×10^{-8}%.

"A. Kh. Breger (Physicochemical Institute imeni Karpov), who participated in the discussion, told about the results of the determination of oxygen in metals by a radioactivation method based on the (γ, n) reaction carried out in a betatron. The sensitivity of this method can be brought to 0.01%.

"I. Ye. Zimakov (State Institute of Nonferrous Metals) told during the discussion about a new variant of the method of isotope dilution, which eliminates determinations of the specific activity of the substances that have been isolated and brings the sensitivity of the method to 10^{-6} - 10^{-7} %.

"A paper by I. N. Gibalo (Moscow State University) and I. A. Sirotina (Scientific Research Institute of Geochemistry and Analytical Chemistry, Academy of Sciences USSR) on the subject of radiometric titrations described new methods for the determination of Be and Zr by titration with phosphate containing P^{32} and of Tl by titration with iodide, chromate, phosphorotungstic acid, or tetraphenylboron sodium with the application of Tl^{204}. V. S. Chernyy (Khar'kov State University) pointed out during the discussion that nonaqueous solvents can be used in radiometric titrations.

"V. B. Gaydadymov (Scientific Research Institute of Geochemistry and Analytical Chemistry, Academy of Sciences USSR) presented a paper on the possible applications of a method based on the reflection of beta particles. The author of the report illustrated this method on the example of the analysis of mixtures of Nb and Ta, Zr and Hf, Mo and W, and also of the determination of Pb in glasses.

"Several communications dealt with the application of radioactive tracers in the solution of problems of applied analytical chemistry. Employment of radioactive tracer atoms in the development of new and checking of old methods for the separation and determination of elements was discussed in a paper by M. I. Troitskaya, Ye. N. Artemova, and A. M. Zarayskiy (State Institute of Nonferrous Metals). The investigations carried out by the authors of this paper referred to the completeness of separation of microgram quantities of a number of elements by various methods. In the course of the work described sufficiently rapid methods were developed for the determination of zinc in nickel, cobalt, and cadmium, and necessary modifications were introduced into the formerly applied methods for the determination of arsenic and phosphorus in nickel and copper and of indium in fly dusts of the lead-zinc production.

"Ye. N. Nanobashvili (Institute of Chemistry, [Academy of Sciences] Georgian SSR) told about the application of S^{35} in the quantitative determination of a number of elements by precipitation in the form of sulfides. A communication by S. I. Tarabayev (Academy of Sciences Kazakh SSR) dealt with the determination by means of tracer atoms of the bound water in some crystal hydrates.

"The conference demostrated that radioactive isotopes are being used extensively and successfully in the USSR for the solution of theoretical and practical problems in analytical chemistry."

Safety Engineering and Sanitation

[See Item No 77.]

Miscellaneous

34. New Electrochemical Institute Organized Under the Academy of Sciences USSR

"Problems of the Institute of Electrochemistry," by Academician A. N. Frumkin, Moscow, Vestnik Akademii Nauk SSSR, No 10, Oct 57, pp 99-101

An Institute of Electrochemistry (Institut Elektrokhimii) has been opened under the Academy of Sciences USSR. It is located in Moscow and is subordinate to the Department of Chemical Sciences of the Academy of Sciences USSR.

IV. EARTH SCIENCES

Geodesy

35. Seasonal Influence on Aerial Photo Results

"Selection of a Favorable Time for an Aerial Photo Survey of Desert Landscapes of South Central Asia," by B. V. Vinogradov, Tr. Labor. aerometodov AN SSSR, 1955, 5, 157-171 (from Referativnyy Zhurnal--Astronomiya i Geodeziya, No 9, Sep 57, Abstract No 7695

Materials from an aerial photo survey of western Turkmenia processed by the Laboratory of Aeromethods, Academy of Sciences USSR, at various times during 1952 and 1953 were analyzed for various types of weather changes and the favorable time for pictures chosen. There are no conspicuous seasonal changes in the case of stone deserts. Argil deserts, on the contrary, exhibit sharp seasonal changes. Their geochemical differences are best studied during summertime; geomorphologic, hydrologic, and geological differences are most visible during the spring. An aerial survey of sand deserts yields best results during springtime, when their grass and bush areas underline their relief. Saline deserts show their salt deposits best during humid months (May-June and October-November).

36. Aerial Photo Quality

"Photographic Quality and Measurement Properties of Aerial Photographs," by O. A. Gerasimova, Tr. Tsentr. n.-i. in-ta geod., aeros'yemki i kartogr., 1955, No 107, 95-136 (from Referativnyy Zhurnal--Astronomiya i Geodeziya, No 9, Sep 57, Abstract No 7698

The shape of boundary curves play an important role in the accuracy of measurements, while the sharpness of boundary curves depends on the exposure and developing. A conclusion is reached that physical blurring is less than the computed one, because it is a function of the geometrical blurring and of the linear dimensions along the direction of the blurring, the photographic sensitivity of the material, and the reflecting ability of the object.

37. Aerial Photo Detail Work

"Microphotometric Characteristics of Images of Some Desert Plants on 1:5,000 Aerial Photos," by B. V. Vinogradov, Tr. Labor. Aerometodov AN SSSR, 1956, 5, 196-203 (from Referativnyy Zhurnal--Astronomiya i Geodeziya, No 9, Sep 57, Abstract No 7699)

In 1953 sample areas with various plant groups were mapped on a scale of 1:100 and 1:250 in western Turkmenia. The microphotometering was accomplished using a photoelectric microphotometer MF-2. The best microphotometric characteristics were obtained for brushwood, the various species of which exhibited various types of microphotometric curves.

38. Aerial Stereophotography With Two Film Types

"Combined Aerial Survey and the Peculiarities of Its Interpretation," by V. S. Moiseyev, Tr. Vses. zaochn. lesotekhn. in-ta, 1956, No 2, 261-267 (from Referativnyy Zhurnal--Astronomiya i Geodeziya, No 9, Sep 57, Abstract No 7717)

The application of orthochromatic, panchromatic, infrachromatic, color, and spectrozonal aerial photos is discussed, with regard to interpretation of forest areas. It is suggested that for stereo pairs pictures on different types of film be used, e. g., panchromatic and infrachromatic or orthochromatic with color, etc. The obtained stereomodel combines qualities of both types of pictures and shows contrast in reproduction of details. Combined aerial photography is done by means of a double aerial camera, consisting of two cameras with different types of films. The cameras operate successively, photographing the area on the two films through a frame with the usual longitudinal overlapping.

39. Vertical Gravity Gradient in Mountain Areas

"The Vertical Gradient of Gravity," by B. L. Ochapovskiy, O. M. Raspopov, and A. D. Sytinskiy. Uch. zap. LGU, 1956, No 210, 114-133 (from Referativnyy Zhurnal--Astronomiya i Geodeziya, No 10, Oct 57, Abstract No 8509)

Methods and formulas for computing the vertical gradient and its anomalies $\Delta\vartheta$ are presented. It is shown that in the case of mountain chains the horizontal gradient $V\Delta$ (its anormal part) is numerically equal to the anomaly of the vertical gradient $\Delta\vartheta$. The computation of the magnitude $\Delta\vartheta$ for a model of a mountain chain showed that the spatial distribution of this magnitude is rather variable and varies in wide limits. The magnitude $\Delta\vartheta$

is computed according to formulas of Malkin and Molodenskiy for several points of the high mountain section of the Caucasus. The highest value of $\Delta\vartheta$ was found to be +176 E.

With the modern knowledge of the European part of USSR, such computations of the magnitude $\Delta\vartheta$ are practically possible by means of intergrating within a radius of 100 km. The error of $\Delta\vartheta$ determination is of the order of a few etvesh (5 - 10 E).

40. Instrument Error Considerations

"Errors in Results of Measurements," by K. K. Aglintsev, Tr. Vses. n.-i. in-ta metrologii, 1954, No 24, 5-7 (from Referativnyy Zhurnal -- Astronomiya i Geodeziya, No 10, Oct 57, Abstract No 8522)

The classical theory of processing measurements determines the mean error of the result based on the law of normal distribution by Gauss which does not take under consideration the resolving power of the instrument, i.e., the minimum value the instrument is able to take. This minimum value is introduced into the formula, and the mean error μ is determined by the formula : $\mu = \sqrt{\frac{\sigma^2}{n} + a^2}$, where 2a is the graduation of the instrument possible to read, σ the discrepancy of the mean result, and n the number of observations. At n sufficiently large μ = a, which leads to the conclusion that the increase of observations cannot lower the error below the resolving power of the instrument.

41. A. Ye. Solomatin, Soviet Geodesist, Dies

"A. Ye. Solomatin" (unsigned article), Moscow, Moskovskaya Pravda, 31 Dec 57, p 4

A. Ye. Solomatin, a well-known Soviet topographer and geodesist, died at the age of 56 on 30 December 1957. Solomatin had been editor of the newspaper Geodezist; the newspaper is a publication of an unidentified establishment. Solomatin was also deputy director of the Central Scientific Research Institute of Geodesy, Aerial Photography, and Cartography, and deputy chief for political affairs of the Moscow Aerogeodetic Enterprise.

Geology

42. Ural Deposits Of Aluminum, Magnesium, Titanium and Beryllium

Geologiya i Poleznyye Iskopayemyye Urala (Geology and Useful Minerals of the Urals), by Prof A. A. Malakhov, Doctor of Geological — Mineralogical Sciences; Moscow, Znaniye, 1957, Seriya VIII, No 32, 29 pp

The pamphlet presents the following information on the four "winged metals," aluminum, magnesium, titanium, and beryllium. The author states that these are objects of careful attention on the part of geologists, and that the metals are used mainly in aircraft construction.

Large deposits of bauxites, which are excellent aluminum ores, are located in the Urals. A group of such deposits, known under the name "Krasnaya Shapochka" (Little Red Hat), is found on the eastern slope of the Northern Urals. Geologists have recently established the presence of a belt of bauxite deposits of the Devonian period running along the eastern slope of the Urals. In addition to Devonian bauxites, bauxites of the Cretaceous period are known which are located in the vicinity of Kamensk. Cretaceous bauxites have also been found in large quantities in the Turgay depression near the location of iron-ore deposits. Bauxites are also found in other regions of the Urals.

Magnesium is lighter than aluminum. It is used in aircraft as an alloy with aluminum, zinc and other metals. The principal raw materials for the production of magnesium metals are magnesite, carnallite, and sea-water brines rich in magnesium salts.

Magnesites, as states above, are found in the largest Satkinsk deposit, but magnesium metal is not extracted from these magnesites. Carnallite deposits are found at Solikamsk, in the central section of the Western Urals. Carnallite occurs here in thick beds of rock salt and potassium salts. In connection with the development of jet aircraft construction, industry has set up new requirements for the "winged metals." Such metals must not only be light, but must also possess high mechanical and corrosion-resistant properties and considerable strength. Titanium and its alloys have such properties. Titanium is used not only in aircraft building, but also in shipbuilding, and is a component of hard alloys, is used in polishing, etc.

At present intensive prospecting is under way to locate deposits of titanium dioxide (rutile) which is the best ore for the production of titanium metal. There are reasons to believe that this type of ore will be found in metamorphic formations of the Central and Southern Urals.

Beryllium is the lightest of all "winged metals." It is extracted from the mineral beryl which is found in pegmatitic veins in the Urals. Pure beryls, occurring in green or other colors, are semiprecious stones. Beryllium ore consists of beryl stones mixed with impurities. Beryllium is also used at present in the preparation of certain alloys.

43. Popular Booklet on Prospecting for Boron Deposits Published

Gde i Kak Iskat' Mestorozhdeniya Bora (Where and How to Look for Deposits of Boron), by V. V. Mel'nitskiy, State Scientific Research Institute of Mined Chemical Raw Materials, Ministry of Chemical Industry USSR; Goskhimizdat, Moscow, 1957, 30 pp

This booklet, of which 2,500 copies have been published, is subdivided into six chapters. The first three chapters contain general information on the applications of boron and its compounds, the distribution of boron in nature, and the principal minerals which contain boron. The fourth chapter gives a brief description of the types of boron deposits. The last two chapters give general information on prospecting for boron deposits.

The booklet is designed for a wide range of natural scientists (geologists, geographers, students specializing in geological sciences, persons who have a good knowledge of a particular region, and students in upper classes of schools).

The following information is given in the introduction.

Boron and its compounds are used extensively in the most diverse fields of industry and agriculture and also in medicine. Boron is used in metallurgy as a component of various alloys, including boron steel. Boron steel is employed in the machine-building industry and in special types of production.

Metallic boron is used in the construction of different instruments, specifically instruments for the measurement of high temperatures. Boron combined with carbon (uglerodistyy bor) is used as a substitute for hard alloys.

Metal borides are used to advantage in various fields of technology. Some borides are distinguished by their refractory properties, great hardness, and high corrosion resistance; they are used for these reasons as material for the construction of parts of rocket and jet engines. Some compounds of this class are used at installations for the transformation of the energy of sunlight into electrical energy and also in the production of nuclear power.

Compounds of boron with hydrogen (boranes) can apparently be used as efficient reaction engine (rocket) fuels.

Boron is of importance in agriculture: boron compounds are used as trace element fertilizers for various industrial, cereal, and vegetable crops. During the next few years, the requirements for boron compounds to be used in agriculture will comprise no less than one half of the total demand for boron in the national economy. Because of the increasing demand for boron and boron derivatives, the directives of the 20th Congress of the CPSU specify a 40-45% increase in the supply of boron minerals during the operation of the Sixth Five-Year Plan. Under the circumstances more attention must be paid to prospecting for new deposits of boron minerals (pp 3-4).

The section dealing with procedures to be followed in prospecting for boron minerals discusses geological and chemical methods only: no information on radiometric procedures is given. This section is concluded with the statement that persons who have discovered deposits of boron minerals will receive rewards. All persons who have discovered such deposits are urged to notify the State Scientific Research Institute of Mined Chemical Raw Materials, 259 Oktyabr'skiy Prospekt, Lyubertsy, Moskovskaya Oblast, and possibly also inform the Division of Mineral Resources of the Ministry of Geology and Mineral Conservation or the local territorial geological administration (pp 25-28).

A bibliography consisting of eight references, all of them USSR, follows the text of the booklet.

The table of contents follows.

V. ELECTRONICS

Components

44. New Soviet Industrial Photoelectron Multipliers

"New Industrial Types of Photoelectron Multipliers," by L. G. Leyteyzen, A. G. Berkovskiy, I. Ya. Breydo, B. M. Glukhovskiy, O. S. Korol'kova, and Ye. I. Tarasova; Moscow, Izvestiya Akademii Nauk, Seriya Fizicheskaya, No 12, Dec 57, pp 1653-1659

At present the photoelectron multipliers of the authors' design described in the article are either in the preparatory stage or in actual production.

The production of a special multiplier for scintillation spectrometers FEU-29 was recently begun. The amplitude resolution of this multiplier was checked with the aid of NaI(Tl) crystal and the Cs^{137}. This type of multiplier will be very useful for geological prospecting. To further improve the device a series of experiments were conducted with dynodes made of various alloys.

Another type of photoelectron multiplier, designated FEU-24, with a cathode diameter from 70 to 80 mm is now produced on a laboratory scale and is planned for series production in the immediate future. This device contains two cathode-ray tubes, one illuminating and one receiving, both synchronized with the raster scan. This 14-pin base multiplier has 13 dynodes with an over-all length of 235 mm. The average static parameters are as follows: integral sensitivity of the cathode about 37 microamp $lumen^{-1}$, "blue" sensitivity of 7 microamp/$lumen^{-1}$. The cathode thermionic current is about $5 \cdot 10^{-15}$ amp/cm^2.

The FEU-19 and FEU-33 photomultipliers were developed for investigation in the field of nuclear physics. The measurement conducted at the Physics Institute imeni Lebedev -- of the Academy of Sciences USSR disclosed high time transit of the FEU-19. The FEU-19 experimental models with accelerating grids attained amplification of an order of 10^8 at a potential of 3 kv.

The experimental model bismuth-silver-caesium multiplier FEU-29 was designed for operation in the red region of the visible spectrum. The FEU-29 multiplier has 11 amplification stages. Its integral sensitivity is about 50 microamp $lumen^{-1}$, amplification of the order 10^{-5} to 10^{-6} at a potential of 1,500 v.

Computers and Automation

45. Soviet All-Semiconductor Analog Computer

"The First in the World," by Ye. Radzivilov; Moscow, Izvestiya, 26 Jan 58

At the close of 1957 the associates of the Scientific Research Institute of Computer Machine Building designed the small-size, fully transistorized "MN-10" analog computer, the first of its kind in the world.

The "MN-10" weighs only 45 kg and is about half the size of the similar, tube computer, "MN-7." The power requirement of the MN-10" is only 200 w, and the life of such a computer is several tens of thousands of hours.

With the aid of the "MN-10" higher mathematics equations, for example, the common nonlinear differential equations up to the 6th order, can be solved. For more complex problems several such machines are connected for operation in parallel. The operations of summing, multiplying, integrating, and others are performed with great speed. Calculation of 30 variants of the flight trajectory of a plane would require only 2-3 days.

This machine can be utilized for the control of manufacturing processes.

46. Automation System With Inductive Transducer

"New Electronic Bridge Circuit With Induction Transducer, by Yu. G. Kochinev; Moscow, Priborostroyeniye, No 12, Dec 57, pp 5-9

An electronic bridge with induction transducer is used in control and automation systems when the transformation on nonelectric values into electric functions is difficult owing to the technological peculiarities of the process in question.

The new automatic control system incorporates a phasing bridge and converts the nonelectric values of the controlled process into comparatively large displacements of the moving element of a transducer. The first experimental model of such a device was built utilizing for its basic component a standard electronic bridge EMD-232. The electronic amplifier has two selector stages, one of which is intended for the suppression of the harmonics.

The characteristics of the device are as follows: sensitivity for the maximum values, 0.1%; response, 6 sec; error due to the fluctuation of supply voltage, ± 1%. The over-all demensions of the device are 295 by 295 by 130 mm. The transmission line between the transducer and the control instruments can be over 100 m, provided the line is well shielded from interferences.

47. Largest Soviet Analog Computer, 'Integral-1'

"The Largest Mathematical Machine," by Ye. N. Rodzivilov; Moscow, Priborostroyeniye, No 12, Dec 57, pp 28-29

"At Kiev State University imeni T. G. Shevchenko the largest mathematical machine in the Soviet Union, a powerful differential analyzer of 24 integrators designated as 'Integral-1,' was put into operation.

"The design of this machine was made at the Moscow Design Bureau of Instrument Building and Automation Equipment under the direction of A. A. Bednyakov, chief designer.

"The powerful differential analyzer of 24 integrators belongs to a class of mathematical machines of continuous action. It is intended for automatic solution of complex systems of ordinary differential equations encountered in various fields of modern science and engineering.

"These unique mathematical machines comprise a huge combination of various devices of electromechanical type. Some of these devices perform complex mathematical operations, as integration multiplication, functional transformation, etc., and the others assure automatic adjustment and operation of the machine.

"The machine occupies an area of 250 m^2, weighs more than 25 tons, and consumes 100 kw of power.

"The machine has 200 servomechanisms with operating speed up to 1,000 rpm. The setting of the machine for the solution of problems and the control for the correctness of the setting is done automatically from the perforated tapes and control desk by an automatic system containing up to 3,500 various relays and 185 servomotors.

"The electronic part of the machine contains 1,200 radio tubes. The length of all the connecting wiring is over 100 km.

"The procedure for problem solution, which would require several months with a manually operated calculating machine, can be carried out on the new machine automatically and will require on the average not more than one hour. The setting of the machine for the solution and the

control of the correctness of setting will require about 30 minutes, depending on the complexity of the problem. The solution is obtained with sufficient accuracy for most of the problems encountered in various fields of modern engineering. An interesting peculiarity of the machine is that it can solve up to four problems simultaneously, while the solution of each of them is carried out in one of the four sections comprising the machine. In case of complicated problems all the sections solve the same problem, receiving the commands from the control desk, which unifies the whole machine.

"The differential analyzer is a fully automatized mathematical machine: the machine stops automatically after the solution of the problem. The results of the solution are recorded automatically during the course of the solution of the problem in two forms -- tables and graphs.

"The machine is universal. Besides the solution of systems of ordinary differential equations, it can be used for the solution of special equations, as transcendental, algebraic, and differential with boundary conditions.

"After the final adjustment, conducted by Kiev State University, the machine successfully solved all the control problems. At this time it worked infallibly, and no irregularities were observed."

Instruments and Equipment

48. High-Resolution Radio-Frequency Mass Spectrometer

"Radio-Frequency Mass Spectrometer With Increased Resolving Power," by M. Ya. Shcherbakov, Ye. F. Doil'nitsyn, and A. I. Trubetskoy, West Siberian Affiliate of the Academy of Sciences USSR; Novosibirsk, Izvestiya Vostochnykh Filialov Akademii Nauk SSSR, No 9, Sep 57, pp 94-101

A group of associates of the Laboratory for the Absolute Geological Age of the West Siberian Affiliate of the Academy of Sciences USSR are working now on the problem of designing a high-resolution radio-frequency mass spectrometer suitable for analysis of gases in a wide mass range.

A mass spectrometer of 100 resolving power should overcome the present difficulties in determining the absolute age of geological formations. Two types of high-resolution mass spectrometers were developed: a radio-frequency mass spectrometer tuned to the second maximum and a mass spectrometer utilizing a pulsed ion source. It was shown that the resolving power of a mass spectrometer can be improved by increasing the length of the analyzer and by adding auxiliary grids.

The experiment has revealed that the resolving power of a high-frequency mass spectrometer can be greatly improved without complicating much of its construction.

49a. Multichannel Amplitude Analyzer

"Multichannel Amplitude Analyzer With Potentioscope Recording," by G. P. Mel'nikov, L. I. Artemenkov, and Yu. M. Golubev; Moscow, Pribory i Tekhnika Eksperimenta, No 6, Nov/Dec 57, pp 57-66

The cathode-ray tube analyzer ELA-1 is a multichannel amplitude analyzer utilizing a new method of recording the result of analysis on a storage-type cathode-ray tube.

The first ELA-1 model operates on 64 channels and the second model operates on 64, 128, and 256 channels with a capacity of 2^{64}, 2^{32}, and 2^{16} pulses per channel, respectively. The dead time of the recording unit is about 25 microsec. The analyzing unit utilizes the principle of amplitude-time transformation of the pulse with a dead time of 1.5 microsec per channel. The amplitude spectrum is displayed on the screen of a cathode-ray tube. The total number of tubes incorporated in the device is 170.

The principal feature of the new device is its high speed of recording of the results of the analysis. The cathode-ray tubes of this analyzer can be replaced with ferrite cores.

The analyzer is built with the following blocks: input block, transformation block, control block, deflection block, cathode-ray tubes block, plate and filament power supply block, and the high-voltage block. The amplitude of the output signals is up to 120 v; channel width can be adjusted within the limits of 0.1-1.0 v; maximum imput is about 10^4 of randomly distributed pulses per sec. The resolution time for pulse coincidence is less than 0.5 microsec.

The analyzer ELA-1 was used for spectrum measurement in a number of physical experiments. The energy spectrum of gamma-radiation at an average input of 10^4 pulses per sec was examined.

A further improvement in the ELA-1 model will permit the construction of an analyzer having only 50 tubes, operating on 300 channels, and possessing a practically unlimited pulse-input capacity.

49b. Thickness Gage for Plating on Ferromagnetics

"Electromagnetic Thickness Gage With Compensation Circuit," by D. A. Gol'dring, Engineer; Moscow, Pribory i Stendy, Tema 9, No P-56-531, 10 pp

The author describes his design for a thickness gage which facilitates accurate (to ± 1 micron) measurement of zinc, cadmium, copper, oxide, paint, varnish, or other coatings on ferromagnetic items in any preestablished range of thicknesses.

Circuit diagrams, a parts list, and a description and photographs of the instrument and its operation are given.

The instrument is calibrated using control specimens made of polished Armco iron electroplated under rigid control. Repeated calibration, construction of a mean-value curve, and plotting of points on the instrument scale are recommended.

The gage can be used to measure coating thickness during the plating process and provides a high degree of accuracy regardless of the item size. Measurements at two or three points on an item being plated takes about 40 sec, facilitating control during accelerated galvanic processes.

The author states that the instrument has been built by "a plant" and that its application has eliminated plating flaws on ferromagnetic parts, promoted anode saving, and done away with losses occasioned by the need for plating adjustment when thickness measurements were made by the drop method.

Magnetic, Dielectric, Semiconductor Materials

50. Hungarians Report on Soviet Semiconductor Research

"Use of Transistors in Military Technology" (unsigned article); Budapest, Radiotekhnika, Vol VIII, No 10, Dec 57, pp 295-296

Concerning the thermoelectric effect of semiconductors, the article says, "Thus, a Leningrad research group under the leadership of Academician Joffe developed in the Soviet Union a thermoelectric generator which uses the heat from an oil lamp and powers a battery radio receiver. The power source consumes half a kilogram of oil for 8 hours of operation. The development of thermoelectric generators is now under way for use as the power supply in 5-watt short-wave transceivers."

Concerning the use of semiconductors for measuring temperatures the article says, "For example, a type was worked out in the research institute at Leningrad which has a maximum diameter of 50 microns and has platinum and nickel contacts pressed in glass. This thermistor measures between -70 and +250 degrees centigrade."

51. Evaporation of Barium From the Surface of Metals

"Evaporation of Barium From the Surface of Certain Metals," by P. M. Marchuk, Institute of Physics, Academy of Sciences Ukrainian SSR; Moscow, Radiotekhnika i Elektronika, No 12, Dec 57, pp 1479-1490

The problem of studying the process of evaporation of monoatomic barium films from the polycrystalline surface of pure tungsten, tungsten coated with rhenium, carbide-coated tungsten, and platinum-coated tungsten is of great importance because the Ba-W cathodes are now widely used in the electron-vacuum industry.

The experiment consisted in spraying the vaporized barium on the cold filament and heating the filament to the desired temperature. The change of electron emission from the filament was observed as a function of the amount of barium evaporated from the surface of the filament. All measurements were conducted with tubes of similar design. The tubes were built of three parts: diode with cylindrical plate, the barium-coated filament, and an ionizing manometer. The plate and the shield rings were made of tantalum sheet; the diameter of the plate was 20 mm. The filament length varied from 120 to 140 mm and its diameter from 89 to 100 microns.

The source of barium was in the form of a thin-walled tantalum tube filled with a mixture of barium beryllate and tantalum powder. A stream of vaporized barium was initiated by heating the tantalum tube with an electric current.

The experiment has disclosed that the evaporation of barium was least from the surface of platinum-coated tungsten filament.

52. USSR Account of Czechoslovak Conference on Single Crystals

"Third Czechoslovak Conference on Single Crystals," by N. N. Sheftal', Doctor of Geological-Mineralogical Sciences; Moscow, Vestnik Akademii Nauk SSSR, Vol 27, No 11, Nov 57, pp 133-134

"A delegation of scientific workers from the Academy of Sciences USSR consisting of V. P. Butuzov, Ye. D. Dukova, L. V. Bryatova, G. F. Dobrzhanskiy, and N. N. Sheftal' participated in the Third Czechoslovak State Conference on Single Crystals.

"The conference was held at the end of June and beginning of July 1957 in the ancient picturesque town of Turnov, situated at a distance of 100 kilometers from Prague. Turnov has been famous for a long time because of the cutting of precious stones done there. In 1936 a special laboratory was founded at Turnov for the evaluation and testing of precious stones. This laboratory was later reorganized into the Turnov Institute for the Investigation of Minerals. At present this institute is becoming a center of work on the growing, treatment, and investigation of the physical properties not only of precious stones, but also of diverse single crystals which have technical applications.

"The papers given at plenary sessions of the conference and at sectional meetings on the growing of crystals (theoretical and experimental investigations), the growing of crystals (technology), equipment, piezoelectricity, and the treatment of crystals have demonstrated that significant advances have been made by Czechoslovak scientists in research on single crystals.

"Of great interest from the scientific point of view is the work by Ja. Kaspar on the growing of crystals of carbonates beginning with calcite and ending with nickel carbonate (11 compounds altogether). Some of these crystals are found in nature as well-defined minerals, others as isomorphous admixtures, while still others are not found at all.

"Excellent results were obtained by Engr C. Bartu at the Chair of Mineralogy of the Higher Chemical School at Prague in work on the synthesis from melts by Verneuil's method of transparent rutile, transparent crystals of scheelite with a diameter up to 20 millimeters, and crystals of scandium oxide (melting point, 2,300°) 35 millimeters long and 4 mm wide. Successful experimental work is being conducted on the synthesis by Verneuil's method of crystals of $CdWO_4$ (a compound which has a luminescence superior to that of scheelite) and of crystals of chrysoberyl. The effects of numerous artificially introduced impurities on the luminescence properties of scheelite are being investigated.

"Extensive research by I. Smid on the further development of available methods for growing crystals of ammonium dihydrogen phosphate in aqueous solutions culminated in an industrial method for the production of these crystals. Smid is also engaged in experimental work on the synthesis of quartz from hydrothermal solutions. All these investigations, in connection with which detailed work is done on the morphology

of the crystals and processes of their growth, have led to significant results. There is a rapid development of the synthesis of optical single crystals, specifically alkali metal iodides, from large quantities of molten material (J. Ekstein)

"Work has been begun on the growing of WO_3 crystals in the gas phase (I. Hanzlik), of single crystals of 3.5% SiFe from melts (F. Sostak), and of crystals of polonium amalgam (I. Kaurzimskiy and E. Filcakova). In almost all the work mentioned, the effects of the conditions under which the crystals grow on the physical characteristics of the crystals are subjected to investigation.

"Much attention was paid at the conference to equipment, particularly equipment for the growing of crystals. Precise methods for regulating the temperature under laboratory conditions within the range from 0.1° to $1{,}000^{\circ}$ were developed by Czechoslovak scientists (V. Vanicek). Of interest are a laboratory method for the production of highly refractory parts of equipment from an aluminum oxide powder in combination with a sodium silicate binder, work on the development of sealing compounds which protect the heater elements in furnaces from the action of corrosive reagents when used together with corrosion-proof casings of steel or nickel that has been saturated with aluminum by diffusion (J. Ekstein and P. Grebner), and work on the replacement of metals in crystallization equipment with resistant nonmetallic materials (V. Sip).

"Communications that are of value from the theoretical and practical standpoint were presented in the section of piezoelectricity, e.g., a paper on the mathematical theory of the correlation between longitudinal and transverse vibrations of anisitropic rods (A. Arfelbek) and another on the application of piezoelectric procedures in the determination of the strength of packaging used in transportation (M. Cermak).

"As far as problems pertaining to the working of crystals are concerned, the following reports were presented in addition to I. Kotliar's introductory report: a paper on the orientation by means of an X-ray spectrograph of crystal plates with a precision reaching 1' (I. Scholz), a paper describing experiments on the production of Ahrens polarization prisms (Z. Dragonevsky), a report on the production of technically pure quartz glass from vein quartz (P. Vidner), and a paper on the production and treatment of quartz fibers (F. Vitak).

"Great interest was elicited by reports of USSR scientists on equipment for syntheses at superhigh pressures, problems pertaining to the solubility of quartz, the effect of supersaturation and temperature on the form of crystals, the spiral growth of crystals, and industrial methods for growing piezoelectric crystals.

"The participants in the conference thoroughly inspected the institute at Turnov and also the Higher Technical School at Librec. At Prague, the USSR delegation paid a visit to Prof J. Kaspar's institute (chair) at the Higher Chemical School, visited the excellent mineralogical museum, and inspected the excellent collections of material used in the teaching of crystallography and mineralogy.

"The work done together at the conference contributed to a further reinforcement of friendly professional contacts between Soviet and Czechoslovak scientists."

[For additional information on magnetic, dielectric, semiconductor materials, see Items No 23 and 29.]

VI. ENGINEERING

Mechanical Engineering

53. Scientific Seminar on Pneumohydraulic Automation

"Scientific Seminar on Pneumohydraulic Automation," by A. I. Semikova; Moscow, Avtomatika i Telemekhanika, No 12, Dec 57, pp 1148-1150

The Laboratory of Pneumohydraulic Automation (Laboratoriya Pnevmogidravlicheskoy Avtomatiki) of the Institute of Automatics and Telemechanics, Academy of Sciences USSR, organized on 28-29 May 1957 a seminar on pneumohydraulic automation. The seminar was led by Prof M. A. Ayzerman, Doctor of Technical Sciences and head of the laboratory. Some 175 persons attended and heard 24 reports.

54. Shock Absorption at Greatly Accelerated Motion

"Shock Absorption at Greatly Accelerated Motion," by A. Yu. Ishlinskiy, Institute of Mathematics, Academy of Sciences Ukrainian SSR; Kiev, Prykladna Mekhanika, No 2, Apr-Jun 57, pp 131-139

The author presents the following information.

To preserve apparatus transported at a great acceleration, various shock absorbers are used. A rather simple investigation demonstrates that in many cases shock absorption may be inadequate, and that moreover it may sometimes lead to a deterioration of the conditions for the functioning of the apparatus mounted on bodies moving at great accelerations. The latter conclusion is valid if the braking distance of the body carrying the apparatus exceeds the maximum possible shift of the apparatus before the impact of the apparatus against the spring supports.

Thus we are led to a conclusion, paradoxical at first glance, that the best thing to do in such cases is to attain as rigid as possible a fastening of the apparatus to the carrying body without any shock absorbers.

The condition is different when the braking distance is short, as in the case when boxes containing apparatus fall on a rigid base during careless transportation.

In such cases, as well as in those involving vibration, a correct calculation of shock absorption is quite suitable.

To prove this principle it is necessary to estimate the value of the relative acceleration w (t) of the apparatus with regard to the body on which it is mounted. This estimate is given by the formula

$$w(t) < \frac{2\delta}{t_1^2} \qquad (1)$$

where δ is the maximum possible shift of shock absorption and t_1 is the braking time, which can be estimated by means of the inequality

$$t_1 > \varkappa \sqrt{\frac{2s_1}{a_{max}}} \qquad (2)$$

where the coefficient $\varkappa$ depends on two parameters: λ, the ratio of the full length s_1 of the braking distance to the shortest distance s_m at the given maximum acceleration a_{max}, and μ is the ratio of the initial to the final velocity of the moving body. Inequalities (1) and (2) lead to inequality

$$w(t) < \frac{1}{\varkappa^2} \frac{\delta}{s_1} a_{max}$$

which essentially solves the problem, since the force acting on the apparatus by the shock absorber is expressed by the formula

$$A = ma(t) - m \frac{d^2x}{dt^2}$$

Electrical Engineering

55. USSR Building Huge Solar Electric Plant in Armenian SSR

"Electric Power Plant Using Solar Energy" (unsigned article), Bucharest, Pentru Apararea Patriei, Jan 58, p 24

A great electric power generating plant, to be powered by a solar furnace, will shortly be put in operation on the shores of a lake [unidentified] in the Armenian SSR. The furnance constructed of 1,293 large mirrors arranged in a circle one kilometer in diameter, will direct the rays of the sun on a boiler in the center of the circle at a height of 40 meters. The steam generated in this boiler will be able to operate a 1.2-million-kilowatt turbine [sic].

Miscellaneous

56. USSR Plans Atomic Aircraft

"Atomic Airplane" (unsigned article), Bucharest, Pentru Apararea Patriei, Jan 58, p 24

Soviet aeronautical and atomic scientists are currently planning a commercial aircraft which will use atomic power, the article states. The plane will be equipped with turbocompressor engines of [a total of] more than 100,000 horsepower and will be able to carry 80-100 tons at a speed of over 1,250 kilometers per hour. Initially, while the motors are being tested, the plane will fly without a pilot, being radio-controlled. Pending the development of a lighter-weight radiation shield than is currently available, it is planned that the atomic motors will be placed in the rear of the fuselage and that the passengers will be carried in the front section.

57. Artist's Sketches of an Atomic and a Vertical Take-Off Aircraft Appear in Danish Newspaper

[Sketch] Copenhagen, Berlingske Tidende, 20 Jan 58, p 1

The caption reads: "Statements in various Soviet journals give the impression that the USSR, as is the US, is working on the design of an atomic-powered airplane. According to the magazine Young Engineer, a professor named Pokrovskiy is supposed to have designed a passenger plane like that appearing at the top of the picture. It is supposed to have room for about 200 passengers. At the bottom are seen two other sketches [sic] which have been made at the Zagi research institute. The idea is that the craft should take off vertically and thus not need a runway."

[SIR Note: Although the caption mentions three sketches, there are actually only two in the photograph, the upper one being an atomic-powered airplane and the lower one, a vertical take-off airplane. The "Zagi research institute" mentioned is apparently TsAGI (Central Aero-hydrodynamics Institute imeni N. Ye. Zhukovskiy).]

58. Czechoslovak Academy Member Is 60 Years Old

"Corresponding Member of Czechoslovak Academy of Sciences Is 60 Years Old" (unsigned article), Prague, Prace, 12 Jan 58, p 4

Dr Engr Alois Myslivec, Corresponding Member of the Czechoslovak Academy of Sciences and professor of Mechanics of Soils and Construction Foundations of the Czech Advanced Technical School, celebrated his 60th birthday on 11 January 1958. His participation in the Construction of highways, railroads, bridges, tunnels, dams, and canals is well-known and significant.

VII. MATHEMATICS

59. Representation of Functions of Several Variables by Functions of a Single Variable Shown

"On Representation of Continuous Functions of Several Variables in the Form of a Superposition of Continuous Functions of a Single Variable and Addition," by A. N. Kolmogorov, Academician, Moscow, Doklady Akademii Nauk SSSR, Vol 114, No 5, Jun 57, pp 953-956

The article presents a brief exposition of the proof of the follow-

ing theorem:

"For any integer $n \geq 2$, there exist continuous real functions $\psi^{pq}(x)$, defined on the unit line segment $E^1 = [0,1]$, such that each continuous real function $f(x_1,\ldots,x_n)$, defined on the n-dimensional unit cube E^n, may be represented in the form

$$f(x_1,\ldots,x_n) = \sum_{q=1}^{q=2n+1} \chi_q \left[\sum_{p=1}^{n} \psi^{pq}(x_p) \right],$$

where the functions $\chi_q(y)$ are real and continuous."

Construction of the functions ψ^{pq} and χ^q is discussed.

60. Czechoslovak Academician and State Prize Laureate Is 50 Years Old

"Life Jubilee of State Prize Laureate Docent A. Svoboda," by M. V., Prague, Slaboproudy okzor, No 9, Sep 57, p 640

Docent Dr Engr Antonin Svoboda, director of the Institute of Mathematical Machinery of the Czechoslovak Academy of Sciences and State Prize holder, was 50 years old on 14 October 1957. The article gives a general description of his past achievements as the founder of Czechoslovak efforts in the field of mathematical machines and notes his effort in the construction of "SAPO."

VIII. MEDICINE

Hematology

61. Important Results in Development of Soviet Hematology

"Major Results in the Development of Soviet Hematology," by Prof A. A. Bagdasarov, Active Member, Academy of Medical Sciences USSR; Moscow, Problemy Gematologii i Perelivaniya Krovi, Vol 2, No 5, Sep/Oct 57, pp 3-10

Major results in the field of hematology in the USSR include developments on the problem of leukosis. According to the classification developed by the Central Institute of Hematology and Blood Transfusion, all clinical forms of leukosis are regarded as reticulosis in the broad sense of the word. Various types of anemias (iron-deficient, hemolytic, hemorrhagic, aplastic, hypoplastic, radiation, etc.) and methods for their therapy are reviewed. The problem of immuno-hematology, cytotoxins, pathogenesis of radiation sickness, etc., are briefly analyzed.

Experiments of special interest include experimental neurosis and its connection with the activation of erythropoietic function, and bone marrow condition. The author finds convincing evidence for nerve regulation of the blood system and the possibility of increasing the effectiveness of drug therapy of anemias by bringing about changes in the central nervous system.

62. Short Incubation of Donor's Erythrocytes With Recipient's Serum Increases Reliability in Determining Blood Compatibility in Transfusions

"The Significance of Isoimmune Antibodies and the Prophylaxis of Isoantigenic Incompatibility in Blood Transfusions," by M. I. Dudnik, Candidate of Medical Sciences, Kiev Scientific Research Institute of Blood Transfusion and Emergency Surgery; Kiev, Novyy Khirurgicheskiy Arkhiv, No 4 (208), Jul/Aug 57, pp 59-63

The author reviews the mechanism of blood compatibility and proposes a new and simpler method for avoiding post transfusion reactions.

Two drops of the recipient's serum placed in a dry Petri dish are mixed with one drop of donor's erythrocytes mixed with his own serum and with standard serum. This mixture is carefully shaken at room temperature for 3 minutes, and blood-group compatibility is determined. Then the

Petri dishes are lowered into a warm water bath, 40-42°, for 10 minutes and the compatibility for isoimmune antibodies is determined. This is the best temperature to reveal the presence of isoimmune antibodies. Again the Petri dish is shaken carefully and well.

Results obtained after this second procedure are more reliable in determining the compatibility and incompatibility of the blood of donor and recipient during blood transfusions.

63. Purulent and Inflammatory Processes May Have Therapeutic Influence on the Course of Leukosis

"The Influence of Infections on the Clinical Course of Leukosis," by Prof D. M. Abdulayev, A. M. Akhundova, Candidate of Medical Sciences; and O. Kh. Ter-Mkrtycheva, Candidate of Medical Sciences; Clinicohematology Department director, Prof D. M. Abdulayev, honored worker of science), Azerbaydzhan Scientific Research Institute of Blood Transfusion; Baku, Azerbaydzhanskiy Meditsinskiy Zhurnal, No 5, May 57, pp 57-62

The author analyzes the clinical course of leukosis in five patients who, in addition to leukosis, had infectious and purulent processes, such as tuberculosis, pneumonia, chronic lymphadenosis, subleukemic lymphadenosis, etc.

Results indicate that there is evidence of remission under the influence of purulent and inflammatory processes if the foci of mature blood and macrophages are preserved.

64. Chinese Native Filter Paper Tested for Use in Medical Research

"The Application of Domestic Paper in the Electrophoresis of Human Plasma," by Hsia Shou-hsuan (夏 寿 萱) and Lin Kuo-hao(林 國 鎬), Chinese People's Liberation Army Academy of Medical Sciences; Peiping, Chung-hua-I-hsueh Tsa-chih (National Medical Journal of China), Vol 43, No 11, 1957, pp 851-856

In an attempt to resolve the difficulty posed by the shortage of imported filter paper, "Tung-chieh Standard Qualitative Filter Paper" [hereinafter called Manchuria paper], manufactured by the Tung-chieh Paper Plant (in Fu-shun), and two types of hsuan paper produced in Shanghai were tested for their applicability in the paper electrophoresis of human

plasma and compared with Whatman No 1 Filter Paper manufacture in the US. The materials and methods used in and the results of the experiments are presented in detail. The homemade electrophoretic apparatus used was a modification of that devised by W. Grassman and others.

The domestic papers were pretreated with 10 percent acetic acid. It was found that the Manchuria paper excelled Whatman No 1 Filter Paper in wet strength and absorption of plasma proteins, but the latter was superior in compactness and uniformity. Although the domestic papers separated human plasma into five distinct zones, the electrophoretic patterns were not so clear as that produced on Whatman paper. Used in quantitative electrophoretic analysis of human plasma, the Manchuria paper showed a greater degree of error than the Whatman paper.

The authors conclude that the Manchuria paper may be used satisfactorily for clinical analyses, but that Whatman No 1 Filter Paper serves better for research purposes.

65. Chinese Report New Method in Electrophoretic Analysis of Human Plasma

"Microdetermination of Cholesterol and Phosphatides in Serum Lipoproteins," by Li Chien-chai (李 健 斋) and Lin Kuo-hao (林 國 鎬); Peiping, Chung-hua I-hsueh Tsa-chih (National Medical Journal of China), Vol 43, No 11, 1957

This paper presents a "new" method developed by the authors for the electrophoretic isolation of serum lipoproteins and concurrent measurement of lipoprotein cholesterol and phosphatides.

The authors' summary follows:

"1. This article presents an improved method for the microdetermination of cholesterol and phosphatides in human serum lipoproteins. According to this method, 0.20-0.25 cubic centimeter of serum is isolated by paper electrophoresis and the same strips of paper are used to determine the content of phosphatides and cholesterol in alpha and beta zones.

"2. Factors in the satisfactory isolation of serum lipoproteins by paper electrophoresis are discussed briefly.

"3. The ferric chloride reaction of cholesterol was used to determine the cholesterol eluted on filter paper. The color reaction obtained by this method is five times as effective as Liebermann's reaction, and the results are comparable to those obtained by the Schoenheimer-Sperry quantitative method for cholesterol. Youngburg's procedure was followed in the determination of phosphatide in the eluent, but ferrous sulfate instead of phosphomolybdate was used as the reducing agent.

"4. When the same serum specimen was used ten times to determine the amount of cholesterol and phosphatides in alpha and beta lipoproteins, the results were approximately the same. The average recovery of cholesterol and phosphatide from filter paper was 98.4 ± 1.8 and 95.9 ± 2.2 percent, respectively.

"5. Domestic filter paper manufactured in Fu-shun was used experimentally as a substitute for Whatman paper with unsatisfactory initial results."

[SIR Note: Another article in this issue of the journal established Lin Kuo-hao as an affiliate of the Chinese People's Liberation Army Academy of Medical Sciences.]

Immunology and Therapeutics

66. Anniversary Session of the Institute of Epidemiology and Microbiology imeni N. F. Gamaleya

"Session of the Institute imeni Gamaleya," by F. Barinskiy, Candidate of Medical Sciences; Moscow, Meditsinskiy Rabotnik, No 6 (1650), 21 Jan 58, p 4

Some 20 reports were given at the anniversary session of the Institute of Epidemiology and Microbiology imeni N. F. Gamaleya, Academy of Sciences USSR. They discussed 10 years of the institute's activities. The following reports were given: Prof S. N. Muromtsev, on results of the work of the institute for the past 10 years; Prof V. D. Timakov, on the research in the field of variability of microorganisms; Prof P. A. Petrishcheva, Corresponding Member of Academy of Medical Sciences, on the problems of the natural foci of the diseases of man; Prof T. Ye. Boldyrev, on the activities of the Epidemiology Division of the institute in the field of the epidemiology of enteric infectious diseases; Prof L. A. Zil'ber, Active Member of Academy of Medical Sciences USSR, on the etiology and immunology of malignant new growths; Prof Kh. Kh. Planel'yes, Corresponding Member of Academy of Medical Sciences USSR, "The Problems of Infectious Pathology and Experimental Chemicotherapy"; M. S. Zakharova, P. V. Pavlov, and N. I. Apanashchenko, on the search for effective preparations for specific prophylaxis against acute infections of children; Professors P. A. Vershilova, A. I. Togurova, N. G. Olsuf'yev, and M. A. Morozov, on the problem of live vaccines; Prof M. A. Morozov, on the methods of virusoscopy and their use in microbiology; Prof M. K. Yatsimirskaya-Krontovskaya, on the problem

of rickettsiosis and the prophylaxis of rickettsial infections; Prof G. V. Vygodchikov on the fundamental principles of active immunization of combined preparations; Prof V. L. Troitskiy, on the influence of ionized radiation on infections and immunity; K. Ye. Dolinov, on dry biological preparations; N. V. Ploskirev, on dry bacteriological media; and Yu. I. Milenushkin, R. I. Belkin, and A. A. Yefremenko of the Cabinet of the History of Microbiology and Epidemiology, on the results of the work of the cabinet. Other speakers included I. N. Vinogradov, V. A. Blagoveshchenskiy, A. V. Beylinsov, N. I. Kovalev, V. D. Gekker, and I. M. Lyampert.

67. Series of Articles Reviews Influences Exerted by Cytotoxins in Modern Medicine

Tsitotoksiny y Sovremennoy Meditsine (Cytotoxins in Modern Medicine), Kiev, 1956 (from Referativnyy Zhurnal -- Biologiya, No 9, 10 May 57, pp 450-452)

The following is information on a series of articles from the above collection as given in abstracts from Referativnyy Zhurnal -- Biologiya.

An article entitled, "The Influence of Antireticular Cytotoxic Serum (ACS) on the Protein and Nitrogen Composition of the Blood," by I. V. Savitskiy, on pages 69-71 of the collection(Abstract No 38702) states that small doses of ACS administered following hemorrhage stimulate the regeneration of fibrinogen, aid in the restoration of erythrocytes, and increase the albumin fraction and stabilize it.

A second article entitled, "The Influence of ACS on the Relationship Between the Protein Fractions of the Blood of Normal and Cancerous Rabbits, by A. S. Boyko, on pages 72-83 of the collection (Abstract No 38703), states that shifts in the albumin-globulin ratio (A/G) of normal and cancerous rabbits arise following the administration of small amounts of ACS (0.007 ml) and that these shifts and fluctuations appear earlier in normal rabbits than in cancerous ones.

Another article entitled, "General and Tissue Reactions as Results of Increased Doses of ACS," by Yu. A. Spasokukotskiy, on pages 49-55 of the collection (Abstract No 38705), cites that, in experiments on dogs and rabbits, it has been established that intravenous administrations of large doses of ACS (0.15-1.5 ml/kg) cause a sharp shock reaction. The clinical picture of this cytotoxic reaction is analogous to that of anaphylactic shock.

A fourth article entitled, "The Mechanism of the Effect of Large Doses of ACS In Intravenous and Intra-Arterial Administrations," by Ye. G. Morgun, on pages 56-62 of the collection (Abstract No 38706), remarks that the administration of large doses of ACS (0.2-1 ml/kg) to dogs caused shock and that the administrations of the beta-globulin fraction of ACS also were accompanied with the onset of shock; and 5 minutes after the administration of the serum or its fraction, spasms occurred terminating in death in about 76% of the cases.

Another article entitled, "The Stimulating Influence of Myelocytotoxic Serum on Hemopoiesis," by N. A. Fedorov and F. E. Faynshteyn, on pages 246-253 of the collection (Abstract No 38716), presents evidence that the changes in the myelogram following the administration of myelocytotoxic serum indicate a speeding up of the maturation of the cells of the erythroblast and leukoblast series.

"The Protective Function of Lymphadenoid Tissue and the Influence of Antilymphocytic Serum in Infections," by N. D. Yudina, on pages 237-245 of the collection (Abstract No 38718), states that stimulating doses of antilymphocytic serum were administered to rats suffering from Bartonella anemia. The administration of antilymphocytic serum caused hyperplasia of lymph nodes in rats suffering from infectious anemia.

Internal Medicine

68. Brucellosis From Ticks

"The Problem of Brucellosis Infection From Ornithodorus lahorensis Ticks," by M. M. Rementsova, N. F. Zenkova, and N. F. Khrushcheva, Trudy Instituta Krayevoy Patologii, Akademiya Nauk Kazakhskoy SSR (Works of the Institute of Regional Pathology, Academy of Sciences Kazakh SSR), Vol 2, No 3, 1956, pp 37-39 (from Referativnyy Zhurnal -- Biologiya, No 17, 10 Sep 57, Abstract No 74651, by M. V. Pospelova-Shtrom)

"O. lahorensis ticks infected in the laboratory with brucellosis (Br. mellitensis) by feeding on guinea pigs and kept at 4-6° C, preserved the Brucella in their organisms for 27 months. At the end of this time, a man who was feeding infected ticks on a fresh guinea pig was infected while changing, with his bare hands, filter paper impregnated with fluid excreted from the ticks. The guinea pig was infected through this process,

but growth of seedings from its organs was slow, and sero-allergic reactions were absent. Only successive passages of the culture restored its virulence and agglutinogenic properties. The man became rather seriously ill. Fluid excreted from O.lahorensis ticks can serve as a factor in the transmission of brucellosis to humans and animals."

69. Four Decades of Soviet Research on Plague

"Four Decades of Work by Soviet Scientists in the Field of Plague Research," by N. N. Zhukov-Verezhnikov and G. N. Lenskaya, Moscow, Zhurnal Mikrobiologii, Epidemiologii, i Immunobiologii, Vol 28, No 11, Nov 57, pp 84-91

This article surveys Soviet work on plague during the past 40 years. It deals with endemicity of the disease, prophylactic measures, studies of the pathogen, and mechanisms of its action on human and animal organisms, reservoirs, and extermination of rodents, particularly susliks. The author notes that the first successful eradication of plague in a large focus took place in Astrakhanskaya Oblast and that susliks were later exterminated by various methods in other parts of the USSR (1933-1941).

Among studies of different forms of plague, pulmonary plague has been of particular interest. The author mentions that Soviet aid was given to China and India during 1911 epidemics in those countries. He traces expansion of facilities for study and therapy of plague, beginning with the only large laboratories in existence before 1917 (at Kronshtadt and Astrakhan) and the Saratov Institute, opened in 1919, after which a network of antiplague stations and hospitals was set up.

The modifiability and dissociation of B. pestis are discussed. A series of conclusions drawn from the results of research on the plague and rodent pseudotuberculosis pathogens are given which substantiate the assumption that these organisms are separate and distinct but genealogically related. The author notes that pseudotuberculosis strains obtained by Bezsonova and Lenskaya from aging strains of B. pestis have not undergone reverse modification in 20 years.

He reports investigation of methods of culturing B. pestis and notes that antiplague bacteriophage was first isolated in the USSR by Pokrovskaya, at which time it was also found that when both B. pestis and its bacteriophage were present in the same rodent organism, B. pestis could not be cultured on synthetic media.

Extensive studies of the antigenic structure of B. pestis which have facilitated the development of live vaccines are discussed. Pokrovskaya, it is reported, has also investigated pathogenesis and immunogenesis in plague by the cytomorphological method. The following four live antiplague vaccines which have been tested during the past 30 years are described briefly: Zhirar (EV) Otten, Pokrovskaya (AMP), and ZVR. Animal experimentation revealed that the EV strain produced the most satisfactory results and was therefore employed for mass inoculations. In 1944, the "1-17" vaccine, a bivalent vaccine consisting of both continental and oceanic strains, was found to be as effective as the EV strain. Some attention is devoted to attenuation of vaccine strains by X rays, improvement of vaccination methods, and possibilities for obtaining new live vaccines.

The question of clinical treatment and new methods of therapy for plague is considered. Much of the credit for clinical description and diagnostic procedures is given to Rudnev. It is pointed out that only the bubonic and cutaneous forms of plague had been treated with some degree of success before 1945, at which time Zhukov-Verezhnikov, Ivanovskiy, Uroda, and Fadeyeva proposed a new plan of therapy for pulmonary plague, i.e., consistently positive results were obtained from the intramuscular administration of sulfapyridine, which has been adjuvenated by methylene blue, combined with antiplague serum. Streptomycin, first used for experimental plague in laboratory animals in 1947, afforded favorable results in human plague patients in 1948 and constituted a significant advance in pulmonary plague therapy.

In connection with the epizootology of plague in various species of rodents, the interepidemic preservation of the pathogen is attributed largely to fleas. The work of Ye. N. Pavlovskiy is considered the theoretical basis of decontamination of foci. A number of works on the epidemiology and epizootology of plague are referenced. Achievements in the ecological-geographical investigation of natural foci are discussed.

70. Experimental Work on Salmonelloses

"Experimental Investigation of Gaertner's Salmonellosis in Mice After Oral Infection," by M. Smirnova, Kishechnyye Infektsii. Voprosy Bakteriologii, Immunologii i Kliniki Bryushnogo Tifa i Dizenterii, (Intestinal Infections. Problems of Bacteriology, Immunology, and the Clinical Treatment of Typhoid and Dysentery), Leningrad, Medgiz, 1956, pp 68-72 (from Referativnyy Zhurnal -- Biologiya, No 17, 10 Sep 57, Abstract No 73107, by M. Ya. Boyarskaya)

"Mice were infected orally with washings of a one-day agar culture of Gaertner's bacillus (PG; Dublin variant) in physiological solution in doses of one billion and 10 million microbial cells. During the first 2 days after infection, PG was seeded only from the intestinal contents, the walls of the colon, and the mesenteric and submaxillary lymph nodes. Microorganisms were observed in the liver and spleen from the 3d to the 4th day. The majority of the mice infected with the large dose of the culture died 5-6 days following infection (at the height of general infection), but many of the animals infected with the smaller dose remained alive. Abundance of PG seedings from internal organs decreased on the 19th-22d day, and PG were observed in small quantities in the mesenteric and submaxillary lymph nodes in several mice on the 26th day after infection. The mice that survived infection were free from PG by the 40th day. Morphological changes in their organs underwent reverse development. The infection process in mice was similar in nature to the typhous form of salmonelloses in the human."

"Experimental Investigation of Gaertner's Salmonellosis in Mice Following Intraduodenal Infection," by A. M. Smirnova, Kishechnyye Infektsii, Voprosy Bakteriologii, Immunologii, i Kliniki Bryushnogo Tifa i Dizenterii (Intestinal Infections. Problems of Bacteriology, Immunology, and the Clinical Treatment of Typhoid and Dysentery), Leningrad, Medgiz, 1956, pp 73-75 (from Referativniy Zhurnal -- Biologiya, No 17, 10 Sep 57, Abstract No 73108, by M. Ya. Boyarskaya)

"Two experiments were performed on 44 mice with different doses of Gaertner's bacillus (5 and 500 million). A culture was introduced into the duodenal lumen with a syringe. The mice became ill within different periods of time after infection. During the first 2 days following infection with a small dose, bacilli were seeded from the intestinal contents, the wall of the colon, and the mesenteric lymph

nodes, and microorganisms appeared in the blood and in all internal organs on the 3d day. Abundant seeding from the internal organs continued until the 9th day -- the last day of the experiment. The mice died from the 5th day after infection on following generalization of the infection process. On bacteriological investigation of mice infected with a large dose, Gaertner's bacilli were observed in the internal organs on the first day, and their numbers had increased considerably by the 3d day. The mice were sluggish and died from the first day of infection; changes were observed not only in the liver, spleen, and mesenteric lymph nodes, but also in Peyer's patches. Facility of seeding the bacilli and morphological changes in the submaxillary lymph nodes were observed only upon oral infection, and did not appear upon intraduodenal infection."

"Experimental Investigation of Gaertner's Salmonellosis in Rats," by A. M. Smirnova, Kishechnyye Infektsii. Voprosy Bakteriologii, Immunologii, i Kliniki Bryushnogo Tif i Dizenterii (Intestinal Infections. Problems of Bacteriology, Immunology, and the Clinical Treatment of Typhoid and Dysentery), Leningrad, Medgiz, 1956, pp 76-80 (from Referativniy Zhurnal -- Biologiya, No 17, 10 Sep 57, Abstract No 73109, by M. Ya. Boyarskaya)

"A one-day agar culture of Gaertner's bacillus was fed to 12 rats with white bread in the first series of experiments, and the same culture was introduced intraduodenally with a syringe to 30 rats under ether anesthesia. No observable external manifestations of disease were noted for 12 days following oral infection, but the development of a general infection process and penetration of Gaertner's bacilli through the membrane of the oral cavity and the pharynx into the submaxillary lymph nodes appeared bacteriologically and histologically. General infection, proceeding without external manifestations, terminated with complete recovery in 2 weeks after parenteral infection. Gaertner's salmonellosis in rats is distinguished by a cyclic course. The infection course in rats infected orally and intraduodenally is manifested morphologically by the development of a granulomatous reaction in Peyer's patches and in the mesenteric lymph nodes. The character of the infection process in rats infected parenterally with Gaertner's bacillus can be compared with the typhous form of salmonellosis in the human."

71. Hungary to Establish Institute of Gerontology

"An Aged Man Is Not An Old Man," by Andras Turi, Budapest, Esti Hirlap, 20 Sep 57, p 3

The hospital on Benczur Street, Budapest, which is under the direction of Dr Miklos Gondos is to become Hungary's first institute of gerontology. Today, the hospital treats mainly aged patients sent there suffering from incurable cancer. The hospital has been successfully treating these patients with blood transfusions combined with doses of Domagh-type E-39.

The hospital has also achieved considerable success in the treatment of aged patients who are physically incapacitated. The two drugs used in these cases are vasolastin and novocain. Vasolastin has proved effective against cardiac and circulatory disturbances, while novocain inhibits the aging of cells. Paralyzed limbs are reactivated, and the tinnitus which accompanies arteriosclerosis disappears.

Pharmacology and Toxicology

72. Investigation of the Toxic Effect of a New Insecticide

"Toxicological and Hygienic Characteristics of a New Insecticide -- Chlorten," by G. A. Voytenko, Institute of Labor Hygiene and Occupational Diseases, Moscow, Gigiyena Truda i Professionalnyye Zabolivaniya, No 4, Jul-Aug 57, 51-53

The author states that the purpose of this investigation was to determine the toxicological effect of chlorten on warm-blooded animals and to establish the sanitary hygiene requirements necessary for agricultural workers who may come in contact with this insecticide during the course of their work in the fields.

Two samples of chlorten (sample No 1 was obtained from NIUIKh in 1954 and contained 65.5% chlorine, sample No 2 was obtained in 1956 and contained 64.5% chlorine) were used in experiments on white mice, rats, rabbits, and cats. The experimental data showed that internal administration and external application to the skin produced approximately the same toxicity in the animals as DDT or hexsochlorocyclohexane; however, introduction into the respiratory organs made it move toxic than the two afore-mentioned insectisides. The same results, the author added, were not obtained from both samples, thus indicating that the production of chlorten has not been standardized.

In field tests, where chlorcen in various concentrations was sprayed fron an airplane, a hand spray, and other apparatuses, it was found to persist for 2 hours. In connection with this, three cats which were exposed to a 0.002% mg/l chlorten aerosol, died in 18 to 45 days.

Agricultural workers, the author concludes, should use extreme caution when working with chlorten and should take special care to protect the respiratory tract.

73. First All-Union Conference on the Hygiene and Toxicology of Insectofungicides

"The All Union Conference on the Hygiene and Toxicology of Insectofungicides," by A. B. Fratkin, Agronomist-Entomologist, Moscow, Zashchita Rasteniy ot Vreditley i Bolezney, No 5, Sep-Oct 1957, pp 60-61

"Between 25 and 29 June 1957, in Kiev the first All-Union Scientific conference on the Hygiene and Toxicology of Insectofungicides was convened under the auspices of the Ministry of Health USSR. More than 250 representatives from scientific research institutes, public health, agriculture, the chemical industry, the civilian air fleet, and other organizations took part.

"Opening the conference, L. I. Medvedev, chairman of the committee for the control of agricultural chemical poisons of the Main State Sanitary Inspectorate of the USSR, presented a report on the results and tasks of scientific investigations involving the hygienic and toxological evaluation of insectifungicides. Prof N. V. Lazarev (from the Leningrad Institute of Labor Hygiene and Occupational Diseases) presented a report on problems in hygiene and their connection with the task of searching for new insectofungicides and herbicides. Prof N. N. Melnikov (NIUIF) presented a report on the present state and tasks of scientific research in searching for chemical substances for the protection of plants and for the fight against weeds. P. V. Sazonov (VIZR) presented a report on the present status of and prospects for the development of chemical methods for protecting plants in the USSR. D. M Paykin and P. N. Galakhov (VIZR) presented reports on the results and tasks of the work on new chemical poisons for agriculture.

"In addition to these, series of reports were heard at the conference concerning the toxicology of chemical poisons in agricultural; labor hygiene during their utilization; hygienic evaluation of food products

obtained from plants treated with insectofungicides; the clinical picture and therapy of the toxic effects of chemical poisons; and new methods for toxicological investigation of insectofungicides, including methods of utilizing tracer atoms, etc.

"According to the material presented in the reports, it is clear that the following substances were subjected to toxicological and hygienic evaluation: organochlorine insecticides (DDT, hexachlorane, chlorinated turpines, chlorothen, polychlorpinen, and others), compounds of the diene synthesis (chlorodan, hepthachlor, aldrin, dialdrin and others), the organochlorine acaricide (ether sulfonate), organophosphorus chemical poisons (thiophos metaphos, carbophos, mercaptophos, octamethyl, metacystox preparations M-81, M-82, and others), organic fungicides (mordant seed material), mercury compounds (granizan), copper compounds (copper trichlorphenylate), chlorine (hexachlorobenzol); the herbicides, 2,4-D, IFK (isopropylphenylcarbamate), and certain other preparations.

"Especially intensive research was conducted on two basic groups -- organophosphorus and organochlorine insecticides. The work of S. G. Serebryanaya, Ye. A. Antonovich (Ukrainian Food Institute), and others indicated that such organochlorine insecticides as DDT and hexachlorine possess apparent cumulative properties and, when sprayed on warm-blooded organisms, can produce chronic toxic results. In connection with this, the maximum permissible amount of these preparations for food products was determined. For example, with fruits, since the utilization of DDT in the form of a mineral-oil emulsion leaves a large amount of residue, it is very important, in orchards (after flowering), to utilize a suspension of DDT (instead of an emulsion, thereby lowering the residue of DDT on the fruit to permissible limits. Investigations also showed that the gamma isomer of hexachlorane possesses less toxic cumulative properties than hexachlorane itself. As opposed to organochlorine insecticides, phosphorus compounds, phosphorus containing poisonous chemicals, are more toxic to warm-blooded animals and are more dangerous to handle. However, if they fall on the exterior or enter a plant, they are quickly decomposed and transformed into nontoxic products. On the basis of his studies involving the connection between the structure of the organophosphorus poisons and their toxicity, Yu. S. Kagan (Kiev Institute of Labor Hygiene and Occupational Diseases) reported that chemical poisons, such as metaphos, carbophos, metacystox and M-81 and M-82 compounds are less toxic to warm-blooded animals than, for example, diaphos and mercaptophos.

"The investigation of the mechanism of the action of mercury, organophosphorus chemical poisons, and arsenic containing insecticides on warm-blooded animals permitted development of antidotal compounds (unithiol, pentaphane, and others). At the conference, the chemical industry was sharply criticized for failing to mass produce the gamma isomer of hexachlorane and organophosphorus chemical poisons (except thiophos) in the

face of an acute need for these preparations in agriculture. In addition to this, shortages were noted in the production of the following: granozan, mercuran, copper trichlorphenolate, and the herbicide 2,4-D. Production of the new fungicides hexachlorbenzol, TMTD, and others, and the herbicides, 2M-4 Kh, IFK, and others has not even been organized.

"In a resolution the conference acknowledged that it would be necessary to petition the Ministry of Public Health USSR for the establishment of laboratories which would work on the toxicology and hygiene of chemical poisons, along with a petition for newer equipment and apparatuses, and the construction of special laboratories for developing methods of detecting small quantities of chemical poisons in the air and in food products. Mention was also made of the importance of increasing the sanitary supervision of the correct handling of chemical poisons, of the mass production of protective material for individuals, and of the release of insecticides and fungicides in small packages for wide sale to the public.

"The realization of these resolutions will permit the chemical method of protecting plants to rise to a higher plane."

74. Rauwolfia From India Grown in the USSR

"A Valuable Medical Plant," Moscow, Meditsinskiy Rabotnik, 21 Jan 58, p 1

"Batumi. At the experimental section of the Kobulet zonal station of the All-Union Institute of Medicinal and Aromatic Plants, the first Rauwolfia fruits, the seeds of which were obtained from Bombay early last summer, have ripened. This valuable medicinal plant grows well in the subtropic climate of Adzhar.

Rauwolfia was first described by a medical doctor and traveler, Roland Rauwolf, in 1958 and was subsequently named after him. The Indians utilized this plant medicinally on snake and scorpion bites. They also planted Rauwolfia around their homes; snakes avoid its thin stalks and shiny leaves. In addition, they obtained a medicine from this plant which had a sedative and sleep-producing effect.

Not long ago it was discovered that an effective substance against hypertonia could be obtained from the roots of Rauwolfia. This substance was extracted in 1952 by Swedish scientists and called serpasil. In our country, a preparation called reserpin is obtained from Rauwolfia and is used against high blood pressure."

75. New Soviet Antimyasthenia Drug Sent to Norway

"Galantamin, Khrushchev's Medicine for Myasthenia," (unsigned article), Oslo, Aftenposten, 24 Jan 58

Ampules of the new drug Galantamin, developed in the USSR and employed in cases of myasthenia, have been received at the National Hospital (Rikshospitalet), Oslo. Prof Sigvald Refsum of the National Hospital states that, according to information accompanying the drug, Galantamin has the same effect on the disease as drugs hitherto used in the treatment of myasthenia.

On a request directed to Party Secretary Khrushchev, the drug was sent to Norway for the treatment of a patient in the town of Sarpsborg.

Physiology

76. Pancreaticocytotoxic Serum Prolongs Muscle Chronaxie

"Change of Muscle Chronaxie in Dogs Under the Effect of Pancreaticocytotoxic Serum," by A. V. Makhan'ko and Ye. M. Pyatkin, Tr. Mosk. Vet. Akad. (Works of Moscow Veterinary Academy), 1956, No 15, 377-381 (from Referativnyy Zhurnal -- Biologiya, No 10, 25 May 57, Abstract No 43077, p 421)

Muscle chronaxie was studied on dogs. Pancreaticocytotoxic serum was administered subcutaneously, in an experiment, to dogs in 0.3-ml quantities, given twice with a 3-day interval. Control dogs received similar doses of normal serum.

Under the influence of two doses of pancreaticocytotoxic serum, muscle chronaxie was significantly prolonged, and this prolonged chronaxie was sustained for a month. No change in muscle chronaxie was observed in control dogs.

The authors conclude that changes in chronaxie under these experimental conditions point to the effect of pancreaticocytotoxic serum on the central nervous system.

Public Health, Hygiene, and Sanitation

77. New Apparatus for Studying Air Polution

"Apparatus for Investigating Air Dust," by Yu. Ye. Klyukin, Novosibirsk Institute of Transport Engineers, Moscow, Zavodskaya Laboratoriya, No 12, 1957, 1515-1516

"In the sedimentation method of investigation, dust catching is ordinarily conducted on glass discs placed in the atmosphere under investigation. The discs are first covered with a sticky substance. For this purpose, Liesengang's apparatus or its modifications as developed at the Institute of General and Communal Hygiene in 1946 are used. However, even the latest model has some deficiencies."

For the investigation of atmospheric dust, the authors propose a technically improved apparatus consisting of a moving part or wind vane, star wheel with spokes, adapter, and supports.

A sleeve with two vanes moves on ball bearings on a vertical shaft so that the vanes can be set to any desired angle and secured with a set screw. Two adapters are fastened to rods one above the sleeve, the other opposite the vane on the sleeve. These are used to mount glasses 20 x 20 mm and 40 x 40 mm. The adapter connecting pieces have stop screws with which they can be fixed on the horizontal rod (opposite the vane) face up, and on the vertical rod with the face side toward the air stream. The sleeve with the vanes and adapters fastened to rods rests on the upper part of a support shaft and can rotate freely in a horizontal plane. Therefore, the movable part of the apparatus adjusts itself to the direction of the wind like a wind vane. A sprocket with eight radical spokes serves to orient the apparatus. It can be set with a set screw so that the spoke with a painted tip points north.

78. Soviet Research on the Biological Effects of Noise

"Noises and 'Noise Disease,'" by Prof Ye. Andreyeva-Galanina, Moscow, Meditsinskiy Rabotnik, No 95, 26 Nov 57, p 3

"Noise is a by-product of modern technology and is encountered not only in industrial plants, but also on the streets of all cities. Constant exposure to noise enhances the possibility for developing neurasthenia and functional disturbances in the nervous system, particularly in the higher branches of the nervous system. Results of an exhaustive research by T. A. Orlova, the Moscow hygienist, prove that point.

"Control of noise, therefore, is a communal hygiene problem. This problem, however, cannot be properly solved without the participation of engineers and physicists trained in acoustics.

"The problem of noise control was, for many years, approached from the viewpoint of its effects on the organ of hearing.

"It would be unfair to censure such an approach. The level of threshold of audibility affords an objective indication of the effect of noise on the cochlear analysor. Even now only such an approach can establish noise pathology, although additional examinations may be necessary before a diagnosis of 'noise disease' can be reached.

"Fatigue of the organ of hearing depends on the intensity of noise and the duration of its action. Noise of various spectral consistency has its own 'critical intensity.' In other words, there is a minimum amount of loudness which may not lead to depression in the sensitivity of the auditory analysor. This may serve temporarily as a starting point for medical standardization of noises.

"Changes in the central nervous system occur in association with the changes in the auditory analysor. It has been demonstrated that electric activity in the brain undergoes changes both in people and animals if they have been exposed to noise of great intensity. Researchers have called attention to the fact that intensity of noise and duration of exposure to it is reflected in the depressions on an electroencephalogram and in the appearance of an asthenic condition. Disarrangement of the rhythm of the curves was observed in rabbits exposed to extrapowerful sounds. Spasms and confused movements, with fatal results, were observed in mice. The frequency of confusion and spasms is directly dependent on the intensity of noise. All noises of high intensity, between 120 and 130 decibels, appeared to be dangerous. Noises of intensity between 90 and 100 decibels, depending on their spectral composition, may lead to functional disturbances of cortical dynamics. The fact that symptoms appear much sooner in the nervous system than in the organ of hearing must not be overlooked.

"Noise affects mental activity and may cause fatigue, headache, insomnia, and fear sensations. Exposure to noise for a long period of time at work may result in loss of the power of concentration. There is no doubt that noise affects the entire organism, not the organs of hearing alone.

"A number of researchers have demonstrated that noise may cause a fall in blood pressure. In some instances, development of arrhythmia, changes in the tonus of the coronary vessels, and manifestation of an anginal group of symptoms were noted. Noise affects the functions of the endocrine glands. Hyperfunction of the suprarenal glands and increase in the number of eosinophils in the anterior lobe of the pituitary body may be due to noise. The role of endocrine glands in the processes that take place in the osseous tissue is well known. The function of the adrenal cortex becomes disrupted and secretion of the corticotrophic hormone is altered. The amino acid content in the labyrinth liquid decreases leading to a change in the microphonic effect of the cochlea. The motor activity of the stomach and the intestines, as well as secretions in them, become abnormal as a result of noise.

"Noise, therefore, produces reactions in the entire organism and in many of its organs and systems. Furthermore, any disturbance that may take place depends on the intensity of noise, its spectral characteristics, and the duration of its action. Noises of high frequency lead to rapid development of a pathologic condition. There are definite groups of symptoms which correspond to this condition. Just as 'vibration disease' is caused by vibration, 'noise disease' is caused by noise. Its symptomatology consists primarily of disruption of the motility of cortical processes and disturbance of vegetative functions, the functions of analysors, and secretions of the endocrine and other glands. Attention of hygienists and occupational pathologists must be directed toward clarifying the forms and symptoms of 'noise disease.'

"It is well known that the noise factor is not so apparent in some industries as it is in others. It is connected with mechanical oscillations, the frequencies of which may be lower or higher than sound. Ultrasonic vibrations and vibrations that are transmitted through solid conductors or through the air belong to these oscillations. Until recently these three groups of frequencies were considered mechanical oscillations, distinct from one another. This was a mistake and must be corrected. Examples of combined action of noise and vibration are numerous. Examples of a connection between noise and vibration are: breaking up hard coal into small pieces, operating a pneumatic drill, and working with multifrequency vibrators (particularly when used in condensing concrete or performing other industrial operations). Biological reactions to those two factors are analogous. It is very possible that they mutually intensify one another because of their common characteristics.

"A large number of publications have appeared in the past few years discussing the effects of previously unheard of ultrasonic oscillations and the sources of their origin. The possible influence of ultrasound on the organism was denied for a long time. But now, since a method of detection of ultrasound has been developed, such a view seems to be groundless.

"Many apparatuses, including those found in industrial establishments, are sources of inaudible sounds. These pieces of equipment have been widely used in detecting defects in metals and other material. There are frequent instances when at least two ranges of sound frequencies coexist: sonic and ultrasonic.

"Recent scientific research bears out the fact that ultrasound is of great hygienic significance. Ultrasonic oscillations having a frequency of 80,000 cycles damages both tissues and bones; a frequency of one million cycles can destroy the deep structures located on the borders of the cranium and the dura mater. Intensive ultrasound produces pathologic changes in the organic substrata of tissues, causes a decrease in the function of the anterior lobe of the pituitary body, and disassociates some amino acids leading to changes in immunobiological properties of proteins. However, more has been learned about effect of ultrasound on the organs of hearing than its effect on any other organ. Processes that take place in the organs of hearing due to sounds that cannot be heard are similar to those which arise as result of high frequency noises. Differences do exist. Nothing has been found in the literature to show that otosclerosis can develop because of noise, but enough material has been found to prove that intensive ultrasound may cause it.

"In the light of all this, a survey conducted of the New York City population by American ear specialists deserves attention. It was found that there was a considerable decrease in auditory sensitivity among residents of the city of New York. The American physicians concluded that this was due to conditions created by an increase in the ultrasound background in that city.

"All efforts to control noises must be expanded and increased. There are a number of mechanical devices in use which alleviate the harmful effects of noise. Acoustic engineers have already accumulated some experience in that field. Medical efforts consist mainly in protecting the organs of hearing. The time is ripe to legalize and enforce some preventive measures. Pause periods must be made compulsory for workers in factories and shops, and facilities must be provided where those workers can rest in soundproof rooms. Lunch periods must also be spent in rooms where the walls and ceilings are made of soundproof material.

"In any case, if it is impossible to reduce noise, noise-excluding ear muffs should be used. Soviet industry has not yet started to manufacture them.

"It is regrettable that no practical method to protect organs of hearing has been decided on. Professional selection of workers and preventive medical examinations have not yet been introduced, although it is more or less evident that employment of a certain type of people in noisy industrial establishments is not advisable.

"Individuals must undergo preventive medical examinations conducted by otolaryngologists, neuropathologists, and therapeutists once or twice a year. It is desirable that audiometric examinations be made available.

"The time has long since arrived to inaugurate measures protecting humans from the harmful effects of both audible and inaudible sounds and the vibrations encountered both in industrial establishments and elsewhere."

79. Soviet Conference on the Biological Action of Ultraviolet Radiation Scheduled for May 1958

"Conference on the Biological Action of Ultraviolet Radiation," (unsigned article); Moscow, Gigiyena i Sanitariya, No 12, Dec 57, p 80

The Academy of Sciences USSR, the Academy of Medical Sciences USSR, the All-Union Academy of Agricultural Sciences imeni V. I. Lenin, and the Ministry of Health RSFSR will convoke in Leningrad from 27 to 30 May 1958, a conference on the biological action of ultraviolet radiation.

The program will consist of problems concerning the study of the mechanism and laws governing the biological action of ultraviolet radiation, ultraviolet solar radiation and its prophylactic and therapeutic uses, new artificial sources of ultraviolet radiation, ultraviolet irradiation of humans and agricultural animals in order to supplement ultraviolet deficiency, therapeutic use of ultraviolet irradiation, and the measurement of ultraviolet radiation.

An exhibit of new sources of ultraviolet radiation, irradiation equipment, measuring instruments, and photographs of existing and functioning installations will be shown.

Reports will be accepted no later that 15 April 1958 and should be addressed to Moscow, B-71, B. Kaluzhskaya, 33, Institute of Biophysics, Academy of Sciences USSR; or Leningrad, P-101, ul. Mira, D. 6/0, Institute of Radiation Hygiene.

Radiology

80. Clinical Picture and Treatment of Chronic Radiation Sickness Analyzed

"Clinical Picture and Treatment of Chronic Radiation Sickness," by P. M. Kireyev; Moscow, Meditsinskaya Radiologiya, Vol 2, No 5, Sep/Oct 57, pp 72-79

The author presents a rather detailed description of first, second, and third stages of chronic radiation sickness with regard to changes in the peripheral blood system and secretory and motor functions of various endocrine glands and systems.

Treatments are recommended for each of the three stages of chronic radiation sickness; these include whole blood, and erythrocytemass transfusions, high caloric diet, large doses of antibiotics, vitamins, and symptomatic means of therapy.

81. Decrease in Free Cholesterol and Ascorbic Acid Early Symptoms of Ionizing Radiation Injuries

"Cholesterol and Ascorbic Acid Content of Rat Adrenal Cortex Following Effects of Ionizing Radiation," by K. A. Tret'yakova (Moscow), All-Union Institute of Experimental Endocrinology (director, Prof Ye. A. Vasyukova), Moscow, Problemy Endokrinologii i Gormonoterapii, Vol 3, No 3, May/Jun 57, pp 72-74

The purpose of the present research was to clarify certain discrepancies in literature concerning the period and the extent of changes in the chemical composition of the adrenal cortex. White rats were subjected to total irradiation by 700 r of x rays. These animals were sacrificed at various periods after irradiation.

Results indicate that fall in cholesterol content was evident one hour after irradiation (-33.6%), although the greatest fall (-39.3%) occurred 5 hours after irradiation. There was a slight rise in this content (-20.8%) 72 hours after irradiation.

The level, fall, and rise in ascorbic acid content varied with seasons (spring and summer), but the greatest decrease was evident one hour after irradiation; i.e., the level of ascorbic acid was 3.98 mg/g adrenal cortical tissue, as compared with 5.37 mg/g in the controls, in spring; and 3.30 mg/g as compared with 4.46 mg/g in the controls, during summer. Ascorbic acid level then gradually rose toward normal.

The author concludes that the decreased content of free cholesterol and ascorbic acid in the adrenal cortex is connected with changes in the functional condition of the adrenals and is an early index, although not a specific one, of the effects of ionizing radiation on an organism.

82. Reliable Apparatus for Monitoring Protection From Gamma Radiation Described

"Apparatus for Monitoring Protection From Gamma Radiation (BB-DKZ)," by V. A. Petrov; Moscow, Meditsinskaya Radiologiya, Vol 2, No 3, May/Jun 57, p 85

An apparatus simpler and more reliable than the regular DKZ type is described, and its photograph and cross section accompany the article. It contains no dry cells. It consists of (1) an outer casing which serves as its ionizing chamber, (2) a crossbar attached to a wire electrometer whose movements can be traced in a microscope of small magnification, (3) a microscope whose projecting tube is well insulated, (4) a projecting charging point, (5) a small window to admit light, and (6) a small mirror located at the base of the apparatus to reflect the light into the microscope tube.

The volume of the ionizing chamber is about 3 liters, and the electrometric system and the connecting electrodes measure about 40 cm. When the filament moves one division, the potential decreases 10 V. Due to the high potential of this system, constant high tension is guaranteed.

It is possible to measure dose rates starting with one micro r/sec and higher.

83. Conference Held in Moscow, November 1956, Discusses Sequelae Attributed to Ionizing Radiation

"Conference on Sequelae of Injuries Caused by the Effects of Ionizing Radiation," by Z. M. Karelina; Moscow, Meditsinskaya Radiologiya, Vol 2, No 3, May/Jun 57, pp 86-89

A conference was held in Moscow, 20-21 November 1956, on the subject of sequelae of injuries caused by ionizing radiation. The following are some of the 23 reports heard.

M. S. Lapteva-Popova, Doctor of Medical Sciences, reported on changes progressing in the blood due to chronic effects of small doses of X rays. Research was conducted on dogs subjected to daily doses of 5 and 10 r. Four periods of chronic radiation sickness are described: first, characterized by lability of hemopoiesis; second, by a certain inhibition of hemopoietic functions; third, by a temporary adaptation of hemopoietic processes; and fourth, by profound pathological changes in circulation.

V. V. Sokolov reported that fast neutrons cause microcytosis in erythrocytes.

Analogous data were reported by each of I. K. Petrovich, A. A. Kanarevska, and S. Yu. Posherstnik on changes in peripheral blood due to the administration of various doses of radioactive substances (Sr^{89}, Sr^{90}, Po^{210}, Rn, and RTh), and the products of uranium fission. Changes occurred in the number of leukocytes, erthrocytes, reticulocytes, and thrombocytes. In 16 months the number of leukocytes was 50% of the original.

S. M. Mikhaylovich reported on protein and lipid metabolism in dogs under the effect of intravenous administrations of radiothorium in absolutely lethal doses. His findings included decreased blood cholesterol and increased urine protein.

R. Ye. Libenzon talked on decreasing amounts of nucleic acids in various organs of dogs irradiated by Co^{60}.

A. P. Novikova reported on two forms of chronic radiation sickness (complicated and uncomplicated resulting from peroral administration of uranium fission products.

L. L. Vannikov presented material on changes in the glia cells of dogs' brain, at remote periods after the onset of acute radiation sickness.

V. V. Shikhodyrov reported on changes (destructive and regenerative) in loose connective tissue in chronic radiation sickness following single and repeated small doses of fast neutrons and administration of Sr^{89} and Po^{210}.

Ye. V. Erleksova reviewed her studies of changes in organisms, at remote periods after injuries by radiothorium administered intravenously (0.001-0.0005 millicuries/kg body weight). Destructive changes were reported in the liver, heart, kidneys, lymph nodes, etc.

N. N. Litvinov reported on histological changes leading to bone sarcoma, due to the effects of Sr^{90} and Y^{91}.

N. Ye. Trusova, S. P. Voskresenskiy, A. P. Novikova, and T. A. Ivanova reported on the effects of ionizing radiation on sex glands and on offspring.

V. S. Kushneva analyzed injuries caused to animals (rats) by the combined effect of silicon dioxide and radium.

L. N. Burykina's report on the effects of administering orally 0.2 microcurie per kg of Sr^{89} to dogs pointed out that ionizing radiation results in inhibition of leukopoiesis, persistent absolute lymphopenia, decreased absolute number of bone marrow cells, and increased permeability of skin capillaries.

Ye. N. Klimova reported on chronic effects of uranium fission (1×10^{-9} to 1×10^{-10} c/kg) products. These included general exhaustion, broncho-ectopic diseases, general underdevelopment, decreased resistance leading to susceptibility to infections, etc.

A. I. Osipovskiy gave proof of anomalies of development of offspring irradiated by gamma rays (198, 360, and 520 r).

N. S. Boyko reported on changes in electropotentials in the stomach of offspring of dogs subjected to injuries by products of uranium fission. The electromotive force was one half that of the control isolated stomach.

The conference adjourned with the clear understanding that accumulating experimental data indicate significant biological effects at remote periods after the onset of injuries caused by ionizing radiation. These injuries become evident in the offspring also.

84. Two Radioactive Cobalt Machines Set up in the USSR

"Joining the Service", by M. Deshin; Moscow, Meditsinskiy Rabotnik, 3 Dec 57, p 4

CPYRGHT

"A Department of Teleradium Therapy was opened in the Tul'skaya Oblast Oncological Dispensary. Here, in a special installation, two gamma-apparatuses were set up for the therapy of neoplasms by radioactive cobalt."

Surgery

85. Complex Method Combining Ganglion-Blocking, Narcotic, and Neuroplegic Agents Produces Hypothermia (Body Temperature 3-7°C)

"Application of Chemical Hypothermia During Surgery," by Prof G. P. Zaytsev, Chair of General Surgery (head, Prof G. P. Zaytsev) of Pediatric Faculty of Second Moscow Medical Institute; Kiev, Novyy Khirurgicheskiy Arkhiv, No 4 (208), Jul/Aug 57, pp 51-55

The author describes a complex method employing narcotic, ganglion-blocking, neuroplegic, hypotensive, and relaxing agents to arrive at true hypothermia (body temperature at 3-7°C). Under such conditions, arterial blood pressure decreases to 70/35 to 60/25, and oxygen requirements and metabolism in general are very low.

The author lists chemical substances causing hypothermia and classified them with regard to their pharmacological effects and clinical symptoms into four groups; i.e., antiadrenalin, antiacetylcholine, antihistamine, and curare-like. A number of Soviet preparations are mentioned.

Details for using chemical hypothermia as a method of anesthesia are presented, and 56 operations using chemical hypothermia prove its superiority over other prevalent methods of anesthesia. The medical history of a patient 62 years old and her operation using chemical hypothermia are reviewed.

Veterinary Medicine

86. International Conference on Tuberculosis in Cattle Held in Czechoslovakia

"Conference on Tuberculosis in Cattle" (unsigned article), Prague, Zemedelske Noviny, 12 Dec 57, p 3

A 2-day conference on tuberculosis in cattle opened in Prague on 11 December 1957. Among those attending were Prof Dr J. Brill, Warsaw; Prof Dr E. V. Goerttler, East Germany; Academician R. Maninger, Budapest; and Prof Fr N. Plum, Copenhagen.

At the conference papers were read concerning the incidence of tuberculosis in cattle throughout the world and the procedures which would be necessary for its complete eradication.

Military Medicine

87. Czechoslovak Military Medical Academy Engaged in Research on Defense Against Weapons of Mass Destruction

"Facts About the VLA" (unsigned article), Hradec Kralove, Pochoden, 4 Oct 57, p 3

The Hradec Kralove Kraj Committee of the KSC (Communist Party of Czechoslovakia), claims that the VLA (Vojenska lekarska akademie J. Ev. Purkyne, the "J. Ev. Purkyne" Military Medical Academy) in Hradec Kralove conducts research along three main lines, including defense against weapons of mass destruction, surgery, and study of the higher nervous system.

Miscellaneous

88. Scientific Council of the Ministry of Health in the USSR

"Scientific Council of the Republic Ministry" (unsigned article), Moscow, Meditsinskiy Rabotnik, No 7, 24 Jan 58, p 1

The Scientific Council of the Ministry of Health of the union republics is a "scientific consultative and operational organ through which the ministry plans, organizes, and coordinates scientific work. Its functions include the study of progressive experiments, the active support of medical innovators, the wide popularization and introduction into practice of contemporary methods of prophylaxis, diagnosis, and treatment. The Scientific Council is also charged with the direction of the activities of scientific societies and medical publications."

After the reorganization of the ministries of health in which all the vuzes (higher educational institutions) and most of the scientific research institutes have come under the direction of the ministries, the scientific councils now have even more responsibilities. They are, in addition to the above, charged with the supervision of research work done by institutes subordinate to the ministries.

89. New Medical Periodical To Be Published in USSR

"Kazan Medical Journal" (unsigned article), Moscow, Meditsinskiy Rabotnik, No 6, 21 Jan 58, p 1

Kazanskiy Meditsinskiy Zhurnal, a long-established medical periodical will once again be published. It is to be the organ of the Ministry of Health Tatar ASSR and of the Council of Scientific Medical Societies. The periodical had been discontinued after being published for 85 years. It will contain scientific articles in the field of therapeutics, surgery, hygiene, etc.

90. China Moves to Draw Up New Medical Research Programs

"On Reviewing the Execution of the 1957 All-China Medical Research Plan and Formulating the 1958 and Second Five-Year Medical Research Plans," unsigned article, Peiping, Chung-hua I-hsueh Tsa-chih (National Medical Journal of China), Vol 43, No 11, 1957, pp 937-938

This news item reports action taken by the central government of the People's Republic of China to ensure that the national plan will be ready by the beginning of 1958 to guide medical scientists in their research activities of the year.

A summary of the article follows:

Pursuant to a recent directive of the State Council's Planning Committee for Scientific Development, the Medical Divison of this committee has organized five subdivisions to investigate the fulfillment of the 1957 national plan for medical research. These subdivisions will review the state of Chinese research in Western and Chinese traditional medicine with respect to five key areas of concern, namely, schistosomiasis, Japanese B encephalitis, dysentery, silicosis, and cardiovascular diseases. Those medical researches which do not fit under any of the afore-mentioned areas of concern will be reviewed by persons appointed by the agencies which conducted the studies. Written reports should be submitted before 20 September 1957 to the State Council's Planning Committee for Scientific Development, whose business office is located in the offices of the Committee on Medical Research, Ministry of Health, Peiping.

The purpose of this investigation is to ensure the successful execution of the 1957 plan and to collect data for use in formulating and revising the medical research programs for 1958 and the Second Five-Year Plan.

Steps in drawing up the 1958 plan have been mapped out. A document entitled "Rough Draft of 1958 and Second Five-Year Plans for Research in Medical Sciences" was drafted by the Committee on Medical Research of the Ministry of Health; and in September 1957, copies were issued to China's 38 medical colleges, as well as to all federal, provincial, and municipal organizations which engage in medical research and/or the treatment and prevention of disease. Each organization is to select its own future research topics, giving due consideration to the information contained in this rough draft, to the extent to which it was able to carry out its 1957 plan, and to prevailing local conditions. Their proposed research topics will be entered on "Scientific Research Topic Cards" designed especially for that purpose. Each completed card is to be discussed by the scientific committee of the

originating unit, approved by the controlling agency for that unit, and submitted before 1 October 1957 to the Medical Division of the State Council's Planning Committee for Scientific Development. The Medical Division will prepare a report from the data on the cards received.

There are well-defined requirements for a research topic which may be incorporated into the national plan. In general, such topic must either be related to the five tasks of national scientific development and have great theoretical and practical significance, or be unrelated but have some theoretical and practical significance. In addition, each must satisfy one of the following conditions: (1) be concrete and clear in its contents; (2) be feasible with respect to method, personnel, materiel, and basic conditions required, and attainable with respect to basic completion or initiation in 1958; (3) research topics which are repeaters must be backed by scientific theory and evidence of practicability; and (4) contributing to the advancement of Chinese native medicine, practical in content, and attainable with respect to basic completion or initiation in 1958. Research topics dealing with Chinese characteristics, China's geographic location, or the specialties of Chinese scientists will be given due consideration as to their possible place in the national plan.

IX. METALLURGY

Ferrous Metallurgy

91. New Isotope Laboratory at University

"Radioisotope Laboratory in Miskolc" (unsigned article), Budapest, Ujitok Lapja, 20 Dec 57, p 11

A radioisotope laboratory has been established at the Department of Ferrous Metallurgy of the Technical University of Heavy Industry, Miskolc. The radiation meter and most of the other instruments have already arrived. A large part of the equipment was made available by the Isotope Utilizing Committee of the National Atomic Energy Commission (Orszagos Atomenergia Bizottsag isotopalkalmazasi szakbizottsag).

The experiments which are to be conducted at the laboratory will ensure continuity of steel production.

Nonferrous Metals. Rare Metals

93. Soviets Cast Rhenium Metal on Experimental Scale

"Mechanical Properties of Cast Rhenium," by Ye. M. Savitskiy and M. A. Tylkina, Trudy Instituta Metallurgii imeni A. A. Baykov, No 1, 1957, pp 158-161

The article reads as follows:

"Rhenium belongs to the little investigated rare metals. The literature in general describes its chemical properties, methods of extraction from the ore, and the production of its salts and metallic powder. Data on the mechanical properties of rhenium were published only recently. In 1955-1956 works were published concerning the physical and mechanical properties of rhenium obtained in compact form by the powder metallurgy method. In the present work, performed in 1954, efforts were made to establish the possibility of obtaining compact [solid] rhenium by means of casting and to study the effect of temperature on mechanical properties (hardness and ductility at compression). At present the authors are continuing the investigation of the structure and properties of rhenium alloys with molybdenum and other high melting metals (titanium, zirconium, chromium, cobalt, manganese, and nickel).

"From 50 to 100 gr of an initial sample of powdered rhenium (metallic) was compressed into briquettes 20 mm in diameter and 10-15 mm high. The briquettes were either melted directly or were sintered [first] at 1,200°C for 1-2 hours in vacuum. This was to assure degasification and sufficient strengthening, thus permitting handling without special precaution. The melting of unsintered briquettes was complicated by the evolution of gases during heating and melting; therefore, their preliminary sintering should be considered a necessity. The melting of briquettes was conducted in an arc furnace with a tungsten negative electrode in the depressions of the water-cooled copper bottom of the furnace in an argon atmosphere at a pressure 200 mm Hg.

"Before the melting of the rhenium, a sample of titanium is melted, which serves in this case as a gas absorber and purifies the argon.

"The temperature of the cathode spot was approximately 4,000°C, and the melting of the briquettes took place rather fast (voltage 30-35 v, dc current 600-700 a). For the purpose of thorough melting of the whole sample it was turned over in its melting depression and remelted again. Rhenium melts easily and possesses sufficient fluidity and does not require more than two or three remeltings. The surface of the cast rhenium is shiny, specular and resembles, in its outer appearance, cast platinum. Figure 1 shows a sample of cast rhenium magnified 2.5 times. The samples of cast rhenium were subjected to spectroscopic analysis to determine whether the samples were contaminated by tungsten from the electrode. Table 1 shows data of the analysis of the initial rhenium powder and two cast rhenium samples, of which sample No 2 was melted more carefully.

Table 1. Spectral Analysis of Cast Rhenium* Samples

Elements Analyzed	Powder of Initial Rhenium	No 1 Sample Cast Rhenium	No 2 Sample Cast Rhenium
Ni	++	+	+
W	-	-	++
Mo	+	Traces	+
Mn	+	-	-

Elements Analyzed	Powder of Initial Rhenium	No 1 Sample Cast Rhenium	No 2 Sample Cast Rhenium
Cu	/	/	Weak traces
Fe	//	//	/
Si	/	/	/
Ca	//	//	/
Al	//	/	/
Ti	-	-	/
Na	/	-	-

* // contains 0.1 to 1.0%, / contains 0.01 or less

"As seen from Table 1 the contamination of rhenium by tungsten is very slight, and is absent altogether in sample No 1. The appearance of titanium can be explained by the mechanical entry in the form of droplets during its melting as a gas absorber. The quantity of other impurities present in the initial powder (Na, Al, Fe, Cu, Mn, Ni) is reduced in the cast rhenium, so that at high temperatures there occurs a partial refinement of rhenium.

"For the sake of comparison, samples of rhenium metal were obtained by the powder metallurgy method. The powder was pressed at a specific pressure of ~ 8 ton/cm^2 into briquettes, was subjected to in-step sintering in vacuum at slow heating up to 1,200^{0}C and holding for 2 hours, and then subjected to sintering at 2,000^{0}C for 3-4 hours. The specific weight of the sintered rhenium under these conditions was 18 gr/cm^3 (porosity 14%). The density of the sintered sample was obviously too low. The microstructure of rhenium was revealed by etching with concentrated nitric acid.

"Figure 2 a shows the microstructure of cast rhenium, magnified 100 times, which has a coarse crystalline structure, while the grains have polygonal shape.

"It should be noted that the specific conditions of casting and cooling (cooled copper bottom) result in the formation of a heterogeneous mass, with respect to the size of the grains for various portions of the casting. The sintered rhenium has small grain structure and is porous.

"The hardness of rhenium was determined in the temperature range from -194° to +1,150° with a special device. Tests at high temperatures were conducted in a stream of argon. The temperature of -194° was obtained by a cooling of the samples in liquid nitrogen. Hardness was determined by impression of "pobedit" indenter (cone) at 200-kg load, and for 1,000° and 1,150° at 100-kg load for 30 sec. The results of the test are shown in Table 2 and Figure 3.

Table 2. Effect of Temperature on the Hardness of Rhenium

Temperature (°C)	Hardness (H_k, kg/mm^2)	Temperature (°C)	Hardness (H_k, kg/mm^2)
-194	400	800	204
20	274	1,000	144
400	210	1,150	134

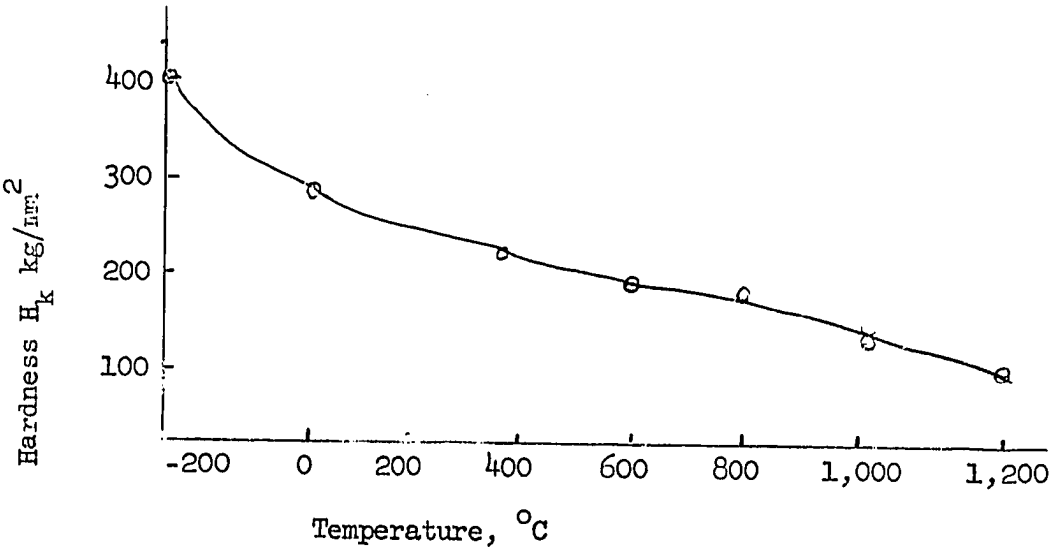

Figure 3. Effect of Temperature on the Hardness of Rhenium

"The ductility of rhenium was determined by compression at room temperature and at 1,000°. A special shape was not imparted to the test specimens, but half pieces of the cast samples were subjected to pressing. These test specimens had the shape of semicircles with an area of 160 mm^2 and were 6.5 mm thick. The compression of the test pieces was conducted at room temperature by the method of static compression on a 35-ton press. Compression at 1,000° was done on a vertical press. The samples were heated in the argon atmosphere and were quickly transferred to the anvil of the press. The coarse crystalline structure of the cast rhenium is detrimental to its ductility. The fracture follows the grain boundaries. The amount of contraction during compression at 20° is 25% to 30%; the compressive strength is more than 200 kg/mm^2. At 1,000° the contraction in compression was 60% (a crack visible on the side surface).

"Figure 2 b shows the microstructure of the sample compressed at 1,000°C. A strong fracturing of grains and their plastic flow are visible. Rhenium has a high tendency toward work hardening. The hardness of deformed rhenium rises to 400-520 kg/mm^2, i.e., cold work hardening reaches ~ 80%.

"By means of microstructural and X-ray methods it was established that the temperature for the beginning of recrystallization of cold deformed rhenium is approximately 1,500°. Figure 2 c shows the microstructure of a sample recrystallized at 1,550°.

"Conclusion

"The work conducted established the possibility of obtaining cast rhenium. The values for its hardness at various temperatures from -194 to +1,150° and for its ductility, by the method of compression at 20° and 1,000°, were obtained. The high degree of work hardening of pure rhenium was established. The beginning temperature of recrystallization of rhenium is approximately 1,500°."

93. Soviet Scientist Discusses Ideal ICBM Nose Cone Materials

"These Are the Metals of the Intercontinental Rocket," by V. Parfenov, Rome, L'Unita, 27 Nov 57

The special qualities demanded of the materials making up an ICBM -- refractory and heat-resistant -- and some of the materials being used both in the nose cone and interiorly are described by Parfenov, Soviet scientist. Among these he mentions tungsten, tantalum, molybdenum, chromium, gold, columbium, and rhenium. Of these, he says that rhenium is "the ideal metal." However, he cites its high cost and the difficulty of extraction as a prohibition to its widespread use. Columbium is another metal which has aroused "great interest."

Inasmuch as the problem of material for missile nose cones cannot be completely solved by refractory and heat-resistant metals, the epoch of rare metals (exotic metals) will soon be a thing of the past and the age of heat-resistant ceramics and metalloceramics will begin. Even these have their failing in that they are friable and not able to withstand the vibrations and impacts of particles and atmospheric dusts they will encounter. This difficulty is met, he states, by alloying the oxides with other materials.

Breif mention is also made of the materials used in motors, combustion chambers, fuel tanks, lines, valves, and nozzles.

[For additional information on ferrous metallurgy, See Item No 29.]

Alloys

94. Stability of Titanium Boride — Niobium Boride Alloys to Oxidation in the Air

"Investigation of the Stability of Titanium Boride — Niobium Boride Alloys to Oxidation," by V. S. Neshpor and G. V. Samsonov; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 30, No 11, Nov 57, pp 1584-1588

Investigation of the stability of metal-like compounds of transition metals to oxidation at high temperatures is of importance, because these compounds retain their hardness up to very high temperatures (of the order of 1,500-2,000°) and can be used as refractory materials. Investigation of TiB_2-NbB_2 alloys in the range of 0-100% TiB_2 at the temperatures 450-1,000° showed that the alloy having the composition 50 mol % (37.8% by weight) of TiB_2 exhibits the highest resistance to oxidation in the air. This resistance was determined on the basis of the increase in weight due to formation of oxides: the alloy of the composition indicated showed the least increase in weight.

95. Stability to Oxidation of Alloys Containing the Intermetallic Compounds NiAl

"Investigation of the Oxidation of Alloys Containing the Intermetallic Compound NiAl," by Ye. I. Mozzhukhin, L. Kh. Pivovarov, and Ya. S. Umanskiy, Moscow Steel Institute; Moscow, Zhurnal Prikladnoy Khimii, Vol 30, No 11, Nov 57, pp 1593-1599

The compound NiAl is homogeneous in an extensive range of concentrations and has the highest melting point within the system of nickel-aluminum alloys; it is therefore of definite interest from the standpoint

of applications in refractory alloys. The refractory qualities of single-phase alloys consisting only of NiAl and of two-phase alloys consisting of NiAl / Ni_3Al were investigated. These alloys were compared with electrolytic Ni and CoAl. The following results were obtained:

It was established that the nature of the oxidation of NiAl depends on the composition of the alloys. When an excess of Al atoms is present, a dense oxide film is formed. In the presence of an excess of Ni atoms there is separation of the Ni_3Al phase with the result that the protective effect of the film is impaired and oxidation accelerated. The same relationships with regard to oxidation apply to NiAl powders the particles of which are covered with an oxide film. When the protective effect of the film on powders is no longer exerted because of damage to the film, the rate of oxidation of the powder decreases rapidly in time because of reduction of the surface of the particles. The compound CoAl oxidizes more readily than the compound NiAl.

X. PHYSICS

Nuclear Physics

96. Solutions Given for Magnetohydrodynamic Equations for Gas-Discharge Plasma

"On the Problem of Pulsations of a Plasma Column," by A. G. Kulikovskiy, Moscow State University imeni M. V. Lomonosov; Moscow, Doklady Akademii Nauk SSSR, Vol 114, No 5, Jun 57, pp 984-987

Excerpts from the article follow.

"The problem of pulsations of a plasma column arose in connection with experiments on high-current gas discharges (L. A. Artsimovich and others, Atomnaya Energiya, No 3, 1956). An approximate solution of this problem was given by M. A. Leontovich and S. M. Osovets (loc. cit.). A certain class of exact solutions for the equations of magnetohydrodynamics is proposed here. The class includes, in particular, periodic solutions.

"We shall consider one-dimensional axially symmetric motion of an unbounded gas with infinite conductivity. The well-known equations of magnetohydrodynamics are written as follows in Lagrangian coordinates:

$$\frac{\partial^2 r}{\partial t^2} = -\frac{1}{\rho}\left(\frac{\partial p}{\partial r} + \frac{1}{8\pi}\frac{\partial H^2}{r} + \frac{1}{4\pi}\frac{H^2}{r}\right);$$

$$\rho = \rho_0 \frac{r_0}{r}\frac{\partial r_0}{r}; \qquad p = p_0 \frac{\rho^\gamma}{\rho_0^\gamma}; \qquad H = H_0 \frac{\partial r_0}{r}.$$

r is the moving coordinate of the particle; r_0, ρ_0, p_0, and H_0 are, respectively, the coordinate, density, pressure, and magnetic field intensity of a particle. The magnetic lines of force are assumed to be closed, concentric circles.

"The first equation expresses particle acceleration; the second, third, and fourth represent the laws of conservation of mass, entropy, and magnetic flux. All solutions here are found with uniform deformation, i.e., such that

$$r/r_0 = \mu(t),$$

where μ is independent of r. Therefore,

$$v = r/t = r\ (t) = r\ \frac{(t)}{(t)},$$

i.e., velocity is a linear function of the radius....

"The solution is given by the formulas

$$\rho = \rho_0 \mu^{-2};$$

$$p = p_0 \mu^{-2\gamma};$$

$$H^2 = H_0^2 \mu^{-2}, \text{ where } \rho_0 \text{ is an arbitrary}$$

function of r;

$$p_0 = A_0 \int_0^{r_0} \rho_0 r_0\ dr_0 \neq N;$$

$$H_0^2 = \frac{8\pi B}{r_0^2} \int_0^{r_0} \rho_0 r_0^3\ dr_0 \neq \frac{M}{r_0^2}.$$

A, B, N, and M are arbitrary constants...."

An interpretation of the equations for different values of the constants is given.

"The solution obtained here is easily generalized to the case when the magnetic lines of force are helical. In this case, the term $-\frac{1}{8\pi\rho}\frac{\partial H_z^2}{\partial r}$ must be added to the right-hand side of the first differential equation. H_z is the component of the magnetic field, parallel to the axis of symmetry and H in the equation will denote the component of the magnetic field, perpendicular to the axis of symmetry.

"The following two formulas must then be added to the five solution equations already given:

$$H_z^2 = H_{z_0}^2 \mu^{-4},$$

$$H_{z_0} = 8\pi D \int_0^{r_0} \rho_0 r_0\ dr_0 \neq L.$$

D and L are arbitrary constants...."

Expressions for $(\frac{d\mu}{dt})^2$ in both cases are also given.

97. Equations Given for Gas-Discharge Plasma With Consideration of Gravitation

"Oscillations of an Infinite Gas Cylinder With Self-Gravitation in a Magnetic Field," by I. M. Yaborskaya, Moscow State University imeni M. V. Lomonosov; Moscow, Doklady Akademii Nauk SSSR, Vol 114, No 5, Jun 57, pp 988-990

The one-dimensional, unsteady-state motion of a gas, "such as occurs in problems of the motion of cosmic masses under the influence of magnetic fields," is considered. It is assumed that the electrical conductivity of the gas is so great that the magnetic lines of force may practically be considered "frozen" in the medium. The radial motion of a gas with cylindrical symmetry under the influence of Newtonian gravitation and internal magnetic fields is also considered. The velocity is assumed to be dependent on the distance from the axis of symmetry.

A solution to the differential equations for the system is discussed for various values of the parameters.

98. Chemical Method Given for Measuring $Si^{30}(p,\pi^{+})Si^{31}$ Reaction

"Radiochemical Investigation of $Si^{30}(p,\pi^{+})Si^{31}$ Reaction," by S. Sekerskiy and A. K. Lavrukhina, Institute of Geochemistry and Analytical Chemistry imeni V. I. Vernadskiy, Academy of Sciences USSR, and Institute of Nuclear Research Polish Academy of Sciences; Moscow, Doklady Akademii Nauk SSSR, Vol 117, No 1, Nov 57, pp 61-64

A radiochemical method for detecting a $Si^{30}(p,\pi^{+})Si^{31}$ reaction is described. The relation between the formation cross section of Si^{31} and the energy of the bombarding particles was studied in the 120-660 Mev range to prove the existence of the above reaction.

The following description of the method is given.

A 60-80 mg sample of spectrally pure powdered silicon wrapped in two layers of aluminum was irradiated for 1-2 hours in the internal beam of the synchrocyclotron of the Laboratory of Nuclear Problems of the Joint Insitute of Nuclear Research. The silicon was then dissolved on a 3M solution of NaOH and put through a paper filter to separate the silicon particles that did not go into solution. 2M HCl and several milligrams of $BeCl_2$ and $MgCl_2$ were added to the filtrate, which was then evaporated until dry. The residue was treated with concentrated HCl, washed three or

four times with the same acid, then dissolved in a 3M solution of NaOH. After the addition of Be and Mg salts, all operations were repeated twice. On the last time, concentrated H_2SO_4 was used in the evaporation. The SiO_2 precipitate was separated and baked at 900° for 45 minutes and weighed. The chemical yield of silicon was 20%. The separation required 4 hours.

The activity of the silicon was measured over 24 hours at intervals of 1-2 hours. The decay curve was then plotted. Silicon beta-radiation that was absorbed in the aluminum was also measured and found to be 1.47 Mev. The Si^{31} formation cross sections were calculated. The energy of the proton beam was determined on the basis of the activity of Na^{24} formed in the reaction $Al^{27}(p,3pn)Na^{24}$.

The Si^{31} cross sections for various proton energies are given in a table. The effect on the results of reactions with deuterons and neutrons is discussed.

It is noted that the above method was not successful in studying the (p,π^+) reaction in heavier nuclei such as germanium and bismuth.

99. Conversion Spectrum of Ho^{160} Analyzed

"Conversion Spectrum of Ho^{160}," by Ye. P. Grigor'yev, Corresponding Member of the Academy of Sciences USSR; and B. S. Dzhelepov, A. V. Zolotavin, B. Kratsik, B. K. Preobrazhenskiy, and I. S. Yanchevskiy, Physics Institute, Leningrad State University imeni A. A. Zhdanov; Moscow, Doklady Akademii Nauk SSSR, Vol 117, No 1, Nov 57, pp 53-56

The conversion spectrum from the $Er^{160} \rightarrow Ho^{160} \rightarrow Dy^{160}$ transition was studied. A double-focusing spectrometer was used to conduct measurements with a 3% relative half width of the lines.

It is noted that the conversion spectrum is the same in both fractions, i.e., the Er^{160} fraction does not give conversion electrons; all electrons belong to the Ho^{160} fraction.

The following observations on the results are made.

The 60-kev transition lines L_I / L_{II}, L_{III}, M, and N were observed in Ho^{160}. The relative intensities of the lines was determined as $L_I : L_{II} : L_{III} : M : N = 0.1 : 1.0 : 1.0 : 0.47 : 0.1$ by resolving them into their components.

The ratio $L_I : L_{II} : L_{III}$ was determined as 0.2 : 1.1 : 1.0 for the 864-kev transition.

The line E_e = 99.3 kev was identified as the L-line of a 107-kev transition. A K-conversion line of the transition was found.

The 298-kev conversion line in the K shell was a narrow doublet with $\triangle E \cong 1$ kev.

The K-conversion lines of the 310, 364, and 394-kev transitions; and K- and L-lines of the 407 kev transition; and the L-line of the 514 kev transition were observed.

K-lines of the 755 and 765-kev transitions were observed between the strong K- and L-conversion lines of the 730-kev transitions.

Conversion lines corresponding to 880 and 967-kev transitions were doublets with a $\triangle E$ equal 7 and 3 kev.

Fourteen lines and 11 different transitions were found in the hard region of the conversion spectrum.

100. Relation Between Shower-Particle Production and Atomic Number Studied

"Relation Between Emission Frequency of Shower Particles and the Atomic Number of the Disintegrated Nucleus," by Zh. S. Takibayev, Physicotechnical Institute, Academy of Sciences Kazakh SSR; Moscow, Doklady Akademii Nauk SSSR, Vol 114, No 5, Jun 57, pp 980-983

Aluminum and tungsten screens embedded in thick photographic emulsions were exposed at 28 km for several hours. The probability for the formation of shower particles was observed to be more than twice as great in plates with the tungsten than in those with aluminum. It is noted that fast π-mesons are generated in tungsten nuclei with a greater probability than in aluminum, but that the probabilities for π-meson generation do not depend as strongly on the atomic number of the disintegrated nucleus as do those for the generation of shower particles.

101. Neutron Yield From Various Radon Sources Measured

"Neutron Yield From Rn/B, Rn/C, Rn/CaF_2, Rn/Mg, Rn/Al, Rn/Si, Rn/SiO_2, and Rn/Granite Sources," by G. V. Gorshkov and V. I. Matviyenko, Radium Institute imeni V. G. Khlopin, Academy of Sciences USSR, Moscow, Doklady Akademii Nauk SSSR, Vol 116, No 2, Sep 57, pp 211-212

The neutron yield and other characteristics of radon neutron-sources were studied. The sources were cylindrical in shape, 20 mm in diameter, and 40 mm in length. The number of neutrons was determined in two ways: with an all-wave boron counter and by readings from the density distribution of slow neutrons in a water tank.

Results are shown in a table giving neutron yield relative to a Rn/Be source, relaxation length, and neutron energy.

102. Hungarian Nuclear Physicists Travel to Belgrade

"Hungarian Nuclear Physicists Leave for Belgrade" (unsigned article) Budapest, Nepszabadsag, 21 Nov 57, p 8

Pal Lenard, deputy director of the Central Physics Research Institute (Kozponti Fizikai Kutato Intezet), is in charge of an eight-member delegation which left for Belgrade on 20 November 1957 to examine Yugoslav nuclear physics research as conducted in the Boris Kidric Institute. The delegation will spend 10 days in Yugoslavia.

Atomic and Molecular Physics

103. Equation for Diffusion of Plasma Particles Given

"On the Diffusion of Charged Particles in a Homogeneous Electromagnetic Field," by Kh. R. Khristov, Sophia State University and Moscow State University imeni M. V. Lomonosov; Moscow, Doklady Akademii Nauk SSSR, Vol 116, No 2, Sep 57, pp 213-216

The introductory paragraphs follow.

"In recent works we considered diffusion of molecules, neutrons and shower particles. We wrote the equations and gave approximations for the probabilities $V_{ij}(s, \underline{q}, \underline{u}, t, \underline{r}, \underline{v})d\underline{r}\, d\underline{v}$ that a particle of type i with position $\underline{q}$ and velocity $\underline{u}$ at time s creates at time t a particle of type j with radius vector between $\underline{r}$ and $\underline{r} + d\underline{r}$ and with velocity between $\underline{v}$ and $\underline{v} + d\underline{v}$. Using this notation, we shall write the equation for the function $\overline{V}$ and give a method for the approximate solution of the equation when the particles whose diffusion we are seeking are charged and in a homogeneous and unchanging medium which is in a homogeneous electromagnetic field.

"We shall assume that the particles are identical and that, in addition to being scattered in collisions with molecules of the medium, they also are absorbed and generate new particles. It is further assumed that the motion of each particle between collisions is affected only by the external electromagnetic field and not by the fields of other particles.

"Such a process occurs, for example, in a weakly ionized plasma in a stationary state, where ions of a given type collide with one another and with other ions and gas molecules and not only are scattered but recombine and generate new ions through impact ionization."

It is noted that the diffusion expression and method of solution are applicable to nonstationary as well as stationary processes in an ionized medium and can be used to calculate the transfer coefficients of the medium.

104. Hungarian Atomic Research

"The Situation in Hungarian Atomic Research," by Dr Mark Klinko and Otto Oltvanyi; Budapest, Ujitok Lapja, 20 Dec 57, pp 10-11

Dr Lajos Janossy, professor, renowned expert on cosmic radiation, says that the 2-megawatt Hungarian reactor will probably be ready to operate on a trial basis during the second half of 1958. It will be used to make investigations in neutron physics and radiation chemistry and to prepare radioactive isotopes.

The third function of the reactor will be to promote the training of physicists and engineers who will participate in the construction of the atomic power plant which is to be built later. As a result of the help of the USSR, Hungary will soon be able to make atomic energy available to its economy.

The Central Physics Research Institute, owing to its cooperation with the Joint Institute for Nuclear Research near Dubna, has had access in its investigations to the 680- and the 10,000-Mev synchrocyclotrons of the latter institute. These investigations were concerned primarily with the evaluation of (photographic) plates which had been irradiated by the synchrophasotron, and study of high-energy nuclear interaction. The Central Physics Research Institute will also take a very active part in the investigation now being conducted in Dubna by means of the bubble chamber technique. The Central Physics Research Institute currently has a staff of 120 physicists, some of whom are doing research in nuclear physics.

Academician Dr Sandor Szalay, director of the Nuclear Research Institute of the Hungarian Academy of Sciences, Debrecen, says that the most interesting work done at the institute was that of Gyula Csikay, who constructed a Wilson-type cloud chamber which operates on low-pressure hydrogen. With the aid of the cloud chamber, Csikay was able to photograph the decomposition of the isotope of helium — 6. Careful measurements also made it possible to calculate the impulse, i. e., mass and speed, of the neutrino which was discharged from the helium atom together with the electron.

The institute has completed most of its work in the field of uranium geochemistry and medicine and will now concentrate on the physical investigation of the fundamental atomic nucleus and on the practical uses of atomic power in Hungary. For this purpose, the institute will construct, entirely from its own resources, a small, homogeneous boiling water reactor.

Szalay and Denes Berenyi, a colleague, recently made calculations concerning the possibility of harnessing the energy produced by the fusion of the heavy isotope of hydrogen into helium. The results of the calculations were negative.

105. Activities at Czechoslovak Atomic Reactor

"The First Success in Rez-Husinec," (unsigned article), Prague, Prace 2 Nov 57, p 3

The first Czechoslovak atomic reactor will soon be turned over to the Czechoslovak Academy of Sciences (Ceskoslovenska Akademia Ved).

As of 1 November 1957, the reactor had completed about 170 hours of operation. The most varied samples have been successfully irradiated in the experimental channels. These samples are needed by the Institute of Nuclear Physics (Ustav jaderne fysiky) for further research. Samples of rare earths were tested through the nuclear spectroscope, and the characteristics of plastic materials under radiation and the effect of gamma radiation in the sterilization of foodstuffs (edible fats, butter, grease, rape oil, and sunflower oil) and gelatine were tested. There is even preparation of experiments with test animals.

Theoretical Physics

106. General Expression for All Problems on Diffusion of Radiation in a Semi-Infinite Medium Given

"Diffusion of Radiation in a Semi-Infinite Medium," by V. V. Sobolev; Moscow, Doklady Akademii Nauk SSSR, Vol 116, No 1, Sep 57, pp 45-48

"The problem of diffusion of radiation in a semi-infinite medium is met in astrophysics in studying stellar and planet atmospheres and in geophysics in studying water basins. Particular cases of this problem

are usually considered individually. We shall show in this article that the solution of all problems on the diffusion of radiation in a semi-infinite medium where the distribution of radiation sources is different may be expressed by the same function. This function depends only on the optical depth.

"We shall assume that radiation scattering is isotropic in the medium, whereupon the probability of quantum survival in an elementary scattering act is equal to λ. To determine the radiation field in a given medium, it is necessary only to solve the following integral equation for a function $B(\tau)$:

$$B(\tau) = \frac{\lambda}{2}\int_0^\infty B(\tau')\ \mathrm{Ei}|\tau-\tau'|\ d\tau + g(\tau), \qquad (1)$$

where $g(\tau)$ is the distribution function of the radiation sources. If $B(\tau)$ is known, then the radiation intensity at an optical depth τ and at an angle ϑ to the normal is given by

$$I(\tau,\vartheta) = \int_\tau^\infty B(\tau')\ e^{-(\tau'-\tau)\sec\vartheta}\sec\vartheta\, d\tau \qquad (\vartheta < \pi/2) \qquad (2)$$

$$I(\tau,\vartheta) = \int_0^\tau B(\tau')\ e^{-(\tau-\tau')\sec\vartheta}\sec\vartheta\, d\tau' \qquad (\vartheta > \pi/2) \qquad (3)$$

"The formal solution of (1) has the form

$$B(\tau) = g(\tau) + \int_0^\infty \Gamma(\tau,\tau')\ g(\tau')\ d\tau', \qquad (4)$$

where $\Gamma(\tau,\tau')$ is the resolvent kernel. This may be determined by the equation

$$\frac{\partial\Gamma}{\partial\tau} + \frac{\partial\Gamma}{\partial\tau'} = \Gamma(\tau,0)\,\Gamma(0,\tau'), \qquad (5)$$

which yields for $\tau' > \tau$

$$\Gamma(\tau,\tau') = \Phi(\tau'-\tau) + \int_0^\tau \Phi(x)\ \Phi(x+\tau'-\tau)\ dx \qquad (6)$$

$\Gamma(\tau,0)$ is denoted by $\Phi(\tau)$.

" $\Phi(\tau)$ is given by the integral equation

$$\Phi(\tau) = K(\tau) + \int_0^{\tau} K(\tau - \tau')\ \Phi(\tau')\ d\tau', \tag{7}$$

where

$$K(\tau) = \frac{\lambda}{2}\int_0^1 e^{-\tau/\eta}\ \varphi(\eta)\frac{d\eta}{\eta} \tag{8}$$

and...

$$\varphi(\eta) = 1 + \frac{\lambda}{2}\eta\varphi(\eta)\int_0^1 \varphi(\xi)\ \frac{d\xi}{\eta + \xi}. \tag{9}$$

Applying the Laplace transform

$$\int_0^{\infty} \Phi(\tau)\ e^{-m\tau}\ d\tau = \frac{1}{1 - \frac{\lambda}{2}\int_0^1 \varphi(\eta)\ \frac{d\eta}{1 + m\eta}} - 1$$

The inverse of the Laplace transform yields the following asymptotic formula for $\Phi(\tau)$ for large τ:

$$\Phi(\tau) = \frac{e^{-k\tau}}{\frac{\lambda}{2}\int_0^1 \varphi(\eta)\ \frac{\eta\, d\eta}{(1 - k\eta)^2}} \tag{12}$$

where

$$\frac{\lambda}{2k}\ \lg\frac{1 + k}{1 - k} = 1.$$

"From (10) it is possible to obtain exact and approximate formulas for $\bar{\Phi}(\tau)$....

"Thus the determination of the radiation field in a semi-infinite medium for arbitrary radiation sources reduces to finding the function $\Phi(\tau)$. If this function is known, then formula (6) gives the resolvent kernel $\Gamma(\tau, \gamma)$, formula (4) gives the function $B(\tau)$, and formulas (2) and (3) give the radiation intensity $I(\tau, \vartheta)$."

Three particular cases with different $g(\tau)$ are discussed.

Radiophysics

107. New Institute of Radiophysics and Electronics Opened in Siberian Branch of Academy of Sciences USSR

"Siberian Institute of Radiophysics and Electronics," by Yu. B. Rumer, Doctor of Physicomathematical Sciences, and G. V. Krivoshchekov, Moscow, Vestnik Akademii Nauk SSSR, No 10, Oct 57, pp 108-110

An Institute of Radiophysics and Electronics (Institut Radiofiziki i Elektroniki) has been opened under the Siberian Branch of the Academy of Sciences USSR. The institute was organized on the basis of the Division of Technical Physics (Otdel Tekhnicheskoy Fiziki) of the West Siberian Affiliate of the Academy of Sciences USSR.

Luminescence

[See Item No 27.]

XI. MISCELLANEOUS

108. Vacancies Available for Active and Corresponding Members of Siberian Branch of Academy of Sciences USSR

"From the Academy of Sciences USSR" (unsigned article), Moscow, Izvestiya, 28 Jan 58, p 4

Vacancies for the position of Active and Corresponding Members of the Siberian Branch, Academy of Sciences USSR, in the following fields are given: mathematics -- two Active and two Corresponding Members; physics -- one Active and three Corresponding Members; chemistry -- no Active and six Corresponding Members; geology and geography -- three Active and ten Corresponding Members; biology -- no Active and one Corresponding Member; mechanics -- two Active and two Corresponding Members; automatics -- no Active and one Corresponding Member; electrical engineering -- no Active and two Corresponding Members; heat Engineering -- no Active and one Corresponding Member; mining and metallurgy -- no Active and two Corresponding Members; economics and statistics -- no Active and two Corresponding Members.

All sponsoring organizations must have data on their candidates sent to the Presidium of the Academy of Sciences USSR, Moscow, Leninskiy prospekt, 14, no later than 15 March 1958.

109. Czechoslovak Academicians in Hungary

"Foreign Scientists Arrived in Hungary for Study Tour" (unsigned article), Budapest, Nepszabadsag, 12 Dec 57, p 1

Dionyz Ilkovic, Corresponding Member of the Czechoslovak Academy of Sciences, and Viliam Thurzo, Corresponding Member of the Slovak Academy of Sciences, arrived in Hungary for a study tour.

110. Czechoslovak Scientists Visiting Poland

"Delegation of Czechoslovak Academy of Sciences in Warsaw" (unsigned article), Warsaw, Trybuna Ludu, 11 Dec 57, p 2

On 10 December 1957, a delegation of the presidium of the Czechoslovak Academy of Sciences arrived in Warsaw. The delegation included Prof Vilem Laufberger, deputy chairman of the Czechoslovak Academy of Sciences; Prof Andrej Siracky, chairman of the Slovak Academy of Sciences; and Engr Miloslav Svoboda, representative of the foreign department of the Czechoslovak Academy of Sciences. This delegation has started talks with representatives of the Polish Academy of Sciences to establish a plan for scientific cooperation in 1958 between the interested academies.

111. Hungarian Academician in USSR

"Trips Abroad by Academicians" (unsigned article), Budapest, Nepszabadsag, 27 Nov 57, p 5

Laszlo Erdey, Academician, left for Moscow to attend a scientific conference.

112. Hungarian Academician in Poland

"Trips Abroad by Academicians" (unsigned article), Budapest, Nepszabadsag, 27 Nov 57, p 5

Rezso Bognar, Academician, went on a study tour to Poland.

113. Soviet Professor Visits Hungarian Central Physics Research Institute

"News" (unsigned article), Budapest, Nepszabadsag, 5 Dec 57, p 8

M. A. Markov, Soviet professor, visited the Central Physics Research Institute (Kozponti Fizikai Kutato Intezet) where he lectured on problems related to particle research.

114. Soviet Scientist Ends Visit to Slovakia

"News" (unsigned article), Bratislava, Praca, 30 Nov 57, p 2

Prof N. S. Arzhanikov, Soviet scientist, who was in Slovakia by invitation of the Czechoslovak Society for the Furthering of Scientific and Political Information, left Slovakia on 28 November 1957.

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