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CENTRAL INTELLIGENCE AGENCY

SCIENTIFIC INFORMATION REPORT



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PLEASE NOTE

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

SCIENTIFIC INFORMATION REPORT

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NOTE: Items in this report are numbered consecutively.

I. ASTRONOMY

1. Restricted Three Body Problem

"An Approximate Computation of the Ephemeris in a Restricted Three Body Problem," by B. M. Shchigolev, Chair of Celestial Mechanics and Gravimetry; Moscow, Vestnik Moskovskogo Universiteta, Seriya Matematiki, Mekhaniki, Astronomii, Fiziki, Khimii, No 5, 1958, pp 37-48

An attempt is made to find the motion of an asteroid under the gravitational pull of the Sun and Jupiter. Jupiter's motion is considered known from tabulated functions of time. The mass of the Sun is taken as unity, and the mass of the asteroid is neglected. The differential equations of the asteroid will have the form, the Sun's center taken as origin of coordinates:

$$\frac{d^2x}{dt^2} + \frac{k^2x}{r^3} = k^2m' \left(\frac{x' - x}{\Delta^3} - \frac{x'}{r'^3} \right)$$

and equations are similar for the two other coordinates. k^2 is Gauss' constant of gravitation, m' the mass of Jupiter, $r^2 = x^2 + y^2 + z^2$; $r'^2 = x'^2 + y'^2 + z'^2$, $\Delta^2 = (x - x')^2 + (y - y')^2 + (z - z')^2$.

The approximate analytic methods, in particular, the method connected with mean variations, were studied at the faculty of celestial mechanics of Moscow State University (N. Moiseyev and N. Reyn, Uspekhi astronomicheskikh nauk, sb. 3, Moscow, 1933; N. F. Reyn, DAN SSSR, 19, 1-2, 1938; N. D. Moiseyev, Trudy GAISH, 14, 1, Moscow, 1945).

A method of replacing a variable by a mean constant value is applied. This procedure differs from conventional methods in celestial mechanics. It consists in a certain simplification of the differential equations of motion, by substituting certain parts of the differential equations in such a way as to render them solvable in a finite form. In the above equations the nonlinear factors $1/r^3$, $1/r'^3$, and $1/\Delta^3$ involve difficulties. $1/r^3$ is replaced by the constant value of the half major axis of the osculating orbit. The substitution of other cubic factors is more complicated and is explained in detail.

II. BIOLOGY

2. Second International Conference on Peaceful Uses of Atomic Energy Held at Geneva in 1958 Discusses Biological Effects of Radiation

"Concerning the Biological Effects of Radiation," by A. V. Lebedinskiy; Moscow, Atomnaya Energiya, Vol 6, No 2, Feb 59, pp 187-199

The author briefly reviews and analyzes certain numbered reports presented at the Second International Conference on the Peaceful Uses of Atomic Energy at Geneva and outlines certain trends toward the solution of various problems of radiobiology. The major topics discussed are outlined as follows.

1. The study of the phenomena of radiation biology from the biophysical and biochemical aspects with a consideration of the most outstanding achievements in the study of the initial mechanisms of radiation effects, especially with respect to proteins and nucleic acids.
2. The study of the phenomena of radiation biology from the cellular aspect with fundamental considerations of radiation-induced changes in the cellular microstructures, and organoids.
3. The study of radiation biology from the aspect of the whole organism with a consideration of the changes brought about by the participation of the endocrine and nervous systems.
4. The study of the effects of radiation on biological species and the ensuing changes in the offspring of irradiated animals, both as genetic changes and as changes in embryos.
5. The study of chemical protection from radiation and an analysis of new trends and methods in antiradiation therapy and prophylaxis.

The author gives certain general theoretical conclusions and comments that many of these problems will have to be solved on an international scientific cooperation level.

3. Modifiability of Potato Virus

"Directed Modifiability of X-Virus of Potatoes in Mixed Infection With the Tobacco Mosaic Virus," by K. S. Sukhov and O. S. Kapitsa, Tr. In-ta Genet. AN SSSR, (Works of the Institute of Genetics, Academy of Sciences USSR), No 23, 1956, pp 283-295 (from Referativnyy Zhurnal -- Biologiya, No 11, 10 Jun 1958, Abstract No 47771, by G. M. Razvyazkina)

CPYRGHT

"A mixed infection produced by a strain of X-virus and the cyphomandra strain VM was studied. Young tobacco leaves were infected with a mixture of both strains. As a result, yellow-colored mosaic, considerably more pronounced than after infection with only the strain, appears on the growing tobacco leaves. Inclusions belonging to both strains -- amorphous X-bodies characteristic of the X-virus strain and hexagonal crystals characteristic of the cyphomandra strain-- are frequently observed in the same cells of the mosaic leaves. In the initial period, of combination of both viruses, the inclusions of the cyphomandra strain maintain their typical configurations. The X-bodies are considerably enlarged, and the number of them increases, which attests to the increased concentration of X-virus following combined infection with tobacco mosaic virus. Later changes also cover inclusions of the cyphomandra strain. Analogous results were obtained when the cyphomandra strain was replaced by the thermotolerant strain. The authors suggest that the causative modifiability is a mutual metabolic effect, to which different viruses proliferating in the same cells are subjected."

4. New Major Agricultural Institute Opened in Velikiye Luki, Pskovskaya Oblast

"A Faculty for the Advanced Training of Specialists," by I. F. Sutormin, director, Velikiye Luki Agricultural Institute, and M. I. Shevchenko, dean of the faculty; Moscow, Zashchita Rasteniy ot Vrediteley i Bolezney, No 5, Sep/Oct 58, p 58

The Leningrad Institute of Applied Zoology and Phytopathology (IZIF) and the Smolensk Zootechnical Institute have been transferred to Velikiye Luki, Pskovskaya Oblast, and on the base of these institutes the Velikiye Luki Agricultural Institute (Velikolukovskiy Sel'skokhozyaystvennyy Institut) was established. The new institute will have three faculties: the Zootechnical Faculty, the Agronomy Faculty, and the Faculty for the Advanced Training of Specialists in Plant Protection.

At the beginning of the academic studies (1958) the institute had 1,125 students, of whom 550 were enrolled in the Zootechnical Faculty, 175 in the Agronomy Faculty, and 500 in the Faculty for the Advanced Training of Specialists in Plant Protection..

The institute has 21 chairs situated in four large buildings; attached to the institute is a farm with 1,103 head of cattle, 1,692 pigs, and 136 horses.

During the 1958-59 academic year, 250 persons will graduate from the institute's Faculty for the Advanced Training of Specialists in Plant Protection.

5. Vitamin B₁₂ Content of Milk in Latvia

"Vitamin B₁₂ Content of Milk," by S. Ya. Laganovskiy, Doklady Vsesoyuznoy Konferentsii po Molochnoy Delu (Reports of the All-Union Conference on Milk Industry), Moscow, Sel'khozgiz, 1958, 421-425; (from Referativnyy Zhurnal -- Khimiya, Biologicheskaya Khimiya, No 2, 25 Jan 59, p 96, Abstract No 1849)

CPYRGHT

"After testing various milk samples in the Latvian SSR, it was found that winter milk contained more vitamin B₁₂ (average of 4.4 gamma/liter) than summer milk (average of 3.9 gamma/liter). Supplementing cattle feed by cobalt and other mineral substances increases the vitamin B₁₂ content in milk."

6. Phosphate Participation in Phosphorylation in Algae Photosynthesis

"Effect of Light on Phosphate Transformations in Plants," by S. S. Baslavskaya and G. Veber, Moscow State University imeni M. V. Lomonosov; Moscow, Doklady Akademii Nauk SSSR, Vol 124, No 1, Jan/ Feb 59, pp 227-230

The aim of this' research was to discover whether or not the addition of phosphorus to algae cultures in short-term experiments would cause changes in the phosphorus metabolism of plants and whether these changes would influence photosynthesis.

The authors present data in the following form: the effect of light on P^{32} absorption and its content in organic compounds -- total of soluble and insoluble P^{32} in trichloroacetic acid; the effect of light on P^{32} level in organic phosphates soluble and insoluble in trichloroacetic acid; P^{32} content of organic compounds in percent of total P^{32} ; and P^{32} content in various fractions of organic compounds in percent of total organic P^{32} (under dark and light conditions).

Results indicate that light accelerates the admission of phosphorus into plants and its inclusion into organic compounds even when the plant exposure to light was short (1-5 minutes). The content of phosphorylated compounds, both soluble and insoluble in trichloroacetic acid, increases depending on the plant, its general condition and growth, and the duration of exposure to light.

These results confirm the positive effect of phosphorus on algae photosynthesis in short-term experiments. The effect of phosphorus may be explained by its participation in the formation of a number of phosphorylated compounds which, in their turn, participate in processes of fixation and reduction of CO_2 and in the formation of intermediate products and other photosynthetic reactions.

7. Partial Reversibility of Cytogenetic Injuries Caused by Gamma Rays

"On the Reversibility of Cytogenetic Radiation Injuries," by N. V. Luchnik and L. S. Tsarapkin, Institute of Biology of the Ural Affiliate Academy of Sciences USSR; Moscow, Doklady Akademii Nauk SSSR, Vol 124, No 1 Jan/Feb 59, pp 213-216

This research concerns the possibility of partially reversing radiation injuries to chromosomes.

Pea seeds and seedlings, grown in the dark at $23^{\circ}C$, were irradiated with gamma rays of radioactive cobalt, and at definite mitotic periods were analyzed for chromosome fragmentations and other types of aberrations. A neutral 0.01 M cysteine solution was used as antiradiation "protective substance."

Results indicate that, during the passage of ionizing radiations through chromosomes, local changes occur, and these changes are capable, at definite periods and under appropriate conditions, of causing chromosome fragmentation and other types of aberrations. Probably, the development of these changes depends on the general condition of the cell, which may vary greatly, and on a number of other factors, including cumulative radiation injuries to all the protoplasm. With this theory it is easy to explain significant differences in radiation injuries to chromosomes inflicted at various periods

of their mitosis and differences in antiradiation effects of substances administered before or after irradiation. It also eliminates the necessity for choosing between the two theories, i.e., the theory of local effect of ionizing radiation particles on chromosomes and the theory of their effect through changes in cell metabolism.

The mechanism for hard ionizing radiation may differ, the author concludes.

8. Sorption Mechanisms of Radioactive Strontium in Soils

"Strontium (Sr^{90}) Sorption in Soils," by N. A. Timofeyeva and A. A. Titlyanova, Ural Affiliate, Academy of Sciences USSR; Moscow, Izvestiya Akademii Nauk SSR, Seriya Biologicheskaya, No. 1, Jan/Feb 59, pp 111-117

The aim of this research was to determine sorption mechanisms of trace amounts of aqueous strontium solutions in soils and to test the desorption of strontium under dynamic conditions. Solutions used were distilled water, calcium nitrate, and lake water.

Results confirm that strontium-90 is sorbed by all soils and that the mechanism of sorption depends on ion-exchange principles. Furthermore, the degree of absorption by soils and its desorption from soils depends on the quantitative relationships between the exchangeable cations of the soil-absorbing complex and of the soil solution.

The authors conclude that on the whole data suggest that the migration of strontium in soils is effected through ion-exchange reactions (absorption-desorption) and that strontium migrates both vertically and horizontally.

III. CHEMISTRY

Analytical Chemistry

[For information on analytical chemistry, see Item No 23.]

Fuels and Propellants

9. The Flame Temperature of Liquid Fuel Rockets

"The Flame Temperature of a Liquid-Fuel Rocket Engine, Part 1," by N. N. Sobolev, M. M. Belousov, G. M. Rodin, A. G. Sviridov, N. G. Skorobogatov, and F. S. Fayzullov, Physics Institute imeni P. N. Lebedev, Academy of Sciences USSR; Moscow-Leningrad, Zhurnal Tekhnicheskoy Fiziki, Vol 29, No 1, Jan 59, pp 27-36

It was established that the emission spectra of flames of rocket engines operating on "tonka" (50% of xylidine + 50% of triethylamine) + nitric acid or kerosene + nitric acid are continuous in the visible light region of the spectrum and that the energy distribution of the spectrum can be described by Wien's formula. The absorption capacity of the flames was found to increase from the red to the violet end of the spectrum and to decrease with increased coefficients of oxidant excess (α). The temperatures of the flame were measured by the color and brightness methods under different conditions of operation of the engine. It was found that at values of $\bar{\alpha}$ corresponding to ratios close to the stoichiometric the observed temperature corresponds to that calculated for equilibrium flow. The temperature of the gases in the combustion chamber was also measured.

"The Flame Temperature of a Liquid-Fuel Rocket Engine, Part 2," by N. N. Sobolev, V. F. Kitayeva, G. M. Rodin, F. S. Fayzullov, and A. I. Fedorov, Physics Institute imeni P. N. Lebedev, Academy of Sciences USSR; Moscow-Leningrad, Zhurnal Tekhnicheskoy Fiziki, Vol 29, No 1, Jan 59, pp 37-44

The emission spectrum of the flame of a rocket operating on kerosene + liquid oxygen was determined in the visible light range. It was established that this spectrum is continuous and that the absorption capacity is close to unity. The color temperature was measured under different operational conditions. It was found that when the composition corresponds to the stoichiometric the experimentally determined temperature values are close to the theoretical.

The continuous flame spectra are emitted by carbon particles.

On the basis of the results obtained, one may conclude that the color and spectral line reversal methods of measuring flame temperatures should be applied only at compositions close to the stoichiometric. As far as further development of optical flame pyrometry is concerned, the use of the long-wave region of the spectrum appears promising. As already pointed out by A. Ye. Kadyshovich in a report presented at the March 1957 Conference on Optical Flame Pyrometry, spectrometry of radiation in the infrared region for determining average mass temperatures is advisable. One should also attempt to develop methods for measuring flame temperatures with the use of waves of the centimeter and millimeter ranges: emission of waves of these lengths by solid particles and alkali metal salts contained in flames ought to be strong enough to make possible recording by new radiophysical methods that have become available for this purpose as a result of progress made in this field.

10. The Pressure in Detonation Waves

"Investigation of the Pressure in Detonation Waves by the Method of Deformation of Crusher Cones," by S. M. Kogarko; Moscow-Leningrad, Zhurnal Tekhnicheskoy Fiziki, Vol 29, No 1, Jan 59, pp 128-140

On the examples of detonations of a hydrogen-air mixture of critical composition and of methane-air mixtures in a tube of a large diameter (305 mm), it could be shown experimentally that a reaction zone in which the pressure is higher than that of the reaction products at the Jouguet point exists in detonation waves. The measured numerical values of rebound pressure in the detonation of methane-air mixtures of critical composition are in good agreement with values calculated on the basis of present-day theory, from which it follows that the pressure accompanying a detonation in a shock wave must be approximately twice as high as that of the reaction products at the Jouguet point. The experimentally measured pressure in detonations of methane-air and benzene-air mixtures under the conditions studied was found to be approximately twice as high as that of reaction products at the Jouguet point. The crusher device is not suitable for measuring high pressures that develop during the wave detonation of fuel-oxygen mixtures: a method which will make it possible to record the pressure within a shorter period of time must be applied.

[For additional information on fuels and propellants, see Items No 14 and 15.]

Industrial Chemistry

11. Prospects of the Development of the Chemical Industry in the Armenian SSR Under the Current Seven-Year Plan

"The Chemical Industry of the Republic Develops," by E. Ter-Gazaryan, Candidate of Technical Sciences; Yerevan, Kommunist, Vol 25, No 272 (7439), 19 Nov 58

At present the production of synthetic materials in the Armenian SSR is based principally on the conversion of acetylene derived from calcium carbide. The great amount of electric power required for the production of calcium carbide and the restricted availability of power have hitherto formed an obstacle to the production of synthetic materials in Armenia. The decision of the government to construct a pipeline for the transportation of natural gas of the Karadag Deposit to Armenia opens up possibilities of producing acetylene there by the oxidative cracking of methane derived from natural gas.

The unlimited possibilities of producing acetylene from methane and the resulting cheap supply of acetylene assure a considerable expansion of the production at existing plants and make possible the organization of new enterprises of the organic synthetic industry under very favorable technical and economic conditions. Under the circumstances, the planned expansion of the production of synthetic materials on the basis of acetylene must be regarded as sound.

However, the outlined program of the development of the industry of organic synthesis in the Armenian SSR does not assure production in Armenia of the total quantity or even a considerable part of the chemical products that are to be used by the converting industry now or in the future. To give a few examples, the production of automobile tires is still based on imported rubber, a considerable part of electrical insulation materials for the cable industry and electrical engineering industry have to be imported into the republic, the production of capron cord is based on caprolactam produced elsewhere, and the great demand for plastics and resins for the instrument-making and light industries will still have to be satisfied by supplying raw materials produced in distant regions.

Although acetylene may serve as a crude material for a number of materials the production of which is to be organized, not all possible syntheses based on acetylene can be carried out with adequate technical and economic efficiency. For this reason, new types of raw materials derived from petroleum must be used in Armenia. The absence in the Armenian SSR of petroleum

fields and petroleum conversion enterprises cannot form a serious obstacle to the use of petrochemical materials, because the transportation into the republic of petroleum crude materials of uniform quality will definitely be more economical than the importation of a large quantity of diverse synthetic products.

The Council of National Economy, the Gosplan, and the scientific research organizations must take all the necessary measures to expand the raw material basis of the chemical industry along the lines indicated.

Novel technological methods must be developed to achieve the ends envisaged.

New processes and new types of production must not be based on technological schemes applied at present or the production facilities that are available at chemical plants which are already in operation. The practice of installing at chemical plants a large quantity of reserve equipment is out of date. Even in the colder regions of the country, most of the operating equipment can be installed out of doors. If this procedure is followed, only small buildings will have to be erected to accommodate control panels.

[SIR Note: E. Ter-Gazeryan is director of the new Scientific Research Planning Institute under the Armenian Sovnarkhoz; cf. Kommunist, Yerevan, 11 November 1958.]

Inorganic Chemistry

12. Tasks of Inorganic Chemists Under the Seven-Year Plan

"Toward the 21st Congress of the CPSU" (unsigned article); Moscow, Zhurnal Neorganicheskoy Khimii, Vol 4, No 1, Jan 59, pp 3-4

The production of nickel, magnesium, titanium, silicon, germanium, and other rare elements is being increased considerably.

The 1959-1965 Seven-Year Plan for the development of the national economy involves a number of important problems that have to be solved by inorganic chemists.

Particular attention must be paid to the development of plastics which are capable of withstanding high temperatures of the order of 800-1,000°. No polymers that contain carbon atoms are capable of withstanding these temperatures. Nevertheless, a number of branches of the industry urgently require heat-resistant plastics and fabrics. For instance, the branch of industry that builds electrical machines requires high-temperature insulation materials. Asbestos and mica cannot satisfy the requirements of this type of production.

Inorganic chemists must develop new materials which are suitable for use in aggressive media and at high temperatures. One may indicate several ways in which this problem can be solved.

One of the ways is development of new types of glass. Glass fibers made of ordinary silicon dioxide glasses are being produced at present and applied in technology; furthermore, vitreous masses can be also obtained from a great number of other substances with high melting points. One can presumably use polymers of boron compounds for the production of such vitreous masses; it is possible that polymerizable heteropolycompounds obtained in the form of melts will be useful for this purpose.

In the attempts to develop plastic inorganic materials one may also investigate the possibilities of using metals and metal alloys. These can be obtained in the form of very thin fibers and of fabrics woven from these fibers.

Promising possibilities exist as far as the synthesis and investigation of compounds of silicon and germanium are concerned. These elements are analagous to carbon and are capable of forming chain molecules. It is probable that among compounds of these elements polymers with the necessary characteristics will be found.

It is obvious that one cannot search for new materials blindly, without being guided by theoretical concepts. In addition to the solution of practical problems, one must do theoretical work on the polymerization of inorganic molecules and on the conditions under which polymerization reactions will take the desired direction and may be accelerated.

Extensive work will have to be done on the production and regeneration of catalysts. This applies particularly to catalysts consisting of platinum metals.

Work pertaining to the production of nuclear fuel and its recovery as well as to the utilization of by-products derived from nuclear fuel is also a part of the responsibilities of inorganic chemists.

Semiconductor materials are of primary importance in present-day technology. Particular attention in the work done by inorganic chemists must be paid to the development of new semiconductor materials and to methods for their purification.

The so-called rare elements, and the alloys and compounds of rare elements are used for the purposes mentioned above and for many other applications in the national economy. One of the most important and urgent tasks of inorganic chemistry during the coming years will be investigation of the chemistry of a number of rare elements. Development of methods for the separation and purification of these elements and research on new applications for them will form an essential part of the work that has to be done.

Many problems in regard to the full utilization of mineral raw materials remain unsolved. Problems of this type have been successfully solved by inorganic chemical research in the past. They have become particularly urgent at present in connection with the forthcoming utilization of new types of raw material produced in Eastern Siberia, the Far East, Kazakhstan, Turkmenistan, and other regions of the USSR.

USSR inorganic chemists have done successful work in the fields of crystal chemistry, the physical chemistry of the vitreous state, physico-chemical analysis of fusions and solutions, the chemistry of heteropoly-compounds, the chemistry of complex compounds, and other fields. The advances made hitherto form a basis for the assumption that the current problems enumerated above will be solved.

13. Synthesis and Properties of Silicon Nitride

"The Thermal Stability of Silicon Nitride," by I. M. Kuleshov;
Moscow, Zhurnal Neorganicheskoy Khimii, Vol 4, No 2, Feb 59,
pp 488-491

Silicon nitride of the composition $Si_3 N_4$ was prepared by prolonged heating (for 9 hours) of silicon powder in a stream of purified nitrogen at an elevated temperature (1,400-1,450°). The thermal stability of silicon nitride was investigated. It was found that this compound is stable under ordinary conditions in the air, water vapor, and an atmosphere of chlorine and hydrogen. Active metals (magnesium and aluminum) have no effect on this compound. At temperatures above 1,000° noticeable decomposition of the compound takes place. Silicon nitride can be satisfactorily molded at a pressure of 60-80 kg per mm^2 . It sinters at 1,500° in a nitrogen atmosphere. Products made of silicon nitride in this manner are harder than glass.

14. Synthesis of Lithium Borohydride

"The Effect of the Temperature on the Reaction of Lithium Hydride With the Ether Adduct of Boron Trifluoride," by Ye. M. Fedneva; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 4, No 2, Feb 59, pp 286-293

In an earlier communication (V. I. Mikheyeva and Ye. M. Fedneva, Izvestiya Akademii Nauk SSSR, Otdeleniye Khimicheskikh Nauk, No 8, 1956, p 902) the reaction in ether between lithium hydride and the ether adduct of BF_3 at different ratios of the interacting substances was discussed on the basis of the experimental results obtained. In the present work the effect of the temperature on the reaction in question was investigated. The data that have been published in the literature in regard to the effect of the temperature on the reaction between lithium hydride and the ether adduct of BF_3 are sketchy. It has been found in the experimental work described in this instance that the yield of LiBH_4 increases with decreasing temperatures. The highest yield is obtained at $3-10^\circ$. The maximum yield of diborane is obtained at $10-25^\circ$. A method whereby lithium borohydride is obtained with a yield up to 46% is described.

15. The Synthesis of Diborane by the Reaction Between Lithium Hydride and the Ether Adduct of Boron Trifluoride

"Activation of the Reaction of Lithium Hydride With the Ether Adduct of Boron Trifluoride," by Ye. M. Fedneva and N. N. Mal'tseva; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 4, No 2, Feb 59, pp 289-293

A simple and convenient method for the activation with halogens (iodine and bromine) of the reaction between lithium hydride and the ether adduct of BF_3 has been developed. This method makes it possible to prepare diborane by a reaction which proceeds without an induction period, to regulate the course of the reaction, and to carry out the reaction using benzene, toluene, or xylene as a solvent. The conditions for the preparation of diborane in a benzene solution in the presence of iodine or bromine were investigated. It was established that for the complete conversion of lithium hydride an excess of the ether adduct of BF_3 up to 20% is necessary and that the optimum temperature is 35° . The possible mechanism of the reaction of lithium hydride with the ether adduct of BF_3 in benzene in the presence of activators (i.e., iodine or bromine) is discussed.

16. S. A. Voznesenskiy's Work in the Fields of Applied Radiochemistry, Water Treatment, and Fluorocarbon Chemistry

"S. A. Voznesenskiy (1892-1958)," by K. V. Astakhov, M. M. Dubinin, K. V. Chmutov, and B. V. Nekrasov; Moscow, Zhurnal Fizicheskoy Khimii, Vol 33, No 1, Jan 59, pp 234-237

Prof S. A. Voznesenskiy, Doctor of Chemical Sciences, died on 6 August 1958. He was a prominent physical chemist, theoretician, and experimental scientist and an outstanding instructor of inorganic chemistry. As a student, Voznesenskiy participated in research done at Prof N. A. Shilov's laboratory at the Moscow Higher Technical School. He worked on the dynamic activity of carbon and developed methods for testing the gas mask designed by N. D. Zelinskiy. In 1921 Voznesenskiy became instructor at the Moscow Higher Technical School's Chair of Physical Chemistry, which was headed at that time by N. A. Shilov. In 1927 Voznesenskiy became a docent at the Chair of Colloid Chemistry and in 1929 was appointed professor and head of the Chair of Analytical Chemistry at the Moscow Higher Technical School. After Shilov's death in 1930, he became head of the Chair of Inorganic Chemistry. In 1932, the Chemical Faculty of the Moscow Higher Technical School was reorganized into the Military Academy of Chemical Defense. Voznesenskiy remained professor and head of the Chair of Inorganic Chemistry at the Military Academy of Chemical Defense.

During 1921-1941 Voznesenskiy directed the scientific work conducted at the water purification laboratory of the Vodgeo Institute. In 1955, he became professor and head of a chair at the Ural Polytechnic Institute. The scientific research work done by Voznesenskiy was concentrated in the fields of physical, colloid, and inorganic chemistry. He was interested in the economically important problems of the purification of industrial waste waters. As a result of theoretical and laboratory investigations carried out by Voznesenskiy, installations for the purification and decontamination of waste waters were constructed at many USSR enterprises on the basis of methods developed by him.

Voznesenskiy was one of the first in the USSR to recognize the importance of fluoroorganic compounds. Experimental work done by him led to the compilation by him of the monograph Khimiya Ftora (The Chemistry of Fluorine), which became a frequently used manual after World War II, when the importance of fluoroorganic compounds was generally realized. The same applies to his monograph Vnutrikompleksnyye Soyedineniya (Inner-Complex Compounds). The results of Voznesenskiy's research on interphase potentials formed a contribution to the formulation of concepts in regard to boundary potentials. The experimental investigations of the adsorption of vapors from air streams conducted at Shilov's laboratory became the basis of the formulation of a theory of the dynamic activity of layers of adsorbents; they were of fundamental importance for the development of the theory of the action of gas masks filled with carbon. During recent years Voznesenskiy was in charge of a number of important investigations in the field of applied radiochemistry.

[SIR Note: A list of 65 publications and reports by Voznesenskiy follows the review of his activity. The titles listed are grouped under the headings of Inorganic Chemistry, Physical and Colloid Chemistry, and Water Technology. Among the reports and articles listed are the following: "Solubility of Inorganic Salts in Organic Solvents and in Mixtures of Organic Solvents with Water," Zhurnal Neorganicheskoy Khimii, Vol 2, No 4, 1957; "The Adsorption of Radioactive Isotopes by Aluminum Hydroxide," Zhurnal Neorganicheskoy Khimii, Vol 3, No 1, 1958; "Effect of Nonaqueous Solvents on the Adsorption of Radioactive Microcomponents by a Number of Solid Adsorbents," Nauchnyye Doklady Vysshey Shkoly-Khimiya i Khimicheskaya Tekhnologiya, No 3, 1958; "The Electrochemistry of Ion-Exchange Resins" (report prepared in 1944); "Ion Exchange in Highly Concentrated Salt Solutions" (report prepared in 1943); "Adsorption of the Uranyl Ion From Aqueous Solutions by a Cation-Exchange - Sulfonic Acid Phenol-Formaldehyde Resin" (report prepared in 1944); and Ochistka i Opresneniye Vody Elektrolizom (Purification and Desalination of Water by Electrolysis), a treatise published by the Vodgeo Institute in 1933.]

Isotopes

17. Diffusion Cascade for the Separation of Isotopes

"A Separation Cascade Consisting of Diffusion Columns," by R. Ya. Kucherov and G. A. Tevzadze; Moscow, Atomnaya Energiya, Vol 6, No 2, Feb 59, pp 207-208

The design and operation of a laboratory diffusion cascade for the separation of isotopes are described. The results obtained in the separation of Ne²², Ar³⁶, and Cl³ (in the form of methane) are tabulated.

[For additional information on isotopes, see item No 27.]

Nuclear Fuels and Reactor Construction Materials

18. Problems of the Metallurgy of Uranium and of Metals Used in the Construction of Nuclear Reactors

"Problems of the Metallurgy of Uranium and of [Reactor] Construction Metals," by G. A. Meyerson; Moscow, Atomnaya Energiya, Vol 6, No 2, Feb 59, pp 129-134

On the basis of non-USSR reports presented at the Second International Conference on Peaceful Uses of Nuclear Energy (Geneva, 1958) problems are considered pertaining to the production of uranium (reductive smelting,

casting, treatment by the application of pressure, and powder metallurgy), the metallurgy of zirconium (new data on technological flow sheets, the quality of zirconium sponge, and the dimensions of ingots), production of new reactor construction metals, i.e., niobium and vanadium (comparison of different methods of production including the metallothermic, the vacuum carbothermic, and electrolytic refining, and comparison of the quality of the products obtained when these methods are used), the production of thin-walled beryllium tubes to be used as sheathes for fuel elements, the application of zirconium hydride as a moderator, and the use of zirconium-uranium-hydrogen alloy in the cores of fuel elements.

It is pointed out that in the US and in England at present UF_4 is reduced with magnesium rather than calcium.

19. High-Melting Nuclear Fuels

"High-Melting Fuel Materials and Elements," by G. A. Meyerson; Moscow, Atomnaya Energiya, Vol 6, No 2, Feb 59, pp 135-139

On the basis of non-USSR reports presented at the Second International Conference on Peaceful Uses of Nuclear Energy (Geneva, 1958) problems are discussed pertaining to the production and application of fuel elements with cores consisting of uranium dioxide held in tubular or platelike sheathes, the application of carbides and oxides of uranium and thorium in gas-cooled high-temperature reactors (reactors in which temperatures up to 1,000°C are encountered), and the use of metallic thorium in fuel elements.

20. Production of Uranium Tetrafluoride by the Action of Gaseous Hydrogen Fluoride on Uranium Dioxide

"Application of Fluorination With Gaseous Hydrogen Fluoride in the Production of Uranium Tetrafluoride," by Yu. V. Gagarinskiy; Moscow, Atomnaya Energiya, Vol 6, No 2, Feb 59, pp 124-128

On the basis of non-USSR reports presented at the Second International Conference on Peaceful Uses of Nuclear Energy (Geneva, 1958) methods for the production of UF_4 by the action of gaseous HF on UO_2 at elevated temperatures are discussed. Methods applied industrially as well as those being developed in laboratories are taken into consideration. The following conclusions are made.

At present fluorination of uranium dioxide with gaseous hydrogen fluoride is carried out in horizontal reactors equipped with endless screw agitators.

Methods for the fluorination of reduced uranium concentrates by the fluidized solids method (leading to the production of UF_6) and for the fluorination of agglomerated uranium dioxide moving countercurrently to hydrogen fluoride in vertical reactors (leading to the production of metallic uranium) have been brought to the stage of industrial application. The second of the two methods mentioned is regarded as more promising.

21. Treatment of Low-Grade Uranium Ores

"Industrial Methods for the Refining of Low-Grade Uranium Ores,"
by G. Ye. Kaplan, V. N. Laskorin, and V. V. Nevskiy; Moscow,
Atomnaya Energiya, Vol 6, No 2, Feb 59, pp 113-123

On the basis of a review of non-USSR work on the subject, the following conclusions are drawn.

During recent years considerable progress has been made in the technology of the treatment of uranium ores. More than 70% of all uranium is produced at present by a recently developed method for the extraction of uranium from solutions by means of adsorption on resins. Extraction of uranium by liquid extracting agents is also being applied on an extensive scale, particularly at enterprises which apply dissolution of uranium with acids.

Ordinary methods of mechanical concentration (by the specific gravity method, flotation, and other methods) play a relatively minor role. However, in connection with the treatment of an increased percentage of complex and low-grade ores, the importance of mechanical enrichment and mechanical treatment of uranium ores increases. Of particular advantage is radiometric enrichment, which uses the radioactivity of uranium minerals for their separation from the accompanying rocks.

A bibliography consisting of 28 references (none of them USSR) is appended to the article.

22. The Dissociation Constant of the $UO_2 (CO_3)_4^{4-}$ Ion

"The Dissociation Constant of the $UO_2 (CO_3)_4^{4-}$ Ions by A. Ye. Klygin and I. D. Smirnova; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 4, No 1, Jan 59, pp 42-45

The solubility of the uranyl salt of hydroxyquiniline in solutions of ammonium carbonate of an ionic strength of 1.0 at a temperature of 25° was determined. The composition and dissociation constant of the complex ion $UO_2 (CO_3)_4^{4-}$ were determined. The dissociation constant was found to be $(1.7 \pm 0.6) \cdot 10^{-23}$ at 25°. This value differs from the approximate value (5×10^{-19}) determined earlier by a factor of approximately 3×10^4 .

23. Extraction of Inorganic Elements With Solvents

"Application of Extraction in Inorganic Analysis," by A. K. Babko and F. G. Zharovskiy; Moscow, Zhurnal Analiticheskoy Khimii, Vol 25, No 1, Jan 59, pp 42-52

The subject of the separation and isolation of inorganic elements by extraction with organic solvents in the form of inorganic salts or compounds with organic substances is reviewed. Data on elements of importance as nuclear fuels (uranium and thorium) and as reactor construction materials (e. g., zirconium) are given. A table listing information on the extractability of 36 elements indicates the compounds in the form of which these elements can be extracted. A bibliography consisting of 166 references (80 of them USSR) follows the article.

24. The System $HF - NbF_5 - H_2O$

"Investigation of Solubilities and Hydrolysis in the System $HF - NbF_5 - H_2O$," by I. S. Nikolayev and Ya. A. Buslayev; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 4, No 1, Jan 59, pp 205-212

Niobium pentafluoride (NbF_5) was synthesized with the use of different fluorinating agents including ClF_3 . The system $HF - NbF_5 - H_2O$ (20° isotherm) was investigated by the method of isothermic dissolution within the range of 0 - 100% of HF. The existence of solid phases of the composition $Nb_2O_5 \cdot 2H_2O$; $HNb_2F_{11} \cdot 4H_2O$; $HNbF_6 \cdot H_2O$; and NbF_5 was established. The investigated solubility isotherm is of the type having an initial rectilinear section which made it possible to determine the composition of the chemical compound present in a saturated solution and indicated that this composition corresponds to H_2NbOF_5 . Supplementary investigation of the solutions by physicochemical methods of analysis also indicated a predominant formation of a compound of this composition.

25. Potassium Hexanitronickelates of Rare-Earth Metals

"Mixed Potassium-Lanthanum Hexanitronickelates, Part 1," by I. V. Tananayev and M. D. Lyutaya; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 4, No 1, Jan 59, pp 97-102

As distinguished from ferrocyanides, hexanitronickelates are relatively well soluble in water. Nevertheless, some of them can be precipitated when an excess of the reagent (usually $K_4[Ni(NO_2)_6]$) is used. Separation of metals in the form of their hexanitronickelates is of advantage under the circumstances, because it can be carried out in a wider range of concentrations of the metals being separated. The hexanitronickelates of rare-earth metals are being investigated from the standpoint of the possibilities of using them to separate these metals.

The solubilities in the system $La(NO_3)_3 - K_4La[Ni(NO_2)_6] - H_2O$ were investigated at 25°. It was found that, as the concentration of $K_4[Ni(NO_2)_6]$ in the system increases, three different solid phases are formed in succession: $K_6La_2[Ni(NO_2)_6]_3$; $K_{21}La_5[Ni(NO_2)_6]_9 \cdot H_2O$; and $K_5La [Ni(NO_2)_6]_2 \cdot H_2O$.

The existence of these three salts as individual entities was confirmed by the thermographic method. The solubilities of $K_5La [Ni(NO_2)_6]_2 \cdot H_2O$ in KNO_2 solutions at concentrations of 1-7 mols of KNO per liter were determined. A pronounced salting-out effect accompanied by conversion of the initial solid phase into $K_6La_2 [Ni(NO_2)_6]_3$ was observed.

"Mixed Hexanitronickelates of Praseodymium and Neodymium, Part 2," by I. V. Tananayev and M. D. Lyutaya; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 4, No 1, Jan 59, pp 103-109

The solubilities in the systems $Pr(NO_3)_3 - K_4 [Ni(NO_2)_6] \cdot H_2O - H_2O$ and $Nd(NO_3)_3 - K_4 [Ni(NO_2)_6] - H_2O$ at 25° were investigated. It was established that, as the concentration of $K_4 [Ni(NO_2)_6]$ in the system increases, two different solid phases are formed, namely $K_{21}M_5 [Ni(NO_2)_6]_9 \cdot H_2O$ and $K_5M [Ni(NO_2)_6]_2$, where $M = Pr$ or Nd . Both phases were investigated analytically and thermographically. The solubilities of $K_5M [Ni(NO_2)_6]$ in KNO_2 solutions were investigated in the concentration range of 1-7 mols of KNO_2 per liter. It was established that the initial solid phase is transformed into $K_{21}M_5 [Ni(NO_2)_6]_9 \cdot H_2O$.

26. The Hexanitronickelates of Rare-Earth Elements

"Hexanitronickelates of Samarium, Yttrium, and Ytterbium," by I. V. Tananayev and M. D. Lyutaya; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 4, No 2, Feb 59, pp 457-464

The solubilities at 25° in systems consisting of rare-earth element nitrates, potassium hexanitronickelate, and water were investigated. The solid phases which precipitated were isolated and investigated. These phases were found to correspond to a number of complex potassium hexanitronickelates of the rare-earth elements in question. The composition of the complex compounds isolated is given.

27. Separation of Hydrogen Isotopes in the USSR by the Distillation of Liquid Hydrogen

"Progress in Distillation Technology," by M. E. Aerov, Doctor of Technical Sciences, and V. A. Malyusov, Candidate of Technical Sciences; Moscow, Khimicheskaya Nauka i Promyshlennost', Vol 3, No 6, 1958 (Jan 59), pp 736-745

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"Particular attention is paid at present to the production of deuterium by the rectification of liquid hydrogen, because this method is regarded as being potentially of greater advantage from the economic standpoint than other known methods. In addition to the investigation of processes for the separation of hydrogen isotopes by distillation with the use of laboratory columns, experimental and industrial installations for the rectification of liquid hydrogen are being built in France, Western Germany, the US, and India. The greatest progress in the development of this complicated method has apparently been made in the USSR, where an industrial installation [for the separation of hydrogen isotopes by the rectification of liquid hydrogen] has already been in operation for a long time (cf. I. V. Kurchatov, Pravda, 28 Feb 1958)."

28. Critical Heat Fluxes in the Forced Flow of Water

"Generalization of Experimental Data on Critical Heat Fluxes ["Loads"] in the Forced Circulation of Sub-Heated Water" by V. A. Zenkevich; Moscow, Atomnaya Energiya, Vol 6, No 2, Feb 59, pp 169-173

It is predicted on theoretical grounds that the equation proposed earlier by the authors (Atomnaya Energiya, Vol 3, 1957, p 159) can be simplified for applications at low pressures. This equation was proposed on the basis of a generalization of experimental data pertaining to

critical heat loads during forced circulation of water heated to a point below boiling in the pressure range of 100-210 atmospheres absolute. The possibility of using the equation proposed earlier in a more extensive range of pressures (35-210 atmospheres absolute) is demonstrated.

Published experimental data on the critical heat load at low pressures confirm theoretical conclusions concerning the determination of functional relationships between the criterion to be found and the determining criteria at pressures of the water close to the atmospheric. As a result of the conclusions that could be made, the critical equation for this particular case was considerably simplified. The formula for calculations obtained on the basis of this equation is recommended for application in the pressure range of 1-15 atmospheres absolute.

29. The Effect of Nuclear Irradiation on Insulators

"The Effect of Irradiation on Insulators," by Yu. K. Gus'kov and V. F. Sachkov; Moscow, Atomnaya Energiya, Vol 6, No 2, Feb 59, pp 204-205

Problems pertaining to the modification of characteristics of insulators as a result of irradiation with neutrons and gamma rays are of importance, because the materials in question are used extensively in the construction of nuclear reactors. The dependence of the electrical conductivity of porcelain, mica, and quartz on the density of neutron flow and the density of gamma radiation as well as on the total radiation flow was investigated. It was established that quartz, porcelain, and mica preserve their insulating properties to a satisfactory extent at flow densities amounting to 10^{13} neutrons per cm per second and a total flow amounting to approximately 5×10^{18} neutrons per cm^2 .

30. A Method for the Calculation of the Heat Conductivity of Molten Metals

"Calculation of the Heat Conductivity of Molten Metals," by G. F. Vutenko and M. I. Radchenko; Moscow, Atomnaya Energiya, Vol 6, No 2, Feb 59, pp 205-207

Data on the heat conductivity of molten metals cannot be readily extrapolated to high temperatures. On the other hand it is easy to extrapolate the electrical conductivity. An equation has been derived which is of practical interest for the calculation of the heat conductivities of liquid metals at high temperatures. With the use of this equation, the heat conductivity at any temperature can be calculated on the basis of the electrical conductivity at the melting point, the melting point, and the electrical conductivity at this temperature.

The electrical conductivity can be determined experimentally much more easily than the heat conductivity. The equation that has been derived applies to a group of thermodynamically similar substances consisting of metals in the right subgroups of the periodic systems.

[For additional information on nuclear fuels and reactor construction materials, see Item No 187].

Radiochemistry

31. Separation of Yttrium-90

"Separation of Carrier-Free Yttrium-90 in a Radiochemically Pure State, Part IV," by N. P. Rudenko, Scientific Research Institute of Nuclear Physics, Moscow State University, Moscow Zhurnal Neorganicheskoy Khimii, Vol 4, No 1, Jan 59, pp 220-224

It was established that pure yttrium-90 can be extracted repeatedly from solutions of strontium-90 in the form of the salt formed by it with 8-hydroxyquinoline, using chloroform as the extracting solvent. If the extraction is carried out at a pH of about 7 from an acetate buffer solution, the yttrium-90 is obtained in a radiochemically pure state, because the salt formed by strontium with 8-hydroxyquinoline is extracted only at a pH of about 11.

32. Isolation of Carrier-Free Radioactive Antimony and Radioactive Indium

"Isolation of Carrier-Free Sb^{125} and In^{113m} ," by V. N. Rybakov and I. I. Stronskiy; Moscow, Atomnaya Energiya, Vol 6, No 2, Feb 59, pp 208-210

A method has been developed for the separation of tracer quantities of antimony and indium from radioactive isotopes of tin. By using this method, carrier-free Sb^{125} and In^{113m} have been separated. A chromatographic column has been used for the repeated separation of In^{113m} .

33. Coprecipitation of Radioactive Cesium

"Investigation of the Coprecipitation of Microquantities of Cesium With Prussian Blue by the Method of Instantaneous Coprecipitation," by M. Krs and O. Ye. Zvyagintsev, Moscow Chemicotechnological Institute imeni D. I. Mendeleev and Military Academy imeni A. Zapotocky at Brno; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 4, No 1, Jan 59, pp 227-229

The method of instantaneous precipitation was applied for the investigation of equilibria in systems with difficulty soluble components. By using this method for the coprecipitation of cesium with Prussian blue, the validity of some relationships which underlie the formation of anomalous mixed crystals was confirmed.

[For additional information on radiochemistry, see Item No 16.]

Miscellaneous

34. 11th All-Union Conference on High-Molecular Compounds To Be Held in June 1959

"Announcement" (unsigned article); Moscow, Zhurnal Prikladnoy Khimii, No 1, Jan 59, back cover

The Department of Chemical Sciences, Academy of Sciences USSR, together with the State Committee of the Council of Ministers USSR for Chemistry and the Moscow State University plan to convoke in June 1959 in Moscow the 11th All-Union Conference on High-Molecular Compounds which will be concerned with the problem of conversion and application of polymer materials.

The following themes will be discussed at the sessions of the conference: (1) anticorrosive materials; (2) dielectrics; (3) crude and vulcanized rubber; (4) chemical fibers; (5) polymer materials in construction; (6) methods of testing polymer materials; (7) conversion of plastics; (8) polymer materials in machine building; and (9) films, preservation [of food-stuffs, etc.], and packaging.

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"Persons and organizations desiring to participate in the conference must present their theses consisting of no more than 3 pages by no later than 15 February 1959 to the Organizational Committee of the 11th All-Union Conference on High-Molecular Compounds, Moscow, V-71, Leninskiy Prospekt, d. 14, Department of Chemical Sciences, Academy of Sciences USSR."

IV. ELECTRONICS

Communications

35. Selectivity of FM Radio Receivers

"On the Selectivity of Radio Receivers Operating in VHF Sub-range," by B. I. Savitskiy and P. A. Kotikova; Moscow, Elek-trosvyaz', No 1, Jan 59, pp 38-43.

According to the present plans for extension of VHF-FM radio broadcasting in the Soviet Union, it is contemplated to organize four-program radio broadcasting in the frequency range of 66 to 72 Mc and a six-program broadcasting in certain densely populated areas with an added 72-73 Mc range.

The Soviet-manufactured radio receivers operating in the VHF-FM range have an excessively wide band-pass and insufficient selectivity, compared with certain Western European receivers. Thus, for example, according to the existing specifications for the second-class VHF-FM receivers, the band-pass is 160 kc. To improve the selectivity of Soviet-manufactured VHF-FM radio receiving sets, it was proposed to design new circuits for the intermediate frequency tract in which improvement of the linear selectivity of the receiver is obtained through the reduction of the band-pass.

36. Transmission of Signals With Many Discrete Code Elements

"Theory of Transmission of Signals With Many Discrete Elements," by B. A. Varshaver; Moscow, Radiotekhnika, No 1, Jan 59, pp 3-13

The problem of determining the upper limit of speed of transmission and the transmission capability of a communication channel utilizing the corrective code and signals with many discrete code elements is analyzed in this article. The following methods of modulation are examined: pulse-time, phase, frequency and amplitude modulation with dc pulses of different polarity. It was proven that for frequency and pulse-time modulation in the "bit-by-bit" reception of coded combinations, the utilization of average power cannot exceed a certain value.

Formulas and graphs are presented which permit evaluating means for improving the performance of the communications system utilizing signals with a great number of discrete code elements.

37. TV Broadcasting From Satellites

"At the Technical Council of the Ministry of Communications"
CPYRGHT (unsigned article); Moscow, Radiotekhnika, No 1, Jan 59, p 67

"At the meeting of the Technical Council of the Ministry of Communications USSR, a report of Professor S. I. Katayev was heard on the subject of feasibility of solving certain problems of TV broadcasting in conjunction with the launching of the artificial satellites.

"S. I. Katayev has indicated that the solution of the problem of covering a large territory by TV broadcasting encounters great difficulties due to the fact that reliable propagation of VHF waves can be obtained only in the line of direct visibility. This brings up the problem of lifting the relay stations to a great height.

"The solution of this problem can be visualized with the aid of launching an artificial satellite which will revolve in a circular equatorial orbit at an altitude of about 36,000 km.

"The launching of artificial satellites, especially the third Soviet satellite carrying an active transmitting radio station, as well as achievements in allied fields of science and rocket technology, and the preliminary calculations and evaluation of individual assumptions lead to the conclusion that the launching of a satellite with the desired orbit parameters needed to accomplish TV broadcasting over large territories is quite feasible.

"S. I. Katayev has pointed out that in the solution of a number of problems for the subsequent development of TV technology, including the selection of standards, it is necessary even now to take into account the possibility of utilizing a satellite. It is also necessary to start to develop a series of concrete problems, such as transmitting and receiving radio equipment designed for operation over several years without servicing, selection of optimum wave length for the cosmic retransmitter, automatic scanning of large antennas in cosmic space, sufficiently powerful independent long-lined power sources, investigation of the economic variants of color TV designed to utilize the cosmic retransmitter etc.

"The speaker proposed including in the Seven-Year Plan for the development of the national economy basic measures for realization of a cosmic retransmitter of TV programs."

38. Reorganization of Programs at Soviet Technical Schools

"Reorganization of the Program at the Moscow Electrical Engineering Institute of Communications," by N. P. Braslavskiy; Moscow, Vestnik Svyazi, No 2, Feb 59, pp 5-6

The article contains the following passages:

Modern communication technique, based on the principles of radio engineering and electronics, is highly complex and, therefore, requires of students a profound knowledge in the fields of physics, mathematics, electrical engineering, and radio engineering.

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"In conjunction with the above we consider it expeditious that, at the engineering faculties of our institute (radio communication and radio broadcasting faculties, and telegraph and telephone communication faculty) the students, during their first 3 years of studies, should be relieved from work at plants. This will permit thorough study during the first three courses (years), of mathematics, physics, theoretical electrical engineering and other theoretical subjects, and at the same time allow intensification of laboratory work.

"The total study period in the engineering faculties (including a year of work in industry) will be 5 years and 6 months. At the same time, prediploma practice will be lengthened to 8 weeks, when the student will be sent to an establishment to work as a technician, and in special cases even as an engineer. This will bring diploma projects closer to reality and will improve their quality."

39. Sequential Summation of Intelligence

"Sequential Summation of Intelligence in Communication Systems With Duplication," by K. V. Kul'kov; Moscow, Elektrosvyaz, No 1, Jan 59, pp 3-11

To improve reliability of reproduction of transmitted intelligence in the presence of interference, a method of duplication, specifically a method of simultaneous duplication by transmitting the same intelligence through several channels of communication, is successfully applied.

The article describes a new method of intelligence summation for the described duplication process. Such a method consists in sequence connection of the communication channels with the aid of an independently operated selector switch. Investigation has shown that at a proper rate of channel switching, improvement of signal-to-noise ratio is almost as good as for the condition of continuous operation of all the channels. The article also examines the case when a detecting element is inserted between the commutator switch and the summation element.

The advantage of the method of sequential summation is that, for the condition of a large number of duplicating channels, the amplification of signals from different channels can be carried out in one single, common amplifier.

40. Color Television in USSR

"Problems of Color Television Development," by A. Kalkunin; Moscow, Radio, No 1, Jan 59, pp 10-12

CPYRGHT

"After prolonged research and study of findings abroad in the field of color television, the members of the institute [Leningrad Electrical Engineering Institute of Communications] have selected the compatible color system with one subcarrier for color intelligence placed inside the spectrum of the black-white signal."

The band pass of the whole TV channel is 8 Mc, and of the video signal 6 Mc. Broadcasting of color TV programs will be conducted on the 12 conventional channels for black-white TV broadcasting.

At the State Scientific Research Institute of the Ministry of Communications USSR, the design of color TV equipment has been completed and an experimental studio built.

41. TV Receiver "Znamya-58"

"TV Receiver 'Znamya-58'," by V. Klibson and V. Neyman; Moscow, Radio, No 1, Jan 59, pp 33-35

The TV receiver "Znamya-58" is a modernized version of the older "Znamya" set. It is designed to receive programs on all 12 TV channels. The set has 15 tubes, seven semiconductor diodes, and the 43LK2B picture tube. The screen size is 340 X 255 mm. The intermediate frequencies are 34 and 25 Mc for the video signal and 27 and 75 Mc for the audio signal. The sensitivity of the set is about 200 microvolts and adjacent channel selectivity is about 31 db. The power consumption of the set is about 130 w. The over-all dimensions are 520 X 495 X 475 mm, and it weighs 28 kg.

42. Functions of Frequency and Time

"On Certain Asymptotic Relationships Between Functions of Frequency and of Time," by H. Dobesch, Berlin; Berlin, Nachrichtentechnik, No 1, Jan 59, pp 13-18

In the measurement of the properties of quadrupoles, for example in the case of the transmission paths in television, it is possible to begin with the frequency functions of amplitude and, preferable, of the group velocity, or with the time dependences, surge or impulse. Both measurements are equivalent. Their relationship is given, for example, by the Laplace integral. Frequently, special values of functions are sufficient for an estimation of the curve. These are obtained with an asymptotic reference function for $t \rightarrow 0$ or $\omega \rightarrow \infty$, and vice versa, whenever an impulse acts as an input function. The conventional relationships, which, as a reference function, use the first term of the frequency function developed in a series, can be supplemented by the second term, if the group velocity function (group transit time function) is considered in addition to the amplitude function. The asymptotic relationships between the amplitude function, or the group velocity function, and the output time function of the surge are derived and experimentally confirmed.

The article, an abstract of a dissertation presented to the Faculty for Electrical Engineering of the Dresden Technische Hochschule, Institute of Communications Engineering, was presented at the Sixth Annual Conference of the [West German] Television Engineering Society in Munich, 1958.

Components

43. Electronic Accelerometer

"Electronic Acceleration Pickup Unit With Loop Cathode," by L. A. Goncharov; Moscow, Priborostroyeniye, No 2, Feb 59, pp 28-29

The article describes the construction of an electronic acceleration pickup unit developed by the author, in which the cathode loop has a rectangular form. Such a loop possesses high flexibility in the direction perpendicular to its plane. The directly heated cathode is placed between two flat electrodes (the plate and cold cathode), which create a homogeneous electric field. The cathode loop is deflected toward one of the plates when the pickup unit is brought to accelerating motion. Such a deflection of the cathode loop results in the change of the plate current.

The loop cathode was made of oxide-coated tungsten wire 25 microns in diameter. The length of the loop is 20 mm, and the resonant frequency of the hot cathode is 50 cycles. The length of the whole unit is 40 mm and its diameter is 10 mm. The voltage sensitivity of the unit is 4 v at one m/sec, when 50 v are impressed on the plate and 0 v on the cold cathode. The filament voltage is 2.2 v and the filament current is 100 milliamp.

The advantages of the new acceleration pickup unit are simplicity of construction and high sensitivity.

44. Infrared Radiation Sensitivity of Germanium Photodiodes

"Threshold Sensitivity and Noise Spectrum of Germanium Junction Type Photodiodes," by L. Ya. Pervova; Moscow, Radio-tekhnika i Elektronika, No 2, Feb 59, pp 330-334

The relatively high sensitivity of germanium photodiodes (10-50 milliamp/lumen) make them useful for registration of weak fluxes of infrared radiation.

At the Leningrad Physicotechnical Institute recently germanium junction-type photodiodes were developed having such a large sensitive area that they are capable of registering even unfocused radiation. The sensitivity threshold of the germanium photodiodes was found to be about 10^{-10} lumen \cdot sec $^{1/2}$ for the light modulation frequency of 70 cycles when the voltage applied to the photodiode was one v. The sensitivity of the photodiode can be further increased by increasing the light modulation frequency.

The author thanks S. M. Ryvkin and V. N. Makarov for the assistance.

45. Three-Cavity Klystron Multiplier

"Three-Cavity Klystron Frequency Multipliers," by A. D. Sushkov; Moscow, Radiotekhnika i Elektronika, No 2, Feb 59, pp 246-252

The three-cavity klystron multiplier with signal preamplification is a frequency multiplier in which the first two cavities are designed for the input (to be multiplied) frequency and the third for the output (multiplied) frequency. The signal fed to the input of such a klystron is first voltage-amplified, and then its frequency is multiplied.

The performance of the three-cavity klystron was checked experimentally for the multiplication factors of three and five and the output frequency of 3,000 Mc. The experimental data has shown that the three-cavity klystron with signal preamplification has a considerably greater amplification factor than that of an equivalent two-cavity klystron frequency multiplier.

46. Von Ardenne Institute Reports on Miniature Vibrating Capacitor

"On a Vibrating Capacitor With Good Constant," by M. von Ardenne and E. Klar, Manfred von Ardenne Research Institute, Dresden-Weisser Hirsch; Berlin, Nachrichtentechnik, No 1, 1959, pp 26-28

A description, cross sectional drawing, and four photographs are given of a miniature vibrating capacitor which can be used wherever testing instruments with a high input impedance and a good constant are required. The capacitor operates on the principle of electromagnetic excitation of the vibrating electrode. With an operating impedance of 10^{13} ohm, currents of 10^{-15} - 10^{-16} can be identified. The following data is given:

quiescent capacitance \bar{C} :	32 micromicrofarad
coupling capacitance: C_k :	61 micromicrofarad
electrode spacing of quiescent capacitance \bar{a} :	30 microns
capacitance to ground C_{p1} :	8.75 micromicrofarad
C_{p2} :	15 micromicrofarad

conversion factor F_u : 0.10 with excitation current $I_{eer} = 11$ milliamperes
 F_u : 0.18 with excitation current $I_{eer} = 20$ milliamperes.

The special capacitor was developed on contract for the Office of Nuclear Research and Nuclear Engineering, Berlin; S. Klein was in charge of the precision mechanics work.

47. China Components Production

"Manufacture of Power Capacitors" (unsigned article); Peiping, Druzhba, No 33, Aug 58, p 29

CPYRGHT

"In the middle of July, in Sian, the first Chinese electrical power capacitor plant officially began operation.

"This plant is one of the most important units of industrial construction designed with the help of the Soviet Union. It was designed with consideration of the latest technical achievements of the Soviet capacitor industry. Its construction is evidence of the fact that our country has taken a great step forward toward achievement of world leadership in the field of capacitor production. In the past it has been necessary for China to import electrical power capacitors; but now, all demands will be satisfied by domestic production.

"Simultaneously with the construction of the Sian plant, experimental production of electrical power capacitors was begun. With the aid of Soviet specialists at the plant, 19 types of capacitors were developed for production before the plant was officially opened."

Computers and Automation

48. The Future Soviet Computers

"The Near Future of Computer Technique," V. I. Leskutov; Moscow, Priborostroyeniye, No 1, Jan 59, pp 5-6

CPYRGHT

The article contains the following passages:

"The development of modern computer technique in the Soviet Union will be based on the urgent needs of science and the national economy; and, therefore, according to the Seven-Year Plan the volume of computer machine production should be increased 4.7 times, resulting in a production value of 2.1 billion rubles in 1965. At the same time, the qualitative indexes of the computers will be improved.

"However, to manufacture mathematical machines possessing the logical capabilities, speed, and reliability superior to those of similar foreign machines, it would be necessary to expand considerably the volume of scientific and research works and to shorten drastically the time of constructional design.

"In the very near future, machines with a speed of 5,000 and 20,000 operations per second will be produced serially, instead of 100 and 2,000 operations, which are typical of the presently manufactured machines of the type 'Ural', 'Strela' and others. But the mentioned speed is far from the attainable limits. During the coming 2-3 years, it will be necessary to build machines which will perform not less than 100,000-200,000 operations a second and to store up to 3,000-32,000 numbers."

49. Methods of Detecting Systematic Errors of Transformation Discussed

"Concerning Mathematical Methods of Controlling Abstract Transformers," by Yu. I. Zhuravlev, Moscow State University imeni M. V. Lomonosov; Moscow, Doklady Akademii Nauk SSSR, Vol 123, No 2, Nov 58, pp 227-230

In technology devices are encountered which are referred to as transformers, possessing a definite "input" and a definite "output" and which function in the following manner. A certain physical quantity x of a definite nature is entered at the "input." A transformation of that quantity is performed within the device and a quantity $f(x)$, also of a definite physical nature, is obtained at the "output". This is what transpires when the device functions properly. However, breakdowns occurring within the process are assumed. In such cases the $f(x)$ obtained is distorted. It is important to know whether the device is operating properly in each individual case. A running control is used for this purpose during the device's operation which consists in that at a particular moment of time earlier values of x for which $f(x)$ is known are entered at the input. These values are compared with the values obtained by the device.

In the present work, several general questions associated with the evaluation of the possibilities of control are considered. There is discussion concerning the discovery of systematic errors of transformations. Random failures here are, generally speaking, not detected. In the work it was assumed that $x \in [a, b]$ and that $f(x)$ is measurable and bounded on $[a, b]$. The transformer was considered as a register from which one is unable to obtain information concerning its interior during operation. It is assumed that only certain functional characteristics of the transformer are known.

Electromagnetic Wave Propagation

50. Velocity of Propagation of Audio-Frequency Electromagnetic Waves

"Velocity of Propagation of Audio-Frequency Electromagnetic Waves," by Ya. L. Al'pert and S. V. Borodina, Scientific Research Institute of Terrestrial Magnetism, Ionosphere, and Radio Wave Propagation; Moscow, Radiotekhnika i Elektronika, No 2, Feb 59, pp 195-201

The determination of phase velocity of electromagnetic wave propagation in the range of audio frequencies (1,000 - 20,000) is described. The analysis of atmospheric and their phase characteristics was utilized for such determination. It was estimated that with decrease in frequency, the average phase velocity becomes considerably greater than the velocity of electromagnetic waves in free space; such a difference might be as high as 10% at a frequency of 2,000 cycles.

Subsequent experiments will permit obtaining the relationship between velocity and frequency down to a frequency of a few tens of cycles. The results of this experiment will permit the effective conductivity of the lower portion of the ionosphere to be determined.

51. Investigation of Radio Signal Fading

"Investigation of the Nature of Fast Fading Radio Signals Above the Earth's Surface at Middle Distances," by A. A. Semenov and G. A. Kopneyev, Chair of Electromagnetic Wave Propagation, Physics Faculty, Moscow State University; Moscow, Radiotekhnika i Elektronika, No 2, Feb 59, pp 187-194

The Chair conducted, during the period from December 1955 to March 1956, an investigation of electromagnetic wave propagation for the case of direct line of visibility. The radio wave path traversed heavily wooded topography. This experiment to study electromagnetic wave fading was conducted on the 3-cm wavelength.

The experiment could not establish any simple relationship between wind velocity and signal fading. For operations on 3-cm wave length, the effect of reflection from heavily wooded topography can be neglected in many cases.

The results of this investigation can be useful in the study of radar presentation of ground topography.

52. Wave Propagation in Bent Wave Guides

"Propagation of Electromagnetic Waves in Loaded Bent Wave Guides," by A. N. Didenko, Moscow State University, Moscow, Radiotekhnika i Elektronika, No 2, Feb 59, pp 172-180

Electromagnetic wave propagation in loaded bent wave guides displays a series of specific peculiarities not exhibited in the case of rectangular wave guides. Analysis of the dispersion equations and expressions of the field, leads to a conclusion that sometimes these peculiarities are exhibited only as slight modifications of the well known phenomena occurring in rectangular wave guides. Slight nonuniformity of the longitudinal component of the electrical field along the radius of the round wave guide, when comparatively few septums are placed in the wave guide, makes such loaded bent wave guides useful in acceleration of elementary particles in a cyclic installation.

Wave guides partially loaded with dielectric material are more effective from the standpoint of assisting acceleration of elementary particles than are wave guides loaded with septums (ribs).

Instruments and Equipment

53. VHF Oscillator With Delay Feedback

"Problem of Stabilization of Self-Oscillations in a VHF Oscillator with Delay Feedback," by I. S. Gonorovskiy; Moscow, Radiotekhnika, No 1, Jan 59, pp 25-33

Circulation of radio pulses in a ring circuit with delay feedback and the mode of formation of such oscillations is examined in this article. The relationship between the band-pass of the oscillator system and the value of delay, as well as the duration of the trigger pulse and the value with respect to delay for such type circuits are examined and defined. The peculiarity of the system with delay feedback is its ability to generate oscillations at various frequencies, and under certain conditions even to generate simultaneously oscillations of different frequencies.

54. Unretarded Backward-Wave Oscillator

"Experimental Investigation of Unretarded Backward-Wave Oscillator," by K. Ya. Lizhdvoy; Moscow, Radiotekhnika i Elektronika, No 2, Feb 59, pp 212-217

The article describes experimental investigation of a high-frequency oscillator in which the interaction between electron bunch and electromagnetic wave having a phase velocity equal to that of the speed of light is utilized. The length of the experimental oscillator is 18 cm, current at the collector 20 milliamps, strength of electric field 1,000 v/mm and magnitude of magnetic induction 1,000 gauss. It was shown that the oscillator output can be increased if the magnetic field is gradually decreased toward the end of the interaction space.

The possibility of frequency modulation of this type of oscillator was examined.

Materials

55. The Ternary System Thallium-Selenium-Tellurium

"Physicochemical Investigation of the Ternary System Thallium-Selenium-Tellurium," by N. S. Bubyreva and A. P. Obukhov, Leningrad Physicotechnical Institute, Academy of Sciences USSR; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 4, No 1, Jan 59, pp 132-137

The ternary system thallium-selenium-tellurium was investigated. It was found that alloys and/or melts formed within this system exhibit semiconductor properties and have electrical conductivities which differ by multiples amounting to tens of millions depending of the composition. This circumstance is assumed to be of great practical interest, because it makes feasible the development and production of semiconductor materials with the required electrical and chemical characteristics on the basis of chalcogenide phases. The results obtained indicate that it is advisable to investigate ternary and higher multi-component semiconductor systems.

56. Semiconductor Compounds of the Composition $A^I B^I B^{VI}_2$

"Ternary Semiconductor Compounds of the General Formula $A^I B^I B^{VI}_2$," by L. D. Dudkin and A. P. Ostranitsa, Institute of Metallurgy imeni A. A. Baykov, Academy of Sciences USSR; Moscow, Doklady Akademii Nauk SSSR, Vol 124, No 1, Jan 59, pp 94-97

It is assumed that ternary semiconductor compounds are formed on the basis of binary compounds of which one at least must exhibit semiconductor properties. The formation of ternary compounds of the general formula $A^I B^I B^{VI}_2$ (where $A^I = Cu, Ag$; $B^I = Sb, Bi$; and $B^{VI} = Se, Te$) was investigated from this standpoint. It was found that out of the eight possible compounds of this general composition, the following four are actually formed: $CuSbSe_2$, $AgSbSe_2$, $AgSbTe_2$, and $AgBiSe_2$. The physicochemical properties of these compounds and the conditions of their formation were investigated.

57. Physical Properties of Semiconductors

"On the Relation Between Energetic, Electrophysical, and Mechanical Properties of Semiconductors," by B. F. Ormont, Physicochemical Institute imeni L. Ya. Karpov; Moscow, Doklady Akademii Nauk SSSR, Vol 124, No 1, Jan 59, pp 129-132

The range of problems involved is subjected to theoretical (mathematical) treatment. The following problems are considered: relationship between the energy of atomization of the compound, the energy of the lattice, and the enthalpy of formation; relationship between the total specific surface energy and the energy of atomization; correlation between the surface energies of semiconductors and their microhardness, and dependence of the width of the forbidden zone of semiconductors on the strength and type of the chemical bond.

58. Magnetization and Coercivity of Nickel-Zinc Ferrites

"Magnetization and Coercivity of Nickel-Zinc Ferrites Especially in the Case of Impurity Admixtures," by W. Holzmueller, Leipzig, and Th. Kampf, Dresden; Berlin, Nachrichtentechnik, No 1, Jan 59, pp 44-46

Measurements of the magnetization properties and coercivity of ferrites, to which up to 15 percent by volume of BeO , ThO_2 , Cr_2O_3 , and WO_2 had been added, showed that irreversible magnetization processes are to be traced back to Bloch wall shifts. In weak fields, however, rotational processes also play a part, being responsible for the initial permeability.

If the angle between the magnetization and the field H is represented by δ , then only the component $H \sin \delta$ is effective for the rotation in the field direction, so that, as δ approaches 0, the rotation of the magnetization vector in the field direction becomes more and more difficult to determine. Bloch wall movements then play a decisive role. This shifting of the Bloch walls is restrained by the impurities, and the coercive force increases rapidly. A similar effect is exerted by pores, which are especially large and numerous at low sintering temperatures, which is confirmed by measurements of specific gravity. Tungsten oxide vaporizes for the most part during the sintering process, but lowers the sintering temperature considerably.

The coercive force of specimens which were not completely sintered was found to be about one hundred times as great as that of ferrites sintered at $1,500^{\circ}$. Thorium oxide and chromium oxide in particular increase the sintering temperature of the nickel-zinc ferrite by $200-300^{\circ}$.

[For additional information on materials, see Item No 68.]

Miscellaneous

59. Recent Soviet Patents in the Field of Communications

"Authorship Certificates" (unsigned article); Moscow, Elektrosvyaz', No 1, Jan 59, p 80

Class 21a, 32₄₀, No 112778 -- B. V. Krusser and G. A. Morozov; Transmitting Television Tube

Class 21a¹, 13₀₂. No 113135 -- B. N. Petrovskiy and Ye. M. Martynov; Circuit of Multistage Electronic Telegraph Pulse Storage Unit

Class 21a¹, 34₁₁, No 113215 -- I. P. Zhukov; A Method for Brightness Control of Cathode-Ray Oscilloscope

Class 21a², 6. No 112992 -- A. N. Radchenko; Binary Relay Scaling Device

Class 21a⁴, 9₀₁. No 113100 -- S. I. Tetel'baum; Method for Generation of SHF Oscillations and Oscillators Therefor

Class 21a⁴, 22₀₄. No 112999 -- S. I. Borovitskiy; A Method for Separation of Useful Signal in Presence of Noise

Class 21a⁴, 46₀₆. No 113222 -- V. D. Kuznetsov; Cophasal Multiple Horizontal Wide-Band Antenna

Class 21a⁴, 66₀₅. No 112601 -- B. Ye. Kinberg and I. K. Berkovskiy; Mobile Periscopic Antenna Array

Class 21a⁴, 71. No 113191 -- L. N. Bryanskiy; Device for Control of the Process of Matching of Wave Guides at SHF

60. A. S. Popov Centennial

"Preparation for the Jubilee -- The 100th Anniversary of A. S. Popov's Birth" (unsigned article); Moscow, Radio, No 1, Jan 59, p 16

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"During March 1959, a Jubilee All-Union Scientific Conference will take place in Moscow devoted to the problems of development of radioelectronics. The most prominent scientists of the Soviet Union will participate in the conference.

"During the period from 16 March to 7 May scientific-technical conferences concerning the problems of development and assimilation of radioelectronics in various fields of communications will be organized at scientific research institutes and higher educational institutions."

V. ENGINEERING

61. Choice of Nozzle Size for Rocket Engine Discussed

"On the Choice of the Relative Magnitude of the Critical Cross Section of the Nozzle of a Rocket-Engine Chamber," by O. I. Kudrin, Chair AD-2 [Chair of Aircraft Engines - 2], Moscow Aviation Institute; Kazan', Izvestiya Vysshikh Uchebnykh Zavedeniy, Seriya Aviatsionnaya Tekhnika, No 3, 1958, pp 78-88

A theoretical study of the influence of the relative magnitude of the critical cross section of the nozzle on the basic characteristics of a rocket engine is described. The variation of only two factors is considered: thermal efficiency and time of stay of gas particles in the chamber.

Results showed that time of stay is a function of the relative critical cross section of the nozzle; that the volume of a non-isobaric chamber must be greater (by 40-50% in the limiting case) than that of an isobaric chamber to keep the time of stay constant; that engine thrust decreases with an increase in the non-isobaricity of the combustion chamber for a constant chamber volume; and that a change in the time of stay can influence rocket engine characteristics much more strongly than a change in the thermal efficiency of the cycle.

The study was completed in 1951 with the collaboration of A. I. Serovoy.

62. Supersonic Diffusers Studied

"Characteristics of the Simplest Supersonic Diffuser (Reverse Laval Jet)," by B. S. Vinogradov, Chair of the Theory of Aircraft Engines, Kazan' Aviation Institute; Kazan', Izvestiya Vysshikh Uchebnykh Zavedeniy, Seriya Aviatsionnaya Tekhnika, No 3, 1958, pp 60-67

The simplest supersonic diffuser, the reverse Laval jet, is studied because of its importance in the analysis of the characteristics of the supersonic compressors of the inlet portion of ram-jet engines and other supersonic diffuser ducts with a throat. The results of a theoretical calculation of the characteristics of such diffusers are given and the types of air flow corresponding to different operating cycles are briefly considered. The calculations are simplified and kept within the limits of a one-dimensional theory for purposes of clarifying problems connected

with such critical phenomena as duct locking and passing through the velocity of sound in continuous manner or by means of a shock. Friction and the possibility of diagonal shocks or complex systems of shocks are not considered. It is assumed that only normal shocks can occur in the duct.

63. Theory of Induction Flow Meter Studied

"Study of an Induction Flow Meter to Measure Highly Variable Liquid Flow," by B. D. Zhilkin, Chair AD-2 Chair of Aircraft Engines - 2, Moscow Aviation Institutes; Kazan', Izvestiya Vysshikh Uchebnykh Zavedeniy, Seriya Aviatsionnaya Tekhnika, No 3, 1958, pp 68-77

A theoretical and experimental study of an induction flow meter with rectangular duct is described. Harmful electrochemical effects of the liquid on the electrodes are considered. The relation between induction e.m.f. and liquid flow is derived.

64. Forced Oscillations of Circular Plates Studied

"Certain Problems in the Dynamics of Circular Plates and Flat Spherical Shells," by R. L. Malkina, Chair of Structural Mechanics, Ural Polytechnic Institute; Kazan', Izvestiya Vysshikh Uchebnykh Zavedeniy, Seriya Aviatsionnaya Tekhnika, No 3, 1958, pp 50-59

The problem of the forced oscillation of circular plates and flat spherical shells of finite dimensions is considered for arbitrary boundary conditions. The effect of suddenly applied forces is treated in particular. A method is given for reducing problems in the dynamics of flat spherical shells to problems in the dynamics of circular plates.

65. Bending of Cylindrical Panels Studied

"Bending and Stability of Flat Cylindrical Panels and Plates With Elastic Ribs," by M. S. Kornishin, Chair of Theoretical Mechanics, Kazan' Chemicotechnological Institute, Kazan' Affiliate, Academy of Sciences USSR; Kazan', Izvestiya Vysshikh Uchebnykh Zavedeniy, Seriya Aviatsionnaya Tekhnika, No 3, 1958, pp 34-38

The bending and stability of flat cylindrical panels and plates reinforced with longitudinal and transverse ribs of different stiffness are considered. The panels are rectangular in outline and are subjected to a transverse load and axial forces.

A method is given for constructing the force function with consideration of the action of the ribs. The method is then used to solve the bending problem by applying the Bubnov-Galerkin procedure.

66. Creep Considered in Study of Thick-Walled Shell

"Creep of a Spherical Shell," by N. Kh. Arutyunyan, Academician, Academy of Sciences Armenian SSR, and M. M. Manukyan, Institute of Mathematics and Mechanics, Academy of Sciences Armenian SSR, and Yerevan State University; Yerevan, Doklady Akademii Nauk Armyanskoy SSR, Vol 27, No 4, 1958, pp 209-216

Nonlinear creep and variation in the instantaneous deformation are considered in the problem of the equilibrium of a thick-walled spherical shell subjected to uniform external and internal pressure. The problem is reduced to the solution of a second-order nonlinear integral equation of the Volterre type. Expressions are given for the stress state in the shell and the concentration of stresses in a spherical band.

67. Buckling of Cylindrical Panels Subjected to Pressure Studied

"On the Bending and Stability of Flat Shells, Rectangular in Outline, Subjected to External Normal Pressure," by N. I. Krivosheyev, Chair of Higher Mathematics and Theoretical Mechanics, Kazan' Institute of Construction Engineers; Kazan', Izvestiya Vysshikh Uchebnykh Zavedeniy, Seriya Aviatsionnaya Tekhnika, No 3, 1958, pp 34-49

A solution is given for the problem concerning the stability and buckling of flat shells of nonnegative Gaussian curvature subjected to a uniform normal pressure. The solution is obtained by expanding the functions derived in terms of powers of a small parameter. The shell is assumed to be resting on slightly twisted, unstretchable ribs which are flexible in the tangent plane to the surface of the shell.

68. Heat Transfer Agents For the Cooling of Hot Junctions of Semiconductor Cooling and Refrigerating Devices

"A Method of Conducting Heat From Semiconductor Cooling [Refrigerating] Devices," by Ye. A. Kolenko, A. G. Shcherbina, and V. G. Yur'yev; Moscow-Leningrad, Zhurnal Tekhnicheskoy Fiziki, Vol 28, No 11, Nov 58, pp 2543-2545

Inorganic salts, organic compounds, wax, paraffin wax, and Wood's alloy were investigated from the standpoint of their application as heat-absorbing materials for the cooling of the hot junction of an industrial

semiconductor refrigerator of small capacity. Wood's alloy was found to be best as far as the magnitude of the product of the latent heat of fusion and the density is concerned. To utilize the superior latent heat of fusion of salts, the use of metallic sponges filled with a solid salt is suggested. The heat conductivity of salts alone is stated to be inadequate for efficient cooling.

69. National Committee of the Soviet Union on Automatic Control Organized

"On the Convocation in Moscow of the First International Congress on Automatic Control" (unsigned article); Leningrad, Tekstil'naya Promyshlennost', No 1, Jan 59, p 94

A National Committee of the Soviet Union on Automatic Control (National'nyy Komitet Sovetskogo Soyuza po Avtomaticheskomy Upravleniyu) has been organized under the Academy of Sciences USSR. The members of the committee are V. A. Trapeznikov, Corresponding Member of the Academy of Sciences USSR, chairman; Prof A. M. Letov, deputy chairman; B. N. Naumov, Candidate of Technical Sciences, scientific secretary; V. V. Karibskiy, Candidate of Technical Sciences; and Docent Ye. P. Stefani, Candidate of Technical Sciences.

The International Federation on Automatic Control (IFAC) has commissioned the National Committee of the Soviet Union on Automatic Control to organize and convoke the First International Congress in Moscow, which is to be held from 25 June to 5 July 1960.

All inquiries are to be mailed to the following address: Moscow, 1-53, Kalanchevskaya Ul., 15-A, in care of "Congress on Automatics."

70. V. T. Kholin, Soviet Gas Turbine Specialist, Dies

"Vasiliy Tikhonovich Kholin" (unsigned article); Leningrad, Energomashinostroyeniye, No 1, Jan 59, pp 44

The "tragic death" of Vasiliy Tikhonovich Kholin, Stalin Prize Winner and chief engineer of the Nevskiy Machine Building Plant imeni Lenin, occurred on 17 October 1958; he was 51.

Kholin had been directing work on gas turbine installations for gas mains and stationary power gas turbine installations, which were being constructed for the first time in the USSR.

In 1929, he graduated from the Bryansk Industrial Technical School and in 1935 from the Leningrad Industrial Institute. He had been with the Nevskiy Machine Building Plant imeni Lenin since 1947. He was a member of the Editorial Council of Energomashinostroyeniye.

His awards include two Orders of the Labor Red Banner, the Order "Znak Pocheta," and two medals.

[For additional information on engineering subjects, see Section III, Chemistry, Inorganic Chemistry.]

VI. MATHEMATICS

71. Fourier Series Used for Approximating Almost Periodic Functions

"Fourier Series as an Apparatus for Approximating Almost-Periodic Functions," by Ye. A. Bredikhina, Kuybyshev Aviation Institute; Moscow, Doklady Akademii Nauk SSSR, Vol 123, No 2, Nov 58, pp 219-222

One of the problems of the theory of harmonic approximation is the question concerning the establishment of a dependence between deviation of partial sums of a Fourier series from a continuous function of period 2 and the best approximation of this function by trigonometric polynomials.

In the present work several results of considering the analogous problem for almost-continuous functions are briefly stated: namely, the dependence between the deviations of the partial sums of a Fourier series from an almost-periodic function, the Fourier exponents of which do not have finite limit points, and the best approximations of that function by integral functions of finite degree.

72. Convergence of Schwartz-Type Algorithms

"On the Problem of Convergence of Schwartz-Type Algorithms," by K. Kalik, Leningrad State University imeni A. A. Zhdanov; Kazan', Izvestiya Vysshikh Uchebnykh Zavedeniy, Matematika, No 1(8), Jan/Feb, 1959, pp 75-90

In the second half of the last century, an algorithm for the solution of a Dirichlet problem in a certain region Ω was proposed by Kh. A. Schwartz. The region Ω was assumed to be the sum of two partially overlapping regions Ω_1 and Ω_2 for which the Dirichlet problem could be solved individually comparatively easily.

S. G. Mikhlin proposed an algorithm, analogous in design with the algorithm of Schwartz, which he called the "generalized algorithm of Schwartz." This algorithm serves for the approximate solution of boundary value problems in multiply-connected region.

The algorithm of Schwartz was used for the proof of the existence of Dirichlet boundary value problems for regions of a complicated form, when it was known that there existed a solution for regions of a particular

form (for example, the circle). Works on these questions have appeared for a comparatively long time. In recent times the Schwartz algorithm has been utilized as a computation apparatus. The generalized algorithm of Schwartz has begun to bear an applied character.

Hitherto both algorithms have been considered in the fundamental problem of Dirichlet for various equations. The works of G. M. Goluzin [2a] and S. Ya. Kogan [5] are an exception. In the work of G. M. Goluzin the uniform convergence of the generalized algorithm of Schwartz is proved for all three boundary value problems for the case of Laplace's equation if the multiply-connected region is plane and bounded by curves sufficiently removed from each other. S. Ya. Kogan proved that the algorithm of Schwartz converges uniformly for Neuman's problem in the case of the equation of Laplace. It is noted that in this work it follows from the given values of the normal derivative at the boundary that since they are thrice continuously differentiable, it is sufficiently rigidly bounded.

The author briefly enumerates in chronological order the fundamental results pertaining to the problems of Dirichlet, S. G. Mikhlin [7b] proved, using integral equations, that the generalized algorithm of Schwartz converges sufficiently uniformly to the equations of elasticity for given displacements on the boundary in the case of a biconnected region, the boundaries of which are sufficiently removed from each other. Thereafter S. L. Sobolev [8b] proved that both the algorithms converged uniformly in the case of the equations of elasticity for given displacements on the boundary. S. L. Sobolev did not require boundedness but separation of the boundaries. V. I. Krylov [4] considered the method of Schwarz on a wide class of elliptic equations of the second order. A. Ya. Gorgidze [3] proved the convergence of the generalized algorithm for the equations of elasticity for given displacements and for that case when a multiply connected region has order greater than two, if the boundaries are sufficiently distant from each other. B. N. Shibayev [9] proved that the algorithm of Schwartz converges in the mean in the case of the Dirichlet problem for the equation $\Delta u + \lambda u = 0$, if λ is less than the first characteristic number. In the work of S. G. Mikhlin [7c] it is proved that the algorithm of Schwartz converges uniformly in the case of the Dirichlet problem for self-adjoint, elliptic equations of the second order.

In the present work the algorithm and the generalized algorithm of Schwartz are studied for the case of biconnected regions. It is proved that both algorithms may be applied to a sufficiently wide class of boundary value problems; namely, to those which may be considered with the help of the method of orthogonal projections. This signifies that homogeneous, self-adjoint, elliptic equations of any order are admitted, and even strongly elliptic systems. It is also known that the method of orthogonal

projections may be applied for various boundary value problems, in any case for boundary conditions of Dirichlet, Neuman, and the so-called third boundary condition when a linear combination of the conditions of the values of the unknown function and its normal derivative is given on the boundary of the region.

During the consideration of the generalized algorithm we require one other condition to be satisfied; namely, it is required that the sought-for solution may be expressed in the form of a contour integral, taken according to the boundary of the considered region. This last condition somewhat limits the region of applicability of Schwartz's generalized algorithm.

The problem concerning the representation of a solution in the form of a contour integral with the help of the Green function was covered in detail in the work of K. Miranda [6].

1. M. I. Vishik, "Method of Orthogonal and Direct Expansions in the Theory of Elliptic Differential Equations," Mat. sb., Vol 25(67), No 2, 1949
2. G. N. Goluzin
 - a. "Solution of the Fundamental Plane Problems of Mathematical Physics for the Case of the Laplace Equation and Multiply-Connected Regions of Bounded Circumferences," Mat. Sb., Vol 41, No 2, 1934
 - b. "Solution of the Dirichlet Space Problem for the Laplace Equation and for Regions, Bounded by a Finite Number of Spheres," Mat. Sb., Vol 41, No 2, 1934
3. A. Ya. Gorgidze, "An Application of the Method of Successive Approximations," DAN SSSR, Vol 30, No 5-6, 1934
4. L. V. Kantorovich and V. I. Krylov, Priblizhennyye metody vysshevo analiza (Approximation Methods of Higher Analysis), Gostekhizdat, M.-L., 1952
5. S. Ya. Kogan, "Concerning the Solution of the Neumann Problem by the Alternating Method of Schwartz," DAN SSSR, Vol 65, No 3
6. K. Miranda, Uravneniya s chastnymi proizvodnymi ellipticheskogo tipa (Partial Differential Equations of the Elliptic Type), Izd. inostr. lit-ry, M., 1957 (translation from the Italian)
7. S. G. Mikhlin
 - a. Problema menimuma kvadraticnogo funktsionala (Problem of the Minimum of a Quadratic Functional), Gostekhizdat, M.-L., 1952

b. Integral'nyye uravneniya (Integral Equations), Gostekhizdat, M.-L., 1952

c. "Concerning the Algorithm of Schwartz," DAN SSSR, Vol 77, No 4, 1951

8. S. L. Sobolev

a. Nekotoryye primeneniya funktsional'nogo analiza v matematicheskoy fizike (Some Applications of Functional Analysis in Mathematical Physics), Izd. LGU, 1950

b. "The Algorithm of Schwartz in the Theory of Elasticity," DAN SSSR, Vol 4(13), No 6, 1936

9. B. N. Shibayev, "Application of the Alternating Method to a Wave Equation," Dissertation L., 1950

VII. MEDICINE

Bacteriology

73. Macroluminescence for Detecting Bacteria

"The Use of the Macroluminescent Method for Detecting Dysentery and Typhoid Bacteria," by A. P. Konenko, Chair of Microbiology, Khar'kov Medical Institute; Moscow, Laboratornoye Delo, Vol 5, No 1, Jan/Feb 59, pp 51-53

The article reports a search for new methods of culturing intestinal bacteria and for conditions under which differences in the chemism of their life processes could be detected by luminescent methods. A new culture medium consisting of 1,000 ml of meat-peptone bouillon (pH 7.6), 100 ml of bile extract from bulls, and 500 mg of neutral red was developed for these experiments, which are described in detail. The medium is called BNZh (bouillon, neutral red, and bile). A table is given to show luminescence of enteric bacteria on BNZh medium in filtered ultraviolet rays. The following conclusions are presented on the basis of results obtained:

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"1. BNZh, a new differential diagnostic medium for bacteriological diagnosis with the use of ultraviolet rays, has been produced

"2. It was established that dysentery and typhoid bacteria do not change the luminescence of the culture medium. Other bacteria of the intestinal group impart different shades of fluorescent yellow and orange to the BNZh medium.

"3. Atypical dysentery strains maintain the fluorescence inherent in typical dysentery strains on the BNZh medium."

74. Dissociation in Brucella Cultures

"The Phenomenon of Dissociation in Brucella Cultures and Modifiability of Type Characteristics," by B. P. Pervushin, Nauchn. Tr. Kubansk. Med. In-ta (Scientific Works of the Kubansk Medical Institute), No 15 (28), 57, pp 168-176 (from Referativnyy Zhurnal ... Biologiya, No 12, 25 Jun 58, Abstract No 52706, by V. G. Petrovskaya)

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"Out of 528 Brucella cultures titrated, 94.1% belonged to three basic types. Some 5.9% of the cultures could not be identified; 20.1% rugose variants appeared in the typed cultures. Selective investigations of four

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dissociated strains (melitensis, abortus, suis, and paramelitensis types) and their variants showed that the transition of cultures from S- into R-forms was accomplished in part of the cultures by changes in their differential diagnostic characteristics. The significance of this observation was considered, and a study of the cultures immediately after isolation from the organism is recommended; the possibility of changes in type characteristics, which can be reflected in epidemiological evaluation of their significance, should be avoided."

75. Microscopic Observation of B. tularensis in Organs and Tissues

"Certain Results of the Microscopic Observation of the Tularemia Pathogen in the Organs and Tissues of Guinea Pigs," by V. P. Dzhanpoladova, Chair of Microbiology, Rostov-na-Donu Medical Institute; Moscow, Zhurnal Mikrobiologii, Epidemiologii i Immunobiologii, Vol 30, No 1, Jan 59, p 50

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"During studies of experimental tularemia, we sought an explanation of the problem of the length of time the tularemia pathogen is preserved in the organism of a rabbit previously infected with a virulent tularemia strain (100 million microbial bodies subcutaneously in the groin region).

"Results of the experiments demonstrated the presence of B. tularensis in the rabbit organism. Strains isolated from different organs and tissues of the rabbits were found to be typical tularemia bacteria according to their morphological, tinctorial, and pathogenic characteristics.

"On microscopic examination of smears of organs and tissues from guinea pig No 2187 infected with B. tularensis which were isolated in the second passage from bone marrow of rabbit No 30 (413 days from the time of infection), and from guinea pig No 5 infected with B. tularensis isolated from the spleen of rabbit No 64 (333 days after infection), large numbers of bacteria were observed in the spleen, liver, lungs, and other organs and tissues.

"On microscopic examination of smears of organs and tissues from guinea pig No 420, infected with a culture isolated in the second passage from punctate obtained from a bubo of rabbit No 38 (150 days from the time of infection), microorganisms were observed in the spleen, liver, lungs, and lymph nodes.

"Guinea pigs were infected with virulent *B. tularensis* for control purposes. *B. tularensis* were not found in smears from organs and tissues of these animals.

"We repeatedly reported the observation (microscopic) of tularemia bacteria in guinea pig organs and tissues. However, since the results were analogous, we limited the presentation of the above-mentioned data. We did not find similar data in the literature at our disposal."

76. Modifiability of Diphtheria Bacteria

"Modifiability of Diphtheria Bacteria in Experimental Animals," by E. V. Bakulina, Tr. Krymsk. Med. In-ta, (Works of the Crimean Medical Institute), No 17, 1957, pp 148-153 (from Referativnyy Zhurnal -- Biologiya, No 12, 25 Jun 58, Abstract No 52710, by V. G. Petrovskaya)

"Experiments were performed on experimental animals (guinea pigs and white mice) which were susceptible to and naturally resistant to diphtheria. The animals were infected subcutaneously with a gravis type culture; specific serum (1000 AE) was given to one group of animals the day before infection; serum was given to a second group 2 hours after infection, and a third group served as controls. The antidiphtheria serum sharply increased the percentage of survival of atypical forms in guinea pigs. The introduction of serum to guinea pigs did not produce the same results. The biochemical properties of atypical cultures differed; several cultures were characterized by the loss of enzymatic functions."

77. Survival of *R. burnetii* in the External Environment

"Survival of *Rickettsia burnetii* in the External Environment, Their Resistance to the Action of Physical and Chemical Agents, and Methods of Disinfection," by N. I. Fedorova, Institute of Epidemiology and Microbiology imeni N. F. Gamaleya; Moscow, Gigiyena i Sanitariya, Vol 23, No 11, Nov 58, pp 53-57

This article is a survey of the work of many authors on the subjects mentioned in the title. It is pointed out that difficulties are encountered in experimental work with *R. burnetii* since it does not grow on ordinary culture media and that data obtained by different authors seldom correspond. However, statistics on the survival and resistance of this pathogen in the environment are more uniform. The most significant of these collected data are discussed in the following three sections: "Survival of *R. burnetii* Under Environmental Conditions; Resistance of *R. burnetii* to the Action of Various Physical and Chemical agents; and Methods of Disinfection." These sections contain references to research and observations performed from 1943 to 1958.

The first section deals primarily with examination of persons occupationally connected with the processing of meat and dairy products from infected animals. A brief paragraph on 1943 research notes that *R. burneti* can survive in ticks for 1,001 days and that ticks can transmit the pathogen to subsequent generations.

The second section of the report contains references to the effects of various physical factors (temperature, ultraviolet rays) and chemical factors (phenol, chlorine, calcium hypochlorite, formalin, chick embryo yolk sac, acids, and hydrogen peroxide) on *R. burneti*.

The last section of the article presents data on the effectiveness of pasteurizing milk, salting meat, composting manure, and disinfecting rooms and enclosures with steam. Caustic soda, "Preparation KhB" and chloramine are recommended for disinfecting wood or linoleum surfaces and linens; chlorination is suggested as the best method for disinfecting water.

Immunology and Therapy

78. Combination of NIISI Polyvaccine, Smallpox Vaccine, and Brucellosis Vaccine

"The Immunological Effectiveness of Components NIISI Polyvaccine Combined With Live Smallpox and Brucellosis Vaccines," by F. A. Shpugunov, Chair of Microbiology, Military Medical Order of Lenin Academy imeni Kirov; Moscow, Zhurnal Mikrobiologii, Epidemiologii i Immunobiologii, Vol 30, No 1, Jan 59, pp 24-28

The purpose of the research described in this article was to explain the separate and combined effects of live smallpox and brucellosis vaccines on the immunological effectiveness of certain components of the polyvaccine. The polyvaccine, experimental series No 17, was obtained from Moscow Institute of Vaccines and Sera imeni Mechnikov, and was an improved variant of NIISI polyvaccine. In this variant, the typhoid component was reinforced at the expense of Vi-antigen, and a purer tetanus anatoxin was introduced. The smallpox vaccine, series No 121, was obtained from Leningrad Institute of Epidemiology, Microbiology, and Hygiene imeni Pasteur, and the brucellosis vaccine, series No 51-2, from the Institute of Epidemiology and Microbiology imeni Gamaleya.

The vaccines were tested on rabbits in the same dosages used for humans. The immunogenic qualities of the tetanus, typhoid, paratyphoid B, and Flexner's dysentery components of the polyvaccine were studied. The experimental procedure is described in detail; a table and graphs are given to show results observed 60 days after immunization.

CPYRGHT The following conclusions are offered on the basis of the results obtained in these experiments:

"1. After immunization of rabbits with NIISI polyvaccine combined with smallpox and brucellosis vaccines, the immunizing effect of the typhoid, paratyphoid B, Flexner's dysentery, and tetanus components of the polyvaccine did not differ from the effect observed in animals immunized with only the polyvaccine.

"2. The purified tetanus anatoxin component in the NIISI polyvaccine had a sharply pronounced immunological effect following immunization with the polyvaccine alone and with the polyvaccine combined with the smallpox and brucellosis vaccines."

79. Brucellosis in Reindeer

"The Problem of Serological Diagnosis of Brucellosis in Reindeer," by M. K. Bepalova, Byul. Nauchno-Tekhn. Inform. N.-I. In-t S. Kh. Krayn. Severa, (Bulletin of Scientific-Technical Information of the Scientific-Research Institute of Agriculture of the Far North, No 3, 1957, pp 27-28 (from Referativnyy Zhurnal -- Biologiya, No 11, 10 Jun 58, Abstract No 50166, author's summary)

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"Examination of blood sera from 3,040 reindeer of different ages (in addition to calves up to 6 months old), suffering from bursitis and clinically healthy (for detection of inapparent forms of infection), showed that: (a) the RA (agglutination reaction) is specific in examining reindeer for brucellosis, and that the Huddleson reaction is more sensitive than the Wright; (b) sera from reindeer suffering from brucellosis has a high agglutination titer (1:1,600, 1:3,200); (c) the positive reaction disappears with time; (d) bursitis occurs in reindeer which react positively for brucellosis according to the RA. The majority of the reindeer with bursitis react positively to brucellosis antigen."

80. Cholera Therapy With Antibiotics

"Therapeutic Effect of Antibiotics and Chemopharmaceutical Preparations on the Experimental Cholera Process in Rabbits," by T. I. Puchkova and Z. D. Khanina, Tr. Rostovsk. n/D gos. n.-i. protivochumn. in-ta (Works of the Rostov-na-Donu State Scientific Research Institute), 1956, 10, 234-258 (from Referativnyy Zhurnal -- Biologiya, No 13, 10 Jul 58, Abstract No 61530, by M. A. Gruzman)

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"A protracted infectious process developed in rabbits after they were administered a culture of virulent cholera vibriions (100 million microbes) directly into the vesica fellea. A number of rabbits were given therapeutic treatment immediately after the infection; others -- 8 days later (after agglutinins appeared in the blood). No therapeutic effect was obtained by the use of synthomycin, disulfurmin, or sulgine. Streptomycin administered intramuscularly in doses of 50,000 units twice in 24 hours cured the animals completely in both experiments within 20 days. Groups of rabbits were treated with streptomycin for only 10 days; 10 days after the termination of the treatment a culture of cholera vibriion was isolated from the bile of these animals. Thereapy with levomycetin (0.1 gram internally three times in 24 hours) begun immediately after infection provided an immediate effect; it did not, however, always rid the organism of the causative agent; in a number of the rabbits relapses of the infectious process after 10-20 days of therapy were noted."

81. Trachoma Therapy

"Therapy of Trachoma by the Intravenous and Subcutaneous Injections of 0.5-percent Solution of Sodium Sulphidine," by L. Abraitiene, Sveikatos apsauga (Lithuanian), 1957, No 3, 37-40, (from Referativnyy Zhurnal -- Biologiya, No 11, 10 Jun 58, Abstract No 52123)

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"Subcutaneous and intravenous injections of a 0.5-percent solution of sodium sulphidine were given to 120 trachoma patients. The course of treatment continued for 1 1/2-2 months. The majority of the patients recovered; six of the patients required another course of treatment."

82. Ultrasound Atomizer Produces Therapeutic Aerosols

"Application of Ultrasound for Aerosol Therapy," by A. P. Livenson, All-Union Scientific Research Institute of Medical Instruments and Equipment; Moscow, Meditsinskaya Promyshlennost SSSR, Vol XIII, No 1, Jan 58, pp 17-24

Discusses the advantages of the utilization of ultrasound atomizers in the prophylaxis and therapy of diseases requiring aerosol treatment. It has long been known that an ultrasound ray directed toward a body of liquid and focused on the surface of the liquid by means of a sound reflecting device considerably intensifies the formation of aerosol fogs. The mechanism of aerosol formation under the influence of ultrasound has not been fully clarified yet. There are, however, several satisfactory theories. Among them is the theory of cavitation advanced by K. Sollner in 1936 and confirmed by Bergman in 1956; the theory of capillary waves and consequent evaporation advanced by K. Bisa, K. Dirnagl, and R. Esche in 1955 and by B. I. Sorokina in 1957. Before ultrasound atomizers could be utilized for inhalation therapy it was necessary to determine a number of factors: their productivity, that is, air saturation by aerosols for a unit of time; the density of the aerosol fog; drop content of nonvolatile substances; electric charge of the drop; homogeneity of the aerosol; the coefficient of useful effect; and the effect of ultrasound on medicinal substances. As a result of experiments conducted by Streibl, Bisa, and others it was established that ultrasound atomizers provide a density of aerosols considerably greater than that provided by nozzle type atomizers; that the ultrasound produced aerosols are highly homogenous; the aerosol drops are negatively charged; ultrasound atomizers can produce aerosols with a greater content of nonvolatile substances in suspension than do nozzle type atomizers. Despite the well-known fact that ultrasound is capable of decomposing macromolecular compounds, it has no effect on medicinal substances; the coefficient of the useful application of ultrasound atomizers is considerably greater than that of nozzle type atomizers. They can be used as room inhalators for prophylaxis or therapy of diseases requiring inhalation treatment, and for disinfection and other purposes. Ultrasound atomizers are now being manufactured in a number of foreign countries. Within the near future ultrasound atomizers will be widely utilized in inhalation therapy. Bibliography --- seven titles.

[Comment: No mention is made of any ultrasound atomizers now being manufactured in the Soviet Union]

Oncology

83. Tobacco, the Causative Agent of Pulmonary Cancer

"Smoking and Cancer," by Candidate of Medical Sciences V. S. Grazhul'; Moscow, Zdorov'ye, Vol. IV, No 12, Dec 58, pp 22-23

An article calling for an all out struggle against the tobacco habit. It briefly reviews the history of tobacco and the development of the smoking habit. It has long been known that tobacco in all its forms is harmful to the human organism. It was not, however, until recent years that it was definitely established that tobacco is a causative agent of pulmonary cancer. In 1936 Dr Roff, an Argentine physician, isolated the tar from tobacco which produced skin cancer in mice. Since then it has been established that from 90 to 98 percent of the persons who developed lung cancer were heavy smokers. It has also been noted that cancer of the tongue and mouth area is closely connected with the smoking habit. The struggle against the tobacco habit and therefore cancer is a complex problem which cannot be solved by administrative measures alone. It requires the cooperation of society as a whole.

84. Effect of Infections on Leukoses

"Effect of Infections on the Clinical Course of Leukoses," by Ch. M. Abdullayev, A. M. Akhundova, and O. Kh. Ter-Mrktycheva, Azerb. tibb zh., 1957, No 5, 7-12 (from Referativnyy Zhurnal -- Biologiya, No 11, 10 Jun 58, Abstract No 51722, by R. P. Zolotnitskaya)

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"Cited are observations made on three patients afflicted with lymphadenosis in whom the total number of leukocytes has somewhat decreased (from 307,650 to 89,400 per milliliter of blood; from 19,000 to 14,000 per milliliter of blood; and from 128,000 to 89,700 per milliliter of blood) without any essential modification of the leukocyte formula as a result of malaria from which they had recovered. After the malaria attacks abated under the influence of antimalarial therapy, the number of leukocytes again increased and the condition of the patients became worse. The purulent processes which developed in the course of the lymphadenoses induced a 3-week remission in one of the patients, but aggravated the general condition of another patient who died after symptoms of progressive anemia and leukopenia developed. The authors think that the suppurative and inflammatory processes in cases of leukosis may produce a brief remission in patients who retain the functional ability of tissue hemopoiesis, but in other cases the combination with suppurative processes leads to the complete exhaustion of hemopoiesis."

85. Effect of Cancerous Sera on Chicken Embryos

"Effect of Sera From Cancerous Patients on the Development of Chicken Embryos," by Leon Cholewa, Polski tygod. lekar. (Polish), 1957, 12, No 24, 929-932 (from Referativnyy Zhurnal -- Biologiya, No 13, 10 Jul 58, Abstract No 61079, by L. Cholewa)

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"The injection of sera from patients suffering from cancer, chronic myeloid, or lymphatic leukemia, or sera obtained from healthy persons into fertilized eggs (195) on the 5th day of incubation had a negative effect on the development of the embryo; no difference in the effect of the sera, whether obtained from healthy or diseased persons, was noted."

86. Study of Data on Pathogenesis and Development of Hemolytic Diseases of New-Born Infants

"Certain Data on the Pathogenesis and Pathological Anatomy of Hemolytic Diseases of New-Born Infants," by G. G. Gevorkyan, Pathoanatomical Department of Moscow Oblast Scientific Research Institute of Obstetrics and Gynecology (director, O. D. Matspanova, Honorary Physician of RSFSR; and Prof V. P. Mikhaylov, scientific director); Moscow, Akusherstvo i Ginekologiya, No 1, Jan/Feb 59, pp 34-38

The author concludes from personal clinicoanatomic studies of hemolytic diseases and from hematological and biochemical data, that hemolytic diseases of the new-born infants are diseases of the blood system bordering leukosis. In view of this fact, the author deems it advantageous to have thorough blood studies continue up through adolescence in individuals who from birth showed signs of hemolytic diseases, because of the possibility of the development of these symptoms into other forms of hemolytic diseases later on.

87. Therapy of Leukoses

"On the Problem of the Therapy of Leukoses (Second Report), by K. I. Kovaleva, Tr. Otchetn. nauchn. konferentsii (Rostovsk. n/D. med. in-t) (Works of the Reporting Scientific Conference) for 1956, Rostov na-Donu, 1957, 345-346 (from Referativnyy Zhurnal -- Biologiya, No 11, 10 Jun 58, Abstract No 51764)

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"Thirty patients afflicted with leukosis (11 patients with acute leukosis and 19 with chronic) were under observation. The ages of the patients were as follows: 14 of them were up to 25 years of age, and 16, over 30 years old. The patients with acute leukosis were treated

with blood transfusions in combination with antibiotics, vitamins, liver, and iron preparations, with ACTH in individual cases, with 6-mercaptopurine and Khrushchev's preparation. Despite this energetic and complex therapy, not a single case of prolonged remission occurred, and all the patients died within 6 months to 1 1/2 years after the disease set in. The patients with chronic leukosis were subjected to roentgenotherapy in conjunction with blood transfusions, and the administration of liver and iron preparations, and vitamins. Seven of the patients with chronic leukosis were administered P³² after having undergone a course of roentgenotherapy. Clinical remission was observed in five of them within a period of 2-8 months. The general condition of two of these patients worsened within 2-3 weeks."

Pharmacology and Toxicology

88. Effect of Aminazine on Antibiotic Toxicity

"Effect of Aminazine on the Sensitivity of White Mice to Penicillin, Streptomycin, and Biomycin," by L. M. Astanina, Control Analytical Laboratory of the Fourth Main Administration of the Ministry of Health USSR; Moscow, Farmakologiya i Toksikologiya, Vol XXI, No 6, Nov-Dec 58, pp 18-21

White mice were used in experiments which were carried out to determine the effect of aminazine, the hydrochloride of N-(3-di-methyl-aminopropyl)-2-chlorphenothiazine synthesized at the All-Union Scientific Research Chemopharmaceutical Institute by M. N. Shchukina and N. V. Savitskaya, on the toxicity of penicillin, streptomycin, and biomycin when they are used in conjunction with the drug. The mice used weighed 18-20 grams. Aminazine was administered to the animals in the form of 0.1-percent solution subcutaneously in doses of 10 gamma/gram. The antibiotics were injected 60 minutes after the administration of aminazine, when the animals were already in a state of sleep. The experiments established the following:

1. Aminazine raised the sensitivity of the animals to penicillin, particularly to sublethal doses of the antibiotic.
2. Aminazine had no effect on the toxicity of streptomycin.
3. Aminazine raised the sensitivity of the animals to biomycin.
4. The antibiotics had no effect on the duration of sleep induced by aminazine in the mice.

89. Toxic Effects of Aureomycin

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"Danger of the Intraperitoneal Administration of Aureomycin," by Jaroslav Kudr, Rozhl. chirurg. (Czech), 1957, 36, No 1, 32-36 (from Referativnyy Zhurnal --- Biologiya, No 11, 10 Jun 58, Abstract No 52074, by I. A. Frolova)

"The intraperitoneal administration of a suspension of aureomycin to three patients in the course of surgery produced meteorism and other complications in two of the patients, and serous-fibrinous peritonitis in the third patient. The greatest changes took place in the areas where the localized aureomycin residue was visible. The intraperitoneal administration of aureomycin to guinea pigs produced peritonitis and killed the animals."

90. Distribution of Aminazine-S³⁵ in the Tissues of Rats

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"Autoradiographic Investigation of the Distribution of Aminazine-S³⁵ in the Tissues of Rats," by M. F. Merkulov, N. A. Fedorov, and I. A. Poberiy, Uch. zap. 2vo Mosk. Med. in-ta (Scientific Notes of the Second Moscow Medical Institute), 1957, 6, 190-196 (from Referativnyy Zhurnal --- Biologiya, No 16, Aug 58, Abstract No 75709)

"Aminazine-S³⁵ was slowly administered intravenously to rats in doses of 50 milligrams per kilogram of weight. Twenty minutes later the animals were killed and the aminazine content in the tissues was determined. A considerable portion of the radioactivity was washed out during the procedure used for the processing of the tissues, and the autographs obtained revealed the distribution of the aminazine-S³⁵ fractions which were closely attached to the structural parts of the cells. A selective accumulation of aminazine-S³⁵ in the nuclei of the epithelial cells of the alveoli was observed in the lungs; in the renal organs aminazine-S³⁵ was predominantly concentrated in the epithelial formations of the canaliculi and in the Bowman's capsule; in the spleen, the accumulation of aminazine-S³⁵ in the follicles exceeded the level of its accumulation in the red pulp. Comparatively large accumulations of aminazine were found in the follicles of the thyroid gland. In the brain aminazine was absorbed by the gray matter with an intensity twice as great as that of the white matter. In the liver and suprarenals the distribution of aminazine was of a more diffused character."

91. Schizophrenia Therapy

"Comparative Data on the Modifications in the Indexes of Nitrogen Metabolism and Oxidation Processes in the Therapy of Schizophrenia With Aminazine, Serpasil, and Neurotoxic Serum," by E. Ya. Skuin, Vopros. Psikhiiatrii (Problems of Psychiatry) vyp. 2 M., 1957, 118-122 (from Referativnyy Zhurnal -- Biologiya, No 11, 10 Jun 58, Abstract No 59116)

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"Biochemical investigations conducted after aminazine (I) and serpasil (II) were administered to schizophrenic patients disclosed an increase in the peroxidase time and an increase in the blood free oxygen content. In the author's opinion this indicates an inhibition of the oxidation processes. On the basis of all the biochemical indexes the general action of II differs from that of I by biochemical changes which are less expressed than those caused by I, and by an indication of a less pronounced and more gradual effect of II on metabolism. Nitrogen metabolism was normalized by I and II in the process of therapy. Therapy with neurotoxic immune serum provided only temporary relief and the changes in metabolism were irregular and unstable."

92. Drug Reactions in Brucellosis Therapy

"Reaction Caused by Sulfadiazine, Streptomycin, and Chloromycetin in the Therapy of Brucellosis," by Ma Chun-i, Chung-hua nei-k'o Tsa-chih (Chinese Journal of Internal Medicine), 1956, 4, No 8, 633 (from Referativnyy Zhurnal -- Biologiya, No 11, 10 Jun 58, Abstract No 52067, by Kao T'ien-hsiang)

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"A reaction similar to the Herxheimer syphilitic reaction was observed in a brucellosis patient treated with sulfadiazine, streptomycin, and chloromycetin. The patient recovered within 57 days following two courses of treatment with these preparations."

93. Effect of Sulfidine on the Cardiovascular System

"Data on the Effect of Sulfidine on the Cardiovascular System," by Gvishiani, Byul. N.-i. in-t malarii i med. parazitol. Gruz. SSR (Bulletin of the Scientific Research Institute of Malaria and Medical Parasitology, Georgian SSR), 1956, No 3 (27), 66-71 (from Referativnyy Zhurnal -- Biologiya, No 11, 10 Jun 58, Abstract No 52122)

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"A single intravenous administration (to cats and rabbits) of sulfidine (40-60 milligrams per kilogram body weight) lowers blood pressure for 5-30 minutes. Several administrations (twice daily for a period of 10 days)

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lower blood pressure for longer periods of time. Sulfidine in dilutions of 1:10 and 1:5 parts per 1,000 increases the systole and the contracting rhythm (experiments on isolated hearts of cats and rabbits). Sulfidine when administered into the femoral vein dilates the vessels of the ear; in diffusion directly through the ear vessels it constricts them somewhat."

94. Datisca cannabina Toxicity

"On the Toxicity of Datisca Hemp and the Pathohistological Changes Caused by its Administration into the Organism of Experimental Animals," by S. Zaslavskaya and N. Izmaylova, Nauchn. raboty stud. Tashkentsk. med. in-ta (Scientific Works by Students of the Tashkent Medical Institute) Tashkent, AN Uzbek SSR, 1956, 51-57 (from Referativnyy Zhurnal -- Biologiya, No 13, 10 Jul 58, Abstract No 61599, by F. S. Vorob'yeva)

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"The toxic properties of aqueous and alcohol extracts of the roots, leaves, seeds, and seed pods of Datisca hemp (*Datisca cannabina*) were investigated in experiments which were carried out on frogs, mice, and rabbits. The injection of these preparations into the animals produced a depression of the nervous system, paralysis of the extremities, and lowered reflex irritability. Pathohistological investigation of the internal organs revealed plethora, stasis, and various degenerative modifications; more acute changes were noted in the central nervous system. Preparations from various parts of the plant are characterized by similar action, differing only in the degree of their toxicity. The seeds and seed pods are the most toxic. The lethal dose of an infusion prepared from the seeds and seed pods is 0.2 milliliter for frogs and mice; that of an infusion prepared from leaves is 2 milliliters for frogs and one milliliter for mice."

95. Effect of Cobalt on Hemopoiesis

"Effect of Cobalt on the Hemopoietic System of Man," by Hanna Lipinska, Polskie arch. med. wewnetr., (Polish), 1956, 26, No 9, 1337-1348 (from Referativnyy Zhurnal -- Biologiya, No 16, 25 Aug 58, Abstract No 75819, by M. Gruzman)

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"Patients suffering from anemia were given CoCl_2 per os three to five times a day in doses of 10-20 milligrams for periods of 14-16 days; more frequently they were given CoCl_2 in doses of 10 milligrams five times a day. It was shown that CoCl_2 had a stimulating effect on the blood producing organs of persons suffering from various forms of anemia, as well as of persons in whom no modifications of the hemopoietic system were observed. The stimulating effect of CoCl_2 on erythropoiesis was particularly noticeable in the infectio-toxic forms of anemia which accompany neoplasms and which develop after stomach

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resections. No effect of cobalt on erythrocyte resistance was noted. Doses of 50 milligrams of CoCl_2 for periods of 15 days are usually sufficient to stimulate the hemopoietic system; in these doses the preparation is not toxic. The stimulating effect of cobalt lasts for a period of several weeks."

96. "Effect of Antihistamines on Metabolism

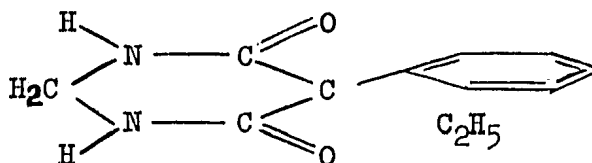
"Effect of Some Phenothiazine Derivatives and Antihistamine Preparations on Carbohydrate Metabolism," by Ye. L. Pravotorova, Laboratory of Pharmacology of Metabolism of the Institute of Pharmacology and Chemotherapy of the Academy of Medical Sciences USSR; Moscow, Farmakologiya i Toksikologiya, Vol XXI, No 6, Nov-Dec 58 pp 7-11

Report on the results of experiments conducted on rabbits, predominantly males, to determine the effect of the phenothiazine derivatives -- aminazine and mepazine -- and the antihistamine preparations -- dimedrol and diazoline (naphthalene-1,5-disulfonate-9-benzil-N-methyl 1,2,3,4-tetrahydrocarbonyl) -- on some aspects of carbohydrate metabolism: blood sugar content, glycogen content in the organs, and hyperglykemia induced by adrenalin. A number of experiments were carried out in which the animals were administered the drugs in various doses. The experiments established that aminazine, mepazine, dimedrol, and diazoline produced no essential changes in the blood sugar content as compared with that in control animals. Mepazine, dimedrol, and diasoline raised the glycogen content in the organs and depressed the hyperglykemia caused by adrenalin. Aminazine sharply intensified the hyperglykemia without causing any essential changes in the glycogen content in the organs. It may be assumed, the author writes, that the effects produced may be the result of the antihistamine properties of the preparations. The contrary effect of aminazine on adrenalin induced hyperglykemia may possibly be due to the fact that antihistamine property of the drug is weakly expressed and it acts mainly on the central nervous system.

97. New Antispasmodic

"The Antispasmodic Drug Hexamidine," by Yu. I. Syrneva, All-Union Scientific Research Chemicopharmaceutical Institute imeni S. Ordzhonikidze; Moscow, Meditinskaya Promyshlennost SSSR, Vol XIII, No 1, Jan 59, pp 56-57

Permission to manufacture hexamidine, a new antispasmodic drug, has been granted by the pharmacological committee of the Scientific Medical Council, Ministry of Health USSR. Chemically, hexamidine is 4,6-dioxo-5-phenyl-5-ethylhexahydropyrimidine, and has the following structural formula:



Hexamidine is a white crystalline substance, is poorly soluble in water, more readily soluble in alcohol, and has a melting point of 277-281 degrees. When administered to animals it acts as an antispasmodic. Clinical tests conducted at the Institute of Psychiatry of the Ministry of Health USSR, the Psychiatric Clinic of the Second Moscow Medical Institute, and the Clinic of Nervous Diseases of the Gorkiy Medical Institute established its effectiveness in epilepsy, mainly in severe attacks. It is only slightly toxic; some side effects such as somnolence, dizziness, headaches, ataxia, and nausea may be observed during the first few days of its use.

98. Use of Atropine in Proserine Intoxication

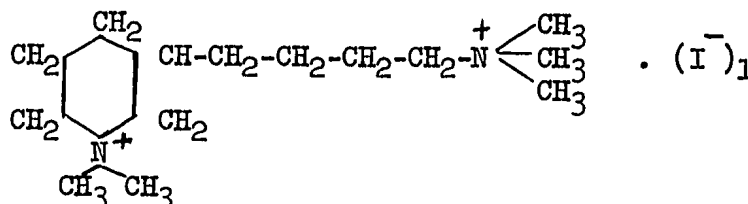
"Effect of Various Doses of Atropine on the Course and Outcome of Proserine Intoxication in White Mice," by V. B. Prozorovskiy, Chair of Pharmacology, Leningrad Medical Institute of Pediatrics; Moscow, Farmakologiya i Toksikologiya, Vol XXI, No 6, Nov-Dec 58, pp 37-41.

White mice weighing 18-22 grams were used in experiments conducted to determine the diapason of effective doses of atropine and to characterize the optimal and minimal doses of the drug when used to counteract proserine intoxication. Aqueous solutions of both preparations, proserine in concentration of 0.005 percent and atropine in concentration of 0.5 percent, were administered to the animals. Two variants of experiments were carried out. In the first variant the mice received proserine in doses about 90 percent lethal. In the second variant lethal doses of proserine were administered. The experiments established that atropine prevented proserine lethality in mice when used in doses ranging from 0.0005 to 300 gamma/gram; that the optimal doses of atropine when used to counteract proserine intoxication in white mice were 50-100 gamma/gram and that the minimal doses was 0.0005 gamma/gram; that the female animals were able to tolerate proserine better than the male mice; that atropine is a more expressed antagonist of proserine in the female mice than in the male animals; that mice which are more tolerant of atropine than other warm-blooded animals were at the same time highly sensitive to the drug when it was used as an antagonist of proserine.

99. Ganglioblocking and Hypotensive Drugs

"Ganglioblocking Activity of Some Derivatives of Nicotine," by D. A. Kharkevich, Laboratory of Special Pharmacology at the Institute of Pharmacology and Chemotherapy, Academy of Medical Sciences USSR; Moscow, Farmakologiya i Toksikologiya, Vol XXI, No 6, Nov-Dec 58, pp 28-30

The ganglioblocking and hypotensive properties of the nicotine derivatives D-47 [diiodomethylate beta-(4-dimethylaminobutyl)-N-methyl piperidine], D-48 [diiodomethylate beta(N-methylpyrrodiline) pyridine], and D-49 [beta-(4-dimethylaminobutyl)-N-methyl-piperidine] were studied. The substances were synthesized by S. V. Zhuravlev and M. I. Dorokhova of the Chemistry Division of the Institute of Pharmacology and Chemotherapy, Academy of Medical Sciences USSR. The experiments were carried out on anesthetized and decerebrated cats. The blood pressure, respiration, and cardiac reaction to the stimulation of a peripheral section of the vagus nerve were registered. In addition records were kept of the muscular contractions of the third eyelid, and the biological currents of the postganglionic fibers when the preganglionic sympathetic stem was stimulated. White mice were used to determine the toxicity of the drugs. The experiments established that D-47 which has the following structural formula



is the most active of the three as a ganglioblocking agent. It also had a marked hypotensive effect when administered to the animals in a dose of one milligram per kilogram body weight. Its hypotensive effect was of 2-3 hours' duration. D-48 and D-49 were only slightly effective as ganglioblocking and hypotensive agents.

100. Antimalarial Drug

"Quinocide, a New Antimalarial Drug," by G. Ye. Gozodova, Institute of Malaria, Medical Parasitology, and Helminthology, Ministry of Health USSR; Moscow, Meditsinskaya Promyshlennost SSSR, Vol XIII, No 1, Jan 59, pp 54-56

Although tropical malaria has been almost completely eradicated in the USSR, 3-day malaria is still widely prevalent in rural areas. Until recent years no drug was available which completely cured the disease. Relapses which were explained by the prolonged existence of the so-called tissue forms of the causative agent of malarial infection in the hepatic

irritability of the mechanoreceptors of the CS. Chlorpromazine similarly administered blocks the irritability of the mechanoreceptors. The injection of chlorpromazine into the tuber cinerum, the third or fourth ventricles, or the cisterna magna depresses the reactivity of the CS without affecting blood pressure in some cases. This points to the existence of separate automatic centers with reflexogenic zones side by side with the vasomotor centers of the medulla oblongata."

Physiology

103. Bone Regeneration and the Cerebral Cortex

"Effect of the Functional Weakening of the Cerebral Cortex on the Regeneration of Bone Tissue," by G. B. Bochorishvili; Tbilisi, Soobshcheniya Akademii Nauk Gruzinskoy SSR, Vol XXI, No 3, Sep 58, pp 359-364

Experiments were carried out on dogs to elucidate the role which the functional state of the cerebral cortex plays in the regeneration of bone tissue. A deeply disturbed condition of the cerebral cortex was produced by developing first positive conditioned reflexes in the dogs by means of visual and sound stimulants; then experimental neuroses. In some dogs a conflict of reflexes was produced by passing an electric current through their bodies at the moment when they were eating meat. Observations established that this functional disturbance of the cerebral cortex in the animals was accompanied by delayed, depressed, and in many cases perverted regeneration of bone tissue. This was clearly indicated on roentgenograms.

104. Morphological and Biochemical Blood Changes Due to Vibration Sickness

"Concerning the Problem of Morphological and Biochemical Changes in Blood During Vibration Sickness," by N. N. Pushkina and L. B. Yushkevich, Inform. Byul. Mosk. N.-I., In-t Sanitarii i Gigieny (Information Bulletin of the Moscow Scientific Research Institutes for Sanitation and Hygiene), 1958, No 16, 47-48; (from Referativnyy Zhurnal -- Khimiya, Biologicheskaya Khimiya, No 3, 10 Feb 59, Abstract No 2906)

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"During morphological studies on the blood of patients suffering from vibration sickness, the following changes were observed: increased leukocyte count (9,000-13,000 especially during the second and third stages of the sickness), a tendency toward lymphocytosis, and changes in the erythrocyte sedimentation rate. No changes were evident in the red blood component. In these patients a tendency toward hypoglycemia was evident

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(70-75 mg %, especially during the second and third stages of vibration sickness) and the quantity of cholesterol ranged from 200 to 225 mg % in 15 % of the patients. The authors recommend the use of morphological and biochemical studies in examining patients suffering from vibration sickness."

105. Acclimatization to Arctic Conditions

"Acclimatization of Humans to Conditions on a Floe in the Arctic Ocean," by L. Ye. Ponomarev and G. M. Sokolov, Department of Polar Medicine of the Main Administration of the Northern Sea Route; Moscow, Sovetskaya Meditsina, No 1, Jan 59, pp 100-106

The authors of this article were members of a group of scientists who set up a base on a flat mass of floating ice in the Arctic in April 1955. They called this base "North Pole Station 4." They spent a year on the floe, until April 1956. They drifted in a general northerly direction, and by September 1955 they had traversed the area of the so-called "pole of relative inaccessibility." Subsequently they reached a latitude of 87°20' North, and a longitude of 177°55' East. The distance they covered in their drift northward was 750 kilometers from their starting point. They made a loop and again drifted northward, covering a distance of 2,600 kilometers during the entire year they spent on the floe.

Their one-year stay on the floating ice was not easy even though they had excellent facilities and equipment available for combating the elements and for recording weather conditions.

Experiencing polar nights that last 5 months and snowstorms that travel 30 meters per second, the members were apprehensive concerning their ability to orient themselves. Several tons of snow gradually covered the camp with a layer 2-3 meters thick. Orientation was also difficult during the summer months when the sun shone 25 hours at a time, melting the ice and resulting in the formation of large lakes 1.5 meters deep which threatened to drown the entire camp. Some other difficulties encountered by members of the expedition were: unusual changes in weather, drop in temperature to -50°C in the winter time, and skirmishes with bears.

Since proper organization of the work regimen and mode of life on floating ice serves to harden the organism and also serves to prevent sickness, proper organization of medical and sanitary measures is absolutely necessary. This was taken care of by physicians who were members of the expedition. Physicians who accompanied the expedition also made observations, insofar as conditions allowed, on the process of acclimatization of the members during the entire year they were adrift.

A sufficiently strict daily routine was established on the station "North Pole 4." This routine was based on experiences of earlier Soviet polar expeditions and polar stations established on drifting ice. Although sharp changes in weather, breaking up of ice, and the presence of drifting snow made it necessary for all hands to do clearance work, proper organization of work and rest helped to prevent fatigue and any morbid conditions. The majority of men felt well even during the months of polar nights, they slept well, and their efficiency was unaffected. No disturbances in the nervous system were noted.

Frame tents, designed by Engr S. A. Shaposhnikov, were used as living quarters and workshops. These frame tents can be carried easily from place to place, set up and taken down without any difficulty. Gas stoves were used to heat these tents. In the spring when there was hardly any wind and the temperature outside was between -25°C and -35°C , one or two burners in each tent held the temperature at 12°C and 14°C (the temperature of the floor remained close to 0°C). The frame booths, which were lived in during winter months, were heated by using economical cast iron-ceramic stoves. Gas stoves were found to be unsuitable for winter use, because continual burning of gas and insufficient ventilation contaminated the air in the booth.

A kitchen was established in one booth adjacent to a booth that was used as a mess room. Food was cooked on gas stoves. In the summer time snowflakes, obtained far away from the area where men lived, were gathered and used as drinking water. A special container was used to melt the snow to warm the water. The authors of this article state that members of the group belonging to the station "North Pole 4" were more successful in collecting snowflakes for water during the 4 months from June to October than during any other months of the year. It was noted that the taste of salts (chlorides) in the water was hardly noticed during the summer months; the content of chlorides in water from snowflakes gradually increased with the approach of early autumn frosts (between 3% and 10%), and the taste of water changed.

Special diets which are applicable to conditions existing on drifting ice in the Far North were observed. Daily food rations were based on results of experiments conducted on Dixon Island. Between 4,000 and 5,000 large calories were found to be needed by each member of an expedition into the Far North. Ingredients and amounts needed per person were as follows: proteins, 140-160 grams; fats, 120-150 grams; carbohydrates, 500-630 grams. According to the classification of the Institute of Nutrition, these caloric quantities of the daily needs of each member of an Arctic expedition correspond to energy expenditure by those people on the mainland who do heavy nonmechanical physical labor. These norms actually corresponded to the energy expenditure of polar explorers on drifting stations (with a few minor adjustments depending on the season of the year). A card file of the daily activity of every member of the expedition was kept on station "North Pole 4," and special tables were used in calculating the energy expended by each member.

The expedition took along a large assortment of products to avoid monotony in eating. The menu was made up a week in advance, which provided an opportunity for selecting varied food products. Food was served three times a day and distribution of calories was: breakfast, 20%; dinner, 46%; and supper, 34%. Vitamin balance was maintained in the organism of each individual by an abundant supply of fresh vegetables: onions, garlic, cabbage, and garden beets. Fruit such as apples, mandarins, oranges, and lemons was also on hand. When fruit was temporarily unavailable, its vitamin content was supplied by polyvitamins and vitamin C.

Bathing facilities were installed in one of the booths. According to the author, solar radiation during the spring-summer period is reflected in large quantities (from 50% up to 97%) by the snow into the atmosphere, whereupon the snow melts slowly. Garbage absorbs heat, and, therefore, if the surface of the camp is contaminated even with small particles of trash, the local thermal balance of the surface changes. These particles absorb heat, which accelerates the melting of snow, and water that forms on the ice surface absorbs the solar energy. All this speeds up the general process of melting the snow and ice and leads to inundation of the camp, thereby creating difficult conditions on the floe. Disposal of excrements and garbage, therefore, is very important from the very first days of the stay on the drifting ice. A spot a distance away from camp was marked and designated for trash disposal, and on station "North Pole 5" the entire load of trash was thrown into a crack close by.

Every member of the expedition was supplied with two pairs of glasses, dark amber in color, which reliably protected the eyes from the adverse effects of radiant energy and at the same time supplied the necessary color contrasts in the visual field. Not one case of eye sickness or snow blindness was observed among members of the group on station "North Pole 4." A study was made of ultraviolet radiation during the summer months (July-September) 1955. This study was made in the region of the North Pole at a latitude between 82° and 83°08' North. A summary of the actual daily average of ultraviolet radiation in July and in August in the area of the North Pole (in comparison with available data that deal with other regions) is presented in the table below.

Over-all Dimensions of Ultraviolet Radiation
(in milligrams per square centimeter of oxalic acid)

<u>Region Under Investigation</u>	<u>July</u>	<u>August</u>	<u>Author's Name</u>
Station "North Pole 4"	21.4	15.6	L. Ye. Panomarev
Leningrad (1947)	14.7	12.1	Ye. V. Donetskaya
Outskirts of Leningrad (1950)	19.9	20.9	G. A. Sviderskaya Z. N. Kulichkova

It can be seen from the table above that the sun shines brightly in the area of the North Pole only a few hours a day during July and August. Ultraviolet rays emitted by the sun in that region exceed ultraviolet rays emitted by the sun in a number of cities located in moderate zones by 2-9 erythemic doses per day. It can also be seen from the figures in the table that the majority of members of the "North Pole 4" and "North Pole 5" expeditions were able to expose their bodies to the sun when the thermometers on the walls of the tents and booths showed that the temperature was 16°C or higher.

The authors of this article further state that during the period of polar nights, the human organism is completely deprived of natural ultraviolet radiation. Beginning with November, therefore, each member of the expedition was subjected to 20-25 exposures under a quartz lamp until pigmentation was noticeable. A quartz mercury vapor PRK4 lamp was used for this purpose. The lamp was usually placed at a distance of 65-75 centimeters from the skin; the duration of each exposure was ordinarily between 3 and 10 minutes every other day. By irradiating the living and working quarters, bacterial contamination of the air was reduced considerably. It was found that people who arrived at the station "North Pole 4" in the middle or toward the end of summer appeared to be less sensitive to artificial ultraviolet radiation than those who arrived at the end of the winter period. Increased cutaneous sensitivity to quartz radiation was noted in the latter.

Almost everyone who ever conducted an expedition into the Arctic region has pointed out the need for medical selection of personnel, because many difficulties arise on drifting ice which demand excellent physical condition, endurance, stamina, and composure. People who have had a previous history of some disease usually suffer a relapse on an ice floe. Personnel on "North Pole 4" were given a physical examination every month during their entire year of stay on the ice floe. Physical examinations included observation of blood pressure and vascular tonus, and examination of blood. Although limited in scope, these observations made it possible to note any changes in the organism during the period of acclimatization.

From a general biological viewpoint, acclimatization, according to the authors of this article, must be looked on as a complicated process of adjustment of the organism to its environment. Acclimatizing reactions were noted in people mainly during the first 4-6 weeks after their arrival at "North Pole 4." These reactions consisted of a tired feeling, decreased appetite, an insurmountable feeling of somnolence while at work, and shortness of breath during light physical exertion. The physical condition of the members improved during polar days, because of the considerable amount of work done out of doors and indulgence in physical exercises (volley ball games and skiing). During the period of polar nights most of the members gained weight up to between 2 and 4 kilograms. Transport of cargo during the autumn and preparation of living quarters and working premises for winter served as an excellent supplementary factor in the physical conditioning process before the onset of polar nights.

During the first 1 1/2-2 months of polar nights, the majority of the members of the expedition lost their appetites and they lost weight as a result; some were restless in their sleep and had unpleasant dreams. Subsequently, people slept well some nights. Slight functional shifts in the nervous system, which were characterized by increased irritability, were noted during this period. Even though the appetite in the majority of the members improved somewhat during January and February, loss in weight increased progressively. Some people weighed even less than when they first arrived.

The physician of station "North Pole 5," Gavrilov, discovered that the vitamin content of blood drops and even goes below normal during the polar night period (particularly during the second half). This is manifested particularly by shortness of breath and rapid fatigue during light physical exercise.

The 28 members of "North Pole 4" were subjected to systematic examination during their entire period of drifting (one year) on the ice floe. Information was obtained by means of an oscillograph and by using the auscultatory method of determining blood pressure. The highest blood pressure found was between 130 mm and 85 mm; the lowest, between 85 mm and 45 mm. The oscillographic blood pressure was somewhat below that of the auscultatory in the majority of those examined.

A persistent drop in blood pressure took place during the first 4-5 months of stay on the ice floe: it dropped 15-30 mm and did not change until the return to the mainland. Changes in blood pressure occurred as a result of intensification of the activity of physiological mechanisms of adjustment, and of compensatory reactions of the organism.

Blood of 24 members of "Station North Pole 4" was examined during the period of polar days (August), in the middle of the period of polar nights (November-December), and at the end of the polar night period (at the beginning of the period of polar days), in March. (Calculation of leukocytes and processing of all blood examination data were done by G. M. Sokolova.) Hemoglobin in all personnel was normal throughout their entire period of stay (from April 1955 through April 1956); it fluctuated between 76 and 96 units. The number of erythrocytes was also normal in all members of the expedition (between 3.9 million and 5.4 million). Fluctuation in the number of erythrocytes did occur in individual members of the expedition but it was not significant. The color index was normochromic in everybody examined; it fluctuated from 0.83 to 1.

The erythrocyte sedimentation rate underwent no changes in the members of the expedition who were examined. The erythrocyte sedimentation rate was from 2 mm to 5 mm per hour in the majority of people examined; in only one member of the expedition, the erythrocyte sedimentation rate was 10 mm per hour during initial examination.

The number of leukocytes during polar days and during the period of polar nights (as well as at the end of the period of polar nights) fluctuated rather widely: from leukopenic numbers (4,100-4,600) to the upper limits of the normal range (9,600-10,000); the range of fluctuations did not change during all these periods.

In comparing the number of leukocytes present during the period of polar days with the number of leukocytes present during the period of polar nights, it was noted that their number increased from 400 to 4,600 per mm³ (in 13 people). On the contrary, in eight people, their number decreased from 4,000 to 4,100 per mm³. No definite change in the number of leukocytes was observed at the end of the period of polar nights or at the beginning of the period of polar days. The cause for leukocytosis in one individual was not clear. In two other members, leukocytosis was thought to be due to frequent exacerbations of chronic tonsillitis in one, and to exacerbations of rhinorrhea in the other.

Attention was attracted by the fact that a high content of eosinophils (1%-8%) and monocytes (2%-14%) was noted in most of the personnel from the very beginning of the period of polar days. The same high percentage of eosinophils and monocytes was noted when the period of polar nights reached its climax and when it was over.

Fluctuation in the percentage of segmentonuclear neutrophils and in the percentage of lymphocytes in some individuals was not considered too important.

As far as avitaminosis is concerned, particularly scurvy, changes in blood took place in the form of anemia, leukopenia with neutropenia, and thrombocytopenia. These changes disappeared after treatment with ascorbic acid (V. Ya. Chekin Ye. M. Yermilova, A. M. Endel'-Smol'nikov, and G. M. Danishevskiy).

No incidence of anemia was observed in individuals examined on "North Pole 4." Leukopenia was observed in five people (between 4,500 and 4,900) during the period of polar days. Neutropenia of between 40% and 49% was also encountered in a few people only, particularly in those in whom leukopenia was observed. Consequently it can hardly be said that these changes were connected with avitaminosis since fresh vegetables and fruit as well as other food products were available in sufficient quantities.

The reason for the higher percentage of eosinophils may be connected with helminth invasion. This is plausible since helminth invasion was observed in various people at different times.

Psychiatry

106. Plans for Developing Soviet Psychiatry in the Next 7 Years

"Prospects for the Development of Soviet Psychiatry in the Next 7 Years," by V. A. Gilyarovskiy; Moscow, Zhurnal Nevropatologii i Psikhiatrii imeni S. S. Korsakova, Vol 59, No 1, Jan 59, pp 3-5

This article discusses the prospective development of Soviet psychiatry during the next 7 years. The author refers to a 1957 article (published in Sovetskaya Meditsina) which reported a decrease in the incidence of psychiatric ailments due to increased emphasis on the prophylactic aspect of psychiatry; this trend will be continued and intensified. Therapy, it is pointed out, must be based on thorough study of all characteristics of patients and on all conditions accompanying the illness. The complexities of analyzing psychiatric disturbances in large groups of patients rather than in individuals are mentioned; this task is controlled primarily by psychiatric organizations and scientific research institutes which are in contact with large hospitals and are therefore in a position to collect the necessary data. The importance of collecting data on incidence in different parts of the country is stressed, since examination of local conditions can explain etiology and can suggest control measures.

The following are among suggested improvements in the handling of psychiatric cases: therapy should be initiated earlier; neuropsychiatric departments should be set up in somatic hospitals, since many psychiatric disorders are directly attributable to somatic ailments; outpatient facilities should be augmented, particularly in outlying districts which are poorly serviced in comparison with urban areas.

In response to a special query from the Scientific Council of the Ministry of Health USSR concerning improvement of psychiatric service in outlying areas, the board of directors of the All-Union Society of Neuropathologists and Psychiatrists proposed a number of necessary measures. Qualifications of psychiatric personnel should be higher, and the number of qualified children's psychiatrists should be increased. Also, more ambulatory care for children and adolescents is proposed in connection with speech therapy for harmonic personality formation.

Alcoholism, it is noted, plays an important part in the etiology of many psychic and other diseases, and its control should be an essential element of the work of all psychiatric collectives. Anti-alcohol brochures are considered helpful.

It is stated that the aforementioned suggestions, which constitute the first stage of improving neuropathological and psychiatric services, can be discussed at sessions of institutes and at the All-Union Conference of Neuropathologists and Psychiatrists which will be called during the next few years. After this stage has been completed, the subsequent stage, consisting largely of scientific research with emphasis on organization of aid and evaluation of results obtained in this field, can be planned. Responsibility for plans for this type of work will be delegated chiefly to separate institutes.

The basic development of Soviet psychiatry, it is stated, follows dialectical-materialistic methodology. The work of Pavlov, Korsakov, and Michurin on the importance of the environment is mentioned.

Several special conditions are considered necessary for successful completion of this development program. The following specific problems must be resolved: the etiology, pathogenesis, and therapy of schizophrenia, and differentiation of this affliction from other psychoses and neuroses; detection of incipient schizophrenia; remissions and relapses; and the relationship of cortical and subcortical areas, particularly the problem of reticular formations.

New institutes are recommended in Central Asia and Siberia and the fact that only one journal of neuropathology and psychiatry exists is deplored.

107. Experimental Psychoses Induced by Lysergic Acid

"Experimental Psychoses Induced by the Diethylamide of Lysergic Acid (LSD)," by Jenone Iranyi and Rozsa Frater, Orv. hetilap, (Hungarian), 1957, 98, No 41, 1115-1120 (from Referativnyy Zhurnal -- Biologiya, No 13, 10 Jul 58, Abstract No 61573)

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"On the basis of the study of experimental psychoses induced by the oral administration of 10-150 gamma of LSD (DLK) to 29 patients suffering primarily from schizophrenia in the chronic stage, and of investigations conducted on themselves, an absence of relationship between the reactions to the dose of DLK and the character and degree of expressed clinical symptoms in most of the patients was observed. Intoxication by DLK resembles weakly expressed reactions of the exogenic type. Romberg's positive symptoms, tremors of the cilia and hands, dysarthria, muscular hypertonia, dizziness, anorexia, paresthesia, somnolence, etc. are noted during the period of intoxication. Psychic disorders are marked by disturbed perceptions (illusions, hallucinations, hyperacousia, disturbed olfactory sense, a sense of unreality and depersonalization), and disturbed thought and attention. Frequently there are aftereffects in the forms of difficulty of thought expression, inability to concentrate,

slow association, etc. A rise in the resistance of psychic patients to the action of DLK is noted (expressed symptoms of intoxication were observed in only 11 of the 29 patients). In addition to its effect on the diencephalon, DLK apparently affects the cortex. The diagnostic value of DLK is doubtful; it has practically no therapeutic effect. DLK may be utilized to some extent as a means for the establishment of temporary contact with the patients."

Public Health, Hygiene, and Sanitation

108. Public Health in the Turkmen SSR

Review of M. G. Berdyklychev's book Zdravookhraneniye Turkmenkoy SSR (Public Health in the Turkmen SSR), Turkmen State Publishing House, 1957, 248 pp, by P. P. Radkin; Moscow, Sovetskoye Zdravookhraneniye, No 12, Dec 58, pp 55-56

The reviewer of this book thinks that it makes a significant addition to an already large number of books published on the subject of health service in various union republics. He expresses the hope that more such books will soon be published on the development of health service in other republics of the USSR. Knowledge of development of health service in various republics of the USSR is considered important not only because the Communist Party program calls for increased effort in health protection, but also because this part of the Communist Party program was incorporated into the constitution of the USSR.

The reviewer of this book calls attention to the fact that the development of health service in each union republic differs: It is influenced by the nature of the local economy, cultural factors, the local way of life, and geographic and climatic conditions. Experiences of health workers in each union republic can benefit health services of the entire USSR and may prove useful to research workers of foreign countries.

The introduction in the book surveys the achievements and long-range aims of Turkmenistan. Since the Soviets gained control of the government, it is noted, Turkmenistan has been transformed from a colonial border state of tsarism into a flourishing Soviet republic of the East. As a member of the Soviet Union, Turkmenistan has achieved great success in all fields of endeavor, including that of public health.

Progress achieved in the development of health service in the Turkmen SSR becomes more conspicuous if it is compared with the situation that existed prior to the October Revolution. The author of the book therefore devoted the first chapter to conditions that existed prior to the revolution. The reviewer states that when one reads in this chapter passages

from dull, callous edicts of tsarist satraps and reports of their subordinates about the horrible death rate among adults and children, about epidemics, and extinction of the population, it is difficult to believe that this took place only 40 years ago. All tsarist edicts are full of supercilious contempt concerning the needs of the native Turkmen population. The author of the book then shows how striking the change has been since the Soviets took control, how realistic the Soviet attitude has been. It became possible to create a genuine national public health service in Turkmenistan only after the October Revolution.

The chapter that discusses the principal stages of the development of health service in the Turkmen SSR seems to be the central one: it consists of four parts which correspond to the principal stages of economic development of the republic. This chapter briefly describes how health service was organized after the October Revolution, its status on the eve of the revolution, and its development during prewar five-year plans, during World War II, and during the period after the war.

Organization of medical service to the population of Central Asia encountered great difficulties at first. Even the insignificant network of medical establishments that existed before the revolution was in a state of decadence toward the end of the Civil War. With the establishment of the Turkmen SSR, in 1924, the population of the republic experienced an economic and cultural uplift. The People's Commissariat of Health RSFSR gave considerable help to the newly formed People's Commissariat of Health Turkmen SSR. The flow of medical workers from Moscow, Penza, Samara, Perm, and other cities increased each year.

The author of the book shows a gradual increase in the allocation of funds for health service, an increase in medical cadres, expansion in the network of therapeutic and preventive medical and sanitary-epidemic control establishments. Expenditures for health service in the republic in 1957 were 370 times greater than in 1925. At present 180 rubles per year per person is spent for health protection in Turkmenistan. In 1914, only 14 kopecks per year per person was spent for health protection. There were 300 hospital beds available in Turkmenistan in 1913. At the beginning of 1957, there were 10,700 hospital beds available in the republic. In 1957, the number of hospital beds available throughout the whole USSR was six times greater than in 1913; in Turkmenistan, the number of hospital beds available in 1957 was 33 times greater than in 1913. Such an improvement in health service in the Turkmen SSR is the result of Lenin's policy concerning the nationalities within the framework of the USSR. The aim of this policy of Lenin was to raise the standards of backward nations to the level of the most advanced. Specialized medical aid can now be found in all rayon hospitals of the Turkmen SSR. At present, therapeutic, surgical, obstetrical, and gynecological service is available to all kolkhozniks in their own rayon hospitals. A number of rayon hospitals have oculists on duty and also professional personnel of other specialties.

A large army of medical workers at present stands guard over the health and welfare of the population of Soviet Turkmenistan. Prior to the revolution there was not a single native physician practicing in this area; now there are hundreds of them. The number of physicians has increased by 26 times since the Soviets gained control of the government.

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"As far as the number of physicians is concerned, the Turkmen SSR was trailing far behind not only the countries bordering it, such as Iran and Afghanistan, but also the United States of America and the countries of Western Europe."

Considerable scientific medical research work is being conducted in the scientific research institutes of the Turkmen SSR which belong to the public health service system. Scientific medical research is also being conducted in the Ashkhabad Medical Institute. Of the 250 scientific medical research workers in the republic, 40 are Turkmen; 23 of 88 candidates of medical sciences are Turkmen. Scientists of Turkmenistan have had over 2,000 scientific medical works published, mainly in the field of regional pathology. Socialist transformation of Turkmenistan drastically changed the nature of regional pathology in the republic. Only 20 years ago malaria and trachoma constituted 40% of the total incidence of disease among the population of the republic. Malaria and trachoma do not play any appreciable role at present. Pappataci fever and typhus have been completely eradicated and the incidence of cutaneous leishmaniasis has decreased to one tenth of the former figure.

The book discusses all phases of health service in the Turkmen SSR, including protection of mothers and children, development of medical resorts, and medical science in general. Physicians of Turkmenistan have succeeded in reducing the incidence of sicknesses that have caused loss of man-hours of work. Statistics that deal with medical service have been compiled by the Scientific Research Bureau of Medical Statistics of the Ministry of Health Turkmen SSR.

Economically strong kolkhozes are constructing excellent buildings for maternity homes and for permanent nurseries. Indexes of the physical development of children brought up in nurseries of the republic surpass the prewar level in growth, an average of 1-2 cm, and in weight, up to one kg. Thus, the nurseries not only free mothers for socially useful work, but help to bring up a healthy group of replacements.

Radiology

109. Multiplicity of Pathogenetic Mechanisms Arising Simultaneously Characterize Acute Radiation Sickness

"The Problem Concerning the Pathogenesis of Acute Radiation Sickness From a Pathophysiological Aspect," by Prof P. D. Gorizontov; Moscow, Meditinskaya Radiologiya, Vol 4, No 1, Jan 59, pp 6-12

The author reviews several works concerning the characteristic changes occurring in the body during acute radiation sickness. Special reference is made to changes in the sorption properties of the tissues of the small intestines, liver, and muscles of irradiated animals; changes in the tyrosine content of various blood vessels after general irradiation; and changes in leukocyte count of peripheral blood of recipient dogs after the perfusion of their extremities with the blood of irradiated dogs. These changes are correlated with time in terms of seconds, minutes, hours, and days.

The author concludes that the pathogenetic effects of ionizing radiation on organisms proceed along several pathways which may be summarized as follows:

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"1. Initial physicochemical and chemical changes arising due to ionization and the stimulation of molecules.

"2. Disturbances of neuroendocrine regulatory mechanisms.

"3. Infections, and manifestations of infectious and noninfectious allergies."

These processes always commence with the initial stage, but may follow different pathogenetic development. This phenomenon is substantiated especially by the fact the cause of death due to or following radiation can differ depending on the conditions of irradiation, the period of the disease development, and individual reactivity.

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The author concludes that

arising almost simultaneously is one of the special characteristics of the effect of ionizing radiation on animal organisms. This fact readily explains the difficulties which arise, for example, in determining the quantitative interrelationships of the effects of ionizing radiation."

110. Exogenic Infections in Radiation Sickness Reviewed

"Exogenic Infections in Radiation Sickness," by R. V. Petrov; Moscow, Uspekhi Sovremennoy Biologii, Vol 46, No 1(4), 1958, pp 48-61

Soviet and non-Soviet literature is rich with reports concerning the study of infectious complications in irradiated organisms arising due to decreased natural and acquired immunity but both lack a general analysis of these data. The present report attempts to supplement this feature, and summarizes radiation effects on exogenic infections with respect to the following: sensitivity of irradiated animals toward infection, the possibility of activating latent infections, characteristics of the course of infectious processes in radiation sickness, and diagnosis and the effectiveness of specific therapy.

111. Effect of Ionizing Radiation on Hepatic Glycogen Content

"On the Mechanism of the Effect of Ionizing Radiation on the Content of Glycogen in the Liver," by B. M. Grayevskaya, Institute of Genetics, Academy of Sciences USSR; Moscow, Doklady Akademii Nauk SSSR, Vol 124, No 1, Jan/Feb 59, pp 202-204

The aim of this research was to define and explain the role of local and distant effects of ionizing radiation on the nature of radiation sickness and hepatic glycogen content.

Tests were conducted on three groups of mice subjected to either general X-ray irradiation with 600 r, local irradiation of the liver area, or irradiation by screening the liver area during general irradiation.

Results verify that there is a sharp decrease in liver glycogen content by the 4th day, both in the group subjected to general irradiation and in the group subjected to local irradiation of the liver area, but no substantial change is evident when the liver area is screened. Within 30 days after irradiation (general irradiation) a 50% mortality rate was observed in the first group, but no deaths were observed in the remaining two groups. A drop in the leukocyte count was increased on the 4th day after general irradiation, but was only slightly increased in the other two groups. Least radiation injury was evident in mice subjected to local irradiation of the liver area, while greatest injuries were evident in animals subjected to general irradiation.

The author could not find any definite correlation between changes in the hepatic glycogen content and the general condition of the irradiated animals. He, therefore, postulates that the quantitative changes in the glycogen content of the liver of irradiated animals are determined, to a great extent, by the direct effect of radiation on hepatic tissue.

112. Effect of Plutonium Poisoning on the Synthesis of Nucleic Acids in Hepatic Tissue

"Nucleic Acid Content and Synthesis in Liver During Subacute Poisoning by Plutonium," by V. V. Konstantinova and R. Ye. Libinon; Moscow, Voprosy Meditsinskoy Khimii, Vol 4, No 5, Sep/Oct 58, pp 339-344

A plutonium nitrate solution (0.02 microcuries per g of body weight) was injected intraperitoneally into rats to study the effect of plutonium on the content and synthesis of nucleic acids in the rat livers. Appropriate tests were conducted 1-2 weeks, and 1-2 months later. Injections of radioactive phosphorus were administered 4 hours before sacrificing the animals. Tables and graphs present experimental data.

Results indicate the following:

"One or 2 months after the plutonium injection the amount of RNA was increased by approximately 25% on the average).

"The DNA content in the liver tissue was decreased (26% below normal on the average) starting with the second week and all through the experimental period.

"After plutonium poisoning, the permeability of hepatic tissue toward radioactive phosphorus was increased.

"The rate of RNA, and DNA synthesis was accelerated almost during the entire experimental period."

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113. Effect of Ionizing Radiation on Teeth and Surrounding Soft Tissues

"The Effect of Ionizing Radiation on Soft Tissues of Teeth and Parodontium," by L. P. Stepantsova, Chair of Histology and Chair of Roentgenology, Moscow Medical Stomatological Institute; Moscow, Stomatologiya, No 5, Sep/Oct 58, pp 22-30

The author reviews work done on the effects of ionizing radiation on the oral region, and describes his own research findings concerning the effects of using large doses of X rays (700 r) on rats. Photomicrographs illustrate osteoclastic resorption, and other destructive changes after irradiation.

Results prove that the morphological changes in the soft tissues inside and around the teeth are significant and appear as tissue resorption and regeneration. Initial symptoms of injury appear in 5 days after irradiation, and maximum changes are attained in 10-30 days after irradiation. In cases of severe injury, these changes remain for as long as 60 days after irradiation. Symptoms of regeneration become apparent 20 days after irradiation and, in cases of mild exposure, are completed within 70 days. In very acute cases some teeth may fall out.

114. Changes in Elastic and Viscous Properties of the Skin After Irradiation

"Changes in Elastic and Viscous Skin Properties After Local Irradiation by Large X-Ray Doses," by V. M. Mastryukova and A. I. Polivoda; Moscow, Biofizika, Vol 4, No 1, Jan 59, pp 101-107

The aim of this research was to study the effect of irradiation and to measure the value of the decrement of damping of the skin and subcutaneous tissues during edema due to irradiation.

A special apparatus to measure the value of the decrement of damping (ν) was constructed and is sketched and described. Damping curves represent fluctuations of beams produced after hitting the skin in shank area of rabbits with a mallet, and graphs illustrate changes in skin (ν).

Among the merits of this method is that the values it measures for the elastic and viscous properties of the skin can be detected earlier than the values obtained by other methods known at present.

These experiments verify that changes in the elastic and viscous properties of the skin after local irradiation are characterized by the development of edema. Evidently, the value of (ν) is closely linked to the physicochemical molecular properties of the live skin.

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The authors conclude the following:

"Changes become evident in the connective and collagenous structures after local irradiation by large X-ray doses (4,500 r). Physicochemical changes occur in the intercellular tissues and in the mechanical structures of the vessel walls which increase their permeability and intercellular fluid content.

"This research ascertained that there are two phases of tissue edema which occur after irradiation, and during this period the elastic and viscous properties of the skin and subcutaneous tissues are changed, and the value for the decrement of damping (ν) is increased. Evidently, these values are the results of disturbances in the afferent innervation of the nerve endings, and are also the result of the direct effect of ionizing radiation."

115. Combined Effect of General Irradiation and Hemorrhage on Restoration of Serum Proteins

"The Effect of General X-Rays Irradiation on the Restoration of Serum Proteins in Dogs After Hemorrhage," by V. M. Rodionov, V. D. Uspenskaya, O. G. Zamyatkina, T. A. Grunt, and V. P. Polyakova, Institute of Biological and Medical Chemistry, Academy of Medical Sciences USSR; Moscow, Voprosy Meditsinskoy Khimii, Vol 4, No 5, Sep/Oct 58, pp 327-338

The aim of this research was to study the shifts in the normal restoration picture of various fractions of serum proteins after hemorrhage following irradiation. Various tables and diagrams and electrophoretic tracings accompany the article.

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The authors make the following conclusions:

"The majority of dogs in which hemorrhage was induced 1-6 days after irradiation (by 500 r) died. In these dogs, essential changes were noted in the processes of serum protein restoration, and there was an increase in the blood stream of a type of protein having the electrophoretic mobility of alpha globulins. In dogs subjected to hemorrhage 1 1/2 months after irradiation, the serum protein restoration picture was similar to that of nonirradiated animals subjected to hemorrhage.

"Evidently these facts indicate that during the acute phase of radiation sickness the processes of regeneration of serum albumin are inhibited, but the organism does not lose the capacity to mobilize extravascular reserves of this protein and to use alpha-3-globulin sources as the albumin deficiency rises in the vascular bed.

116. Gamma Radiation Effects on Blood and Connective Tissue Cells of Explanted Mice Spleen

"A Study of the Effect of Gamma Rays of Co⁶⁰ on Blood and Connective Tissue Cells of Mice Spleen After Explantation," by A. F. Ivanitskaya, Institute of Animal Morphology imeni A. N. Severtsov, Academy of Sciences USSR; Moscow, Doklady Akademii Nauk SSSR, Vol 12¹/₄, No 1, Jan/Feb 59, pp 209-212

Discrepancies have been noted in the radiosensitivity of various types of cells; for example, radiation doses absolutely lethal to blood elements have no effect on connective tissue cells. This discrepancy was studied by the explanation of the spleen before and after the irradiation of animals and by the direct irradiation of the splenic tissue fragments and their incubation in cultures at normal and low temperatures.

Results indicate that of the three major types of cells in the spleen, the lymphocytes are the most vulnerable to radiation injuries, and they are injured first and most severely. The granulocytes of the myeloid series are more resistant, but the cells of the reticuloendothelial tissue are the most resistant. Although it is still difficult to explain the great vulnerability of the lymphocytes and the great resistance of the reticular type cells, it is important to note that the lymphocytes have the largest nucleus to plasma ratio, and the cells of reticular nature have the smallest nucleus to plasma ratio.

Finally, the explantation method proves that radiation injuries to cellular elements occur not only due to direct and distance effects, but also due to the irradiation of isolated fragments of spleen.

117. Accelerating Radioactive Calcium Elimination

"Concerning the Question of Accelerating Ca⁴⁵ Elimination From an Organism," by O. A. Khomutovskiy, Sb. Nauchn. Rabot. po Radiol. i Rentgenol. Kievsk. In-t Uoversh. Vrachey (Compilation of Scientific Works on Radiology and Roentgenology, Kiev Institute for the Advanced Training of Physicians), Kiev, 1957, 49-57 (from Referativnyy Zhurnal -- Khimiya, Biologicheskaya Khimiya, No 3, 10 Feb 59, p 69, Abstract No 2670)

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"In experiments on rats it was shown that one hour after the administration of the disodium salt of EDTA [ethylenediaminetetraacetic acid] at a dose equal to 0.22 mg/kg body weight of the animals, the elimination of Ca⁴⁵ was 24-36% greater than that of the controls. Preliminary saturation of the organism by nonradioactive calcium accelerates the elimination of Ca⁴⁵ by 19-20% above that of the controls."

118. Accelerating Radioactive Phosphorus Elimination

"Accelerating the Elimination of Radioactive Phosphorus From an Organism," by T. P. Sivachenko, Sb. Nauchn. Rabot. po Radiol. i Rentgenol. Kievsk. In-t Usoversh. Vrachey (Scientific Works on Radiology and Roentgenology of the Kiev Institutes for the Advanced Training of Physicians), Kiev, 1957, 41-48 (from Referativnyy Zhurnal -- Khimiya, Biologicheskaya Khimiya, No 3, 10 Feb 59, Abstract No 2669)

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"In experiments on rats it became evident that the acceleration of P³² elimination from organisms was possible by the administration of substances which stimulate the nervous system (caffeine and phenamine, vitamins D₂ and the parathyreocrine hormone, which increase the intensity phosphorus-calcium metabolism). Greatest percentage elimination of P³² follows the ingestion of nonradioactive phosphorus and potassium salts.

119. Effect of Irradiation on Reflex Excitability of the Vagus Center

"The Effect of X Rays on Reflex Excitability of the Vagus Center," by M. M. Gromakovskaya, Institute of Biological Physics, Academy of Sciences USSR; Moscow, Doklady Akademii Nauk SSSR, Vol 124, No 1, Jan/Feb 59, pp 205-208

It has been reported that screening the trunk of animals from ionizing radiations prevents permeability disturbances arising in the hematoencephalic barrier and that these disturbances, on the whole, are due to disturbances in the visceral organs. Thus, the author in this research, attempted to find the relationship between injury to visceral organs and disturbed function of the vagus nerve which supplies these organs. This was done by studying the early changes in the reflex excitability in the vagus center [in the brain] of irradiated rats (160 rats irradiated with 800 r), and then correlating the rate of onset of disturbances occurring in the permeability of the hematoencephalic barrier with changes in the functional condition of the vagus nerve center.

Results of tests using total, or partial irradiation; administration of morphine, atropine, ergotamine, and sodium bromide; and severance of both superior cervical sympathetic ganglia verify the following:

1. Changes in reflex excitability of the vagus nerve center of irradiated animals arise earlier (within the first few minutes) than changes in permeability of the hematoencephalic barrier (within 45 minutes); therefore, it may be assured that changes in the permeability of the hematoencephalic barrier are a result of disturbances in the functional condition of the nervous system.

2. Prevention of disturbances in the functional condition of the vagal center by the administration of morphine or atropine prevents changes in the permeability of the hematoencephalic barrier in irradiated animals.

3. Changes in the permeability of the hematoencephalic barrier, as well as survival of irradiated animals, are closely linked with the irradiation of the trunk or of the abdominal region; thus proving the high radiosensitivity of the organs of the abdominal cavity toward irradiation.

Thus, the author concludes that disturbances in nerve impulses in radiosensitive organs of the abdominal cavity, after their irradiation, are the source of changes in the functional condition of various branches of the central nervous system, including the vagal center which in their turn cause disturbances in the normal permeability of the hematoencephalic barrier.

120. Air Ionization due to Various Therapeutic and Diagnostic Methods

"Air Ionization in Rooms in Which Physical Methods of Therapy and Diagnosis Are Used," by M. I. Salmanova, Chair of Hygiene, Kuybyshev Medical and Moscow Stomatological Institutes; Moscow, Gigiyena i Sanitariya, No 11, Nov 58, pp 74-76

Air ionization was determined in various rooms by using a P. N. Tverskiy I-2 counter) for light ions with a mobility of 0.5-1.0 and heavy ions with a mobility of 0.001 to 0.002 cm²/sec per volt.

Results indicate that the ionization of air in physiotherapeutic chambers (due to the use of high- and low-frequency currents and light therapy) does not attain a high enough degree of concentration to be of occupational-hygienic significance.

In X-ray cabinets when the apparatus is turned on, the concentration of air ions becomes very high, especially when using deep radiotherapy. There is no increase in air ionization when the apparatus is turned off.

A high degree of ionization is detected in radiobiological departments and depends on the quantity of radioactive substances found in the room, the storage conditions, and the protective measures taken.

The highest concentration of air ions, with the predominance of positive ions, occurs in treatment rooms during the process of "changing" the patients with radium, or during the sterilization of radioactive preparations.

This high level of air ionization is largely due to meteorological conditions, the absence of rationally constructed ventilation facilities, and the lack of necessary precautions for insulating these installations from other areas.

Measurement of air ionization may be taken as a sensitive index of air contamination with radioactive substances.

[For additional information on radiology see Item No 33.]

Miscellaneous

121. Plans for Physiological Science

"Immediate Problems in Planning for Physiological Science," by D. A. Biryukov; Moscow, Fiziologicheskii Zhurnal SSSR imeni I. M. Sechenov, No 1, Jan 59, pp 3-6

The author of this article states that the first state plan for development of the national economy was instituted by V. I. Lenin in 1920. The plan consisted of utilization of all scientific knowledge gained both at home and abroad and it placed the main emphasis on electrification of the country. Subsequent advances made in the Soviet Union in science and technology became identified with all stages of planning for development of the national economy and building of socialism and communism in the Soviet Union.

A decree promulgated in 1958 by the Central Committee of the Communist Party of the Soviet Union and the Council of Ministers USSR, dealt with the long-range Seven-Year Plan for development of the national economy: it emphasized that an all-out effort be made to increase labor productivity. The increase in labor productivity is to be based on continuous technological progress and adeptness in extensive utilization by all industrial establishments of the most advanced achievements in science and technology.

The author of this article then quotes from an article published in Izvestiya and another published in Pravda: [REDACTED]

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discoveries" (Izvestiya, No 229 (12536), 1957). "Progress made by Soviet science in chemistry, metallurgy, energetics, automation, biology, physiology, medicine, and many other fields of knowledge is indisputable. But there are many new and complicated problems with which the Soviet scientists are confronted" (Pravda, 3 October 1958). He further states

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that unlimited possibilities have arisen in the Soviet Union for scientific research and development. Advances made by Soviet scientists in many fields of science and technology attest to this. This is also confirmed by the fact that the first artificial earth satellite was sent into space by Soviet scientists. But the scientists of the Soviet Union did not achieve success in every field of science. This statement refers particularly to physiology. It is necessary to isolate imperfections in scientific research in physiology, possibly because that science has recently been given a high priority status, the author says.

A need exists for active planning in physiological research. The article says that great progress must be made in developing the most important segments of physiology in the shortest time possible. Similar attempts were made long ago, but sufficiently satisfactory results were never achieved. Enormous amounts of material, funds, and manpower have been allocated by the government for research in physiology, but this is not fully reflected in the results of scientific research. The state has the right to expect results and to use these results in developing the national economy. The article continues:

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"...The necessary theoretical prerequisite for advances in medical and agricultural sciences is biological progress. A significant increase in the sphere of operation of biological science depends on the progress made in physics and chemistry."

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This is an excerpt from statements made by N. S. Khrushchev in his report to the 21st Congress of the CPSU. It fully illuminates the long-range development of progressive physiology. Khrushchev's statements warn physiologists of the possibilities of improper detachment of Soviet science from broad general biological premises. History has demonstrated that any attempt in "professionalizing" any biological discipline, for example medicine, ultimately creates a stumbling block in the path of its development. Consequently the fear of "biologizing" physiology seems strange at least. It must not be forgotten how much has been done for medicine by people who were not medics, says the author. It is sufficient to name a few: L. Pasteur, V. K. Roentgen, the Curies, I. I. Mechnikov, N. Ye. Vvedenskiy, and others. Furthermore, the above quotation from Khrushchev's statements stress the impossibility of developing physiology further without taking into consideration its organic bond with physics and chemistry.

The article states that planning in economics and in sciences in the USSR is carried out for the benefit and welfare of human beings, and that the nature of research in physiology must be subordinated to this principle.

Speaking at the first conference on planning scientific research in physiology, held a quarter century ago, Academician L. A. Caspeli called attention to the slow progress made by Soviet biophysicists and physiologists.

The need for long-range planning of research in physiology is very acute. This need provides justification for coordinated action on a national scale.

Soviet physiology has been characterized primarily by the formation and development of outstanding schools of this science. I. M. Sechenov, N. Ye. Vvedenskiy, I. P. Pavlov, A. A. Ukhtomskiy, L. A. Orbrli, K. M. Bykov, P. S. Kupalov, I. S. Beritashvili, and others have contributed greatly to Soviet physiology. The main attention of various schools of Soviet physiology has been directed to investigation of evolutionary physiology and nervism. The majority of Soviet physiologists have directed their efforts mainly toward solving the problems of the nervous regulation of functions. Next to the physiology of the nervous system, the greatest attention was given to the study of the function of the digestive tract. In addition, theoretical and practical medicine has experienced the need for solving many problems connected with nervous regulation of the functions of the following systems: blood circulation, respiration, excretion, blood, and lymph.

No systematic comparison can be made between Soviet and foreign investigations in the physiology of the principal functions of animal and human organisms. It can be stated, however, that investigations in the physiology of individual organs are conducted abroad in a more systematic manner.

It is necessary, therefore, to expand research dealing with the principal physiological functions of the organism to the level reached by modern technology. By using modern biophysical methods, it is quite important to intensify efforts toward developing problems of the general physiology of the nervous system, particularly in that area which deals with cortical formations. The physiology of cell reparation is an enormous field and requires further investigation. The functions of the cardiovascular system (particularly at high altitudes and in cosmic space), digestion, respiration, water and salt metabolism, heat exchange, and the physiology of muscles must attract the attention of Soviet physiologists in the next few years.

The position of the Central Committee of the Communist Party of the Soviet Union and the Council of Ministers USSR "concerning strengthening the bond between school and life and concerning further development of the system of national education in the country," makes it imperative that greater effort be made in the study of labor physiology. Relaxed in the past few years, research in this area must be revitalized considerably. Investigations in the labor physiology of adolescents is important, because a large number of young men and women who are in the second stage of their education must turn to professional labor.

The author concludes his article by saying that stress must be placed in USSR on the development of scientific research on the foundation of Marxist-Leninist philosophic principles.

122. Plenum of Scientific Medical Council of Ministry of Health RSFSR

"In the Scientific Medical Council, Ministry of Health RSFSR" (unsigned article); Moscow, Meditinskiy Rabotnik, 20 Feb 59

In a recently held plenum of the Scientific Medical Council of the Ministry of Health RSFSR Prof N. A. Vinogradov, chairman of the council, gave a report on the means for realizing the 7-year problem-thematic plan of scientific research of medical establishments of the RSFSR. His report disclosed that two thirds of the medical research in the republic is conducted in medical vuzes (higher education institutions), especially in such fields as enteric, infectious, and cardiovascular diseases and cancer. Fifteen persons took part in the discussion of the report. Prof V. V. Kovanov and Prof A. K. Sangaylo (Sverdlovsk) pointed out the existing disproportions in financing scientific research in vuzes and scientific research institutions.

The plenum held three sessions at which the following spoke: Prof V. G. Yeliseyev -- "Connective Tissue and Its Role in the Physiological and Pathological Reactions of the Organism"; P. V. Markov, Corresponding Member of Academy of Medical Sciences USSR -- on certain problems of cellular research; A. A. Bagdasarov and S. I. Sherman, I. A. Kassirskiy, A. F. Tur, M. S. Dul'tsin, S. A. Reynberg, N. M. Nemenova and M. P. Khokhlova, and Z. V. Gorbunova and O. S. Patokova -- on various aspects of the problem of leukosis.

123. All-Union Scientific Society on Radiation Medicine Proposed

"To Our Readers," by the Editorial Board; Moscow, Meditinskaya Radiologiya, Vol 4, No 1, Jan 59, pp 3-5

As a proof of the rapidly increasing importance of radiobiology in general, and medical radiology in particular, 120 reports from a total of 690 presented at the Geneva Conference on the Peaceful Uses of Atomic Energy discussed the biological effects of ionizing radiation and the uses of radioactive isotopes in scientific research, diagnosis, and therapy. It was also pointed out at this conference that, since the list of radioactive isotopes is rapidly increasing and the number of uses for each isotope is greatly expanding, the number of radiologists and medical specialists who are engaged in various fields of research and therapeutics and constantly exposed to sources of ionizing radiation is also increasing. In view of the above-mentioned situation, the editorial board

considers that a substantially significant cause exists for the creation of an All-Union Scientific Society on Radiation Medicine. Naturally, the editorial board thinks that the Meditsinskaya Radiologiya journal should be the publishing organ for this new society whose important task will be to correlate the conditions and future prospects for the development of medical radiology both in the USSR and abroad.

Furthermore, the editorial board of the journal considers it its duty to participate in making the necessary arrangements for the first convention on radiation medicine, and will make sure that the prerequisites for the future success of this organization will be met.

124. Joint Conference on Asian Flu Held in Kiev

"Report on the Scientific Conference of Institutes of Academy of Medical Sciences USSR and the Problem Commission of Ministry of Health Ukrainian SSR on Problems of Influenza," by Prof N. I. Morozkin, Corresponding Member of Academy of Medical Sciences USSR; Moscow, Vestnik Akademii Meditsinskikh Nauk SSSR, No 2, Feb 59, pp 81-86

A Joint Conference on Problems of Asian Flu was held by the Institute of Infectious Diseases, Academy of Medical Sciences USSR, the Institute of Virology imeni D. I. Ivanovskiy, Academy of Medical Sciences USSR, and the Institute of Experimental Medicine, Academy of Medical Sciences USSR, in Kiev from 25 to 28 September 1958. The conference was attended by representatives of medical establishments and institutions of the Ukraine, the RSFSR, and most of the union republics, as well as the countries of the People's Democracies.

Over 38 reports on various aspects of Asian flu were given at the conference.

125. Prof O. N. Podvysotskaya, Soviet Dermatology Specialist, Dies

"Ol'ga Nikolayevna Podvysotskaya (1884-1958)," by S. M. Gitman, Candidate of Medical Sciences, Moscow, Vestnik Akademii Meditsinskikh Nauk SSSR, No 2, Feb 59, pp 94-96

Prof Ol'ga Nikolayevna Podvysotskaya, Doctor of Medical Sciences, Honored Worker of Science, Corresponding Member of the Academy of Sciences USSR, Active Member of the Academy of Medical Sciences USSR, and head of the Chair of Skin and Venereal Diseases, First Leningrad Medical Institute, died on 1 December 1958 at the age of 74.

Podvysotskaya was born in Siberia in the town of Yeniseysk, and graduated in 1911 from the Women's Medical Institute in St Petersburg. She obtained her doctor's degree in 1921. Her entire medical career was devoted to the study and teaching of dermatology and venereology. She became head of the Chair of Skin and Venereal Disease, First Leningrad Medical Institute, in autumn 1944.

Podvysotskaya is the author of over 70 scientific works on the clinical and experimental problems of dermatology and venereology, 20 of which are concerned with tubercular diseases of the skin.

126. Yugoslav Chemist Claims Ability to Diagnose Illness From One Drop of Blood

"The Diagnosis of an Illness From One Drop of Blood," by R. L.; Zagreb, Borba, 24 Feb 59

Fahrudin Zejnilagic, a chemist and instructor in the Secondary Dental School in Sarajevo, claims to be able to diagnose cancer, cirrhosis of the liver, nephritis, infectious jaundice, and many other diseases from one drop of blood.

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"The essence of this method is how individual fluids on the basis of their atoms affect individual illnesses.... Even cancer can be discovered early.... The reactions are so clear that even laymen can read them."

Zejnilagic demonstrated his method in January at the First Internal Clinic of the Medical Faculty in Belgrade. He has not offered any details concerning his method.

VIII. METALLURGY

127. Rhenium-Molybdenum Alloys

"Rhenium-Molybdenum Alloys," by Ye. M. Savitshiy, M. A. Tylkina, and K. B. Povarova, Institute of Metallurgy imeni A. A. Baykov, Academy of Sciences USSR; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 4, No 2, Feb 59, pp 424-434

The constitutional diagram of the system Re-Mo was determined. The compounds, solid solutions, and phases formed in this system are characterized.

IX. PHYSICS

Crystallography

128. Properties of Diamond Type Crystals

"Electrical, Optical, and Elastic Properties of Diamond Type Crystals," III. Light Absorption and Dispersion," by V. S. Maskevich, Kiev Polytechnic Institute; Moscow Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 36, No 1, Jan 59, pp 108-115

The dispersion, double refraction, and single photon absorption of light in the infrared region due to lattice vibrations are studied. The parameters of the theory are determined, and a numerical computation of the effects mentioned above is performed. The theory predicts an essential relation of absorption to the direction of propagation and the polarization of light. An experimental check of the theory is considered very desirable.

129. Double Spin Resonance in Alkali-Halide Crystals

"Frequency Spectrum of Double Spin Resonance at Color Centers in Alkali-Halide Crystals," by V. Ya. Zevin, Brest State Pedagogical Institute Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 36, No 1, Jan 59, pp 116-128

The relations of the frequencies of double spin resonance to the orientation of the crystal in an external static magnetic field has been found for U_2^- , F_2^+ , and M-centers in alkali halide crystals. The angular relations are determined by the structure of the center and can be used for a direct experimental study of the structure of the color center of the alkali halide crystal by the double spin resonance method.

Electricity and Magnetism

130. High-Frequency Discharge in Gases

"Investigations of High-Frequency Discharge in Gases in a Wide Range of Decimeter Waves. II," by G. A. Anashkin, Chair of Electronics; Moscow, Vestnik Moskovskogo Universiteta, Seriya Matematiki, Mekhaniki, Astronomii, Fiziki, Khimii, No 3, 1958, pp 69-74

It was shown experimentally (J. S. Townsend et al., Phil. Mag., 26, 290, 1938; B. Lax et al., J. Appl. Phys. 21, 1197 1950; F. Kossel et al., Ztschr. Phys. 139,2, 183, 1954) that the minimum of the characteristic expressing the relation of the discharge voltage of the field to the variation of the strength of the constant magnetic field at low gaseous pressures corresponds to the condition of frequency equality: $\omega_b = \frac{e \cdot H}{m c} = \omega$

where H is the value of the applied magnetic field for a minimum of the characteristic, ω is the circular frequency of the electric field, and ω_b is the circular frequency of the electron rotation. Because other investigations (L. Ferretti et al., Nuovo Cimento, 2, 3, 639, 1955; D. Posin, Phys. Rev. 69, 541, 1946) do not agree with these results, an attempt is made to find out whether resonance minima may be found on discharge characteristics as stated by the first mentioned references and whether the mentioned equality holds in the case of nonuniform field of a coaxial waveguide and to determine the role of formation of stable negative ions in a negatively charged gas and the field frequency for characteristics of discharge.

The results of study of available data proved that the mentioned equality holds for homogeneous and nonhomogeneous fields. At low pressures at any specified frequency, if the tubes are of a sufficiently large diameter, the discharge characteristic may be obtained with its characteristic resonance minimum. To every frequency of the applied electric field there corresponds an optimal pressure at which the resonance minimum is the deepest.

131. Magnetic Moments in a Magnetic Field

"A System of Magnetic Moments in a Weak Variable Magnetic Field," by G. V. Skrotskiy and A. A. Kokin, Ural Polytechnic Institute; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 36, No 1, Jan 59, pp 169-175

A system of magnetic moments is studied. It possesses electric exchange and weak magnetic dipole-dipole interactions and is located in an external magnetic field $H_0 + h(t)$. The equation of the motion of the magnetization vector is derived with accuracy to the second order terms in the perturbation theory (P. Kubo, K. Tomita, J. Phys. Soc. Japan, 9, 888, 1957) for weak variable fields, $h(t) \ll H_0$. The limits of applicability of the equations obtained are analyzed.

Nuclear Physics

132. Penetration Depth of Injected Atoms

"Penetration Depth and the Distribution of Atoms Injected Into a Si-30 Isotope Target," by M. I. Gus'yeva, Ye. V. Inopin, and S. P. Tsitko, Physico-technical Institute, Academy of Sciences Ukrainian SSR; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 36, No 1, Jan 59

The penetration depth and distribution of silicon atoms injected in tantalum and copper backings have been investigated. The targets which were prepared in an electromagnetic separator by direct precipitation of the Si-30 isotope on the backing were bombarded by protons accelerated in an electrostatic generator. The shape of the resonance yield of gamma rays from a single gamma-resonance in the Si-30 (p, gamma) P-31 reaction was observed in four targets and compared with the theoretical density distribution of the injected atoms. The penetration depth and nature of the distribution of the Si-30 atoms injected in the tantalum backing satisfactorily agree with the theory.

133. Decay of Ba-139

"Angular Beta-Gamma Correlation in the Decay of Ba-139 and the Sign of the Ratio of the Beta-Interaction Constants," by N. A. Vlasov and V. P. Rudakov; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 36, No 1, Jan 59, pp 24-27

The differential angular beta-gamma correlation has been measured for the cascade $E_{\beta} = 2.23$ Mev and $E_{\gamma} = 0.163$ Mev in the decay of Ba-139. The anisotropy coefficient for total beta-particle energies of $4 mc^2$ was found to equal $a = 0.058 \pm 0.023$. The result is compared with that obtained by calculations performed on the basis of single-particle model. The theoretical results agree with experiments only for negative values of the ratio g_V/g_A .

134. Conversion Electrons

"Gd-146 and Eu-146 Conversion Electron Spectra," by N. M. Anton'yeva A. A. Bashilov, B. S. Dzhelepov, and B. K. Preobrazhenskiy, Leningrad State University; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 36, No 1, Jan 59, pp 28-31

The conversion electron spectra of neutron deficient isotopes Gd-146 and Eu-146 have been investigated. Conversion electrons corresponding to three nuclear transitions with energies of 114.8; 115.5; and 155 keV have been observed in the case of Gd-146 and to two transitions with energies of 630 and 742 keV in the case of Eu-146. Decay schemes are suggested.

135. Stripping Reactions

"Investigation of Stripping Reactions of the (d,p) Type in Silicon Isotopes," by V. G. Sukharevskiy, Institute of Nuclear Physics, Moscow State University; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 36, No 1, Jan 59, pp 52-59

The angular distribution of protons from the reactions Si-29,30 (d,p) Si-30,31 have been measured with nuclear emulsions for the ground and first excited states at deuteron energies of 4.3 Mev. The orbital angular momenta in the captured neutrons, the absolute values of the differential cross sections of the reactions, and the reduced neutron level widths in the final nuclei have been determined. The experimental proton angular distributions are compared with the theoretical curves of S. T. Butler (Nuclear Stripping Reactions, N Y, 1957) and A. B. Bhatia et al., (Phil. Mag. 43 485, 1952). The spins and parities of the ground and first excited states of Si-31 confirm the computations of P. Goldhammer (Phys. Rev. 101 1375, 1956).

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136. Vacancies in Gold and Platinum

"Energy of Formation and Displacement of Vacancies in Gold and Platinum," by B. G. Lazarev and O. N. Ovcharenko, Physico-technical Institute, Academy of Sciences Ukrainian SSR; Moscow Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 36, No 1, Jan 59, pp 60-67

For gold and platinum values of $(19.0 \pm 0.5) \cdot 10^3$ cal/mole have been respectively obtained for the energy of vacancy production and $(20 \pm 1) \cdot 10^3$ and $(25 \pm 1) \cdot 10^3$ cal/mole for their energy of displacement. These data were obtained on basis of the variation of the electric resistance of metals due to quenching of the vacancies.

137. Spectra of Alpha Particles

"Energy Spectra of Alpha Particles Emitted From the Long Lived Isotopes Th-232 and U-238," by G. Ye. Kocharov, A. P. Komar, and G. A. Korolev, Leningrad Physicotechnical Institute, Academy of Sciences USSR; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 36, No 1, Jan 59, pp 68-75

The high resolving power in energy of the ionization chamber with grid and its satisfactory stability permitted detection of previously unrevealed alpha transitions to the first and second excited levels of daughter nuclei during the study of alpha particle spectra. Data on half-life periods were taken from the work by F. Picciotto and S. Wilgain (Nuovo Cim., 4, 6, 1956) and by B. S. Dzheleпов and L. K. Peker (Skhemy Raspada Radioaktivnykh Izotopov, [Decay Schemes of Radioactive Isotopes], 1957). The energies and the intensities of the transitions to the 2+ and 4+ levels of the daughter nuclei have been determined.

138. Double Beta-Decay of Ca-48

"Search for Double Beta-Decay in Ca-48," by Ye. I. Dobrokhotov, V. R. Lazarenko, and S. Yu. Luk'yanov; Moscow; Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 36, No 1, Jan 59, pp 76-87

An attempt to detect experimentally double beta-decay in Ca-48 is made. The apparatus, method, and control experiments employed in the investigation are described. It is concluded that if a double beta-decay exists in Ca-48 its half-life time must not be below $0.7 \cdot 10^{19}$ years.

139. Isotropic Oscillator

"Symmetry Group of an Isotropic Oscillator," by Yu. N. Demkov, Leningrad State University; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 36, No 1, Jan 59, pp 88-92

It is shown that the determination of the isotropic oscillator group with the aid of the infinitesimal operators and generating elements suggested earlier by the author (ZhETF, 26, 757, 1954; Vestnik LGU, 11,127, 1953) and the determination with aid of canonical transformations presented by G. A. Baker (Phys. Rev., 103, 1119, 1956) are equivalent. The explicit form of the group unitary operators is considered, and the relation of these operators to Green's function for an oscillator is demonstrated.

140. Conservation of Angular Momentum

"Laws of Conservation of Angular Momentum and Parity in the Statistical Theory of Multiple Production," by V. B. Magalinskiy, Moscow State University; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 36, No 1, Jan 59, pp 93-97

The general statistical method of microcanonical distribution is used to compute the statistical weights of a many-particle system obeying an arbitrary statistic, account being taken of the laws of conservation of the total angular momentum and parity. A general computational formula has been obtained under the assumption that all particles obey the Boltzmann statistics. An analogous problem was solved by V. S. Barashenkov and B. M. Barbashov (Nuovo Cim., 7 19, 1958) by means of recurrent correlations for the case of Boltzmann statistics.

141. Scattering of Pi Mesons

"Double Scattering of Relativistic Pi-Mesons on Nucleons," by V. A. Astaf'yev, Institute of Nuclear Physics, Moscow State University; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 36, No 1, Jan 59, pp 98-107

The formalism of the double scattering theory based on invariance of the Hamiltonian of the interaction under rotation in isotopic and x-space is extended to relativistic energies. The expression for the differential cross section has been obtained in a form which is convenient for the analysis of experimental data. To illustrate the application of the formal theory, the problem is considered in an approximation of the radiation damping theory.

142. Two Nucleon Potential

"Two Nucleon LS-Potential in Nonrelativistic Meson Theory," by Yu. V. Novozhilov and I. A. Terent'yev, Leningrad State University; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 36, No 1, Jan 59, pp 129-139

The potential between nucleons is computed in linear approximation (recoil being partly accounted for) with respect to velocity without the aid of the perturbation theory. A potential has been found which decreases as e^{-2R} and depends on the coupling constant as well as on the (π - N) scattering cross section.

143. First Forbidden Beta-Transition

"Beta-Gamma Correlation in First Forbidden Beta-Transitions," by Yu. V. Gaponov, Institute of Nuclear Physics, Moscow State University, Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 36, No 1, Jan 59, pp 193-203

A general formula has been obtained for the beta-gamma correlation of beta decay electrons and circularly polarized gamma quanta emitted by the excited nucleus formed after the beta decay. The formula is valid for the first forbidden beta-transitions. The computation is carried out for an arbitrary mixture of beta coupling, account being taken of the nuclear coulomb field and that of unique and of coulomb beta transitions.

144. Resonance Radiation Diffusion Equation

"On Green's Function for the Resonance Radiation Diffusion Equation," by B. A. Veklenko, Moscow Power Engineering Institute; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 36, No 1, Jan 59, pp 204-211

An analytic expression for Green's function of the resonance radiation diffusion equation has been derived for the case of a homogeneous infinite space. The properties of Green's function have been investigated for a dispersion and Doppler effects of the spectral lines. An analytic expression has been derived for the mean time required for a photon to move as a result of diffusion over a distance greater than some specified value. In conclusion Green's function has been determined for the stationary equation and for a dispersion pattern of the spectral line, its asymptotic expression is given in explicit form.

145. Capture of Hyperons

"Polarization Effects in the Capture of the Σ^- Hyperon by the Deuteron," by S. G. Matinyan and O. D. Cheishvili, Physics Institute, Academy of Sciences Georgian SSR; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 36, No 1, Jan 59, pp 212-215

Absorption of the Σ^- hyperon by a deuteron with formation of an particle is examined phenomenologically. A study of the polarization correlations of these particles yields some definite information on the polarization of the Σ^- hyperon.

146. Nuclear Gamma Vibrations

"Gamma Vibrations of the Surface of the Atomic Nucleus," by A. S. Davydov and D. A. Zaikin, Physics Institute imeni Lebedev Academy of Sciences USSR; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 36, No 1, Jan 59, pp 233-237

The energy and the probability of excitation of gamma vibrations of the surface of an atomic nucleus are computed on the basis of the shell model with assumption of an anisotropic harmonic oscillator potential. It is shown that in order of magnitude the energy of the first excited state of this type is close to that of single nucleon excitations and that the probability of excitation of these states is much smaller than the probability of excitation of rotational states in the nucleus.

147. Cherenkov Radition

"The Cherenkov Radiation of an Electron Moving in a Medium With Spatial Dispersion," by V. N. Agranovich, V. Ye. Pafomov, and A. A. Rukhadze, Physics Institute imeni Lebedev. Academy of Sciences USSR; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 36, No 1, Jan 59, pp 238-243

Vavilov-Cherenkov radiation in an isotropic gyrotropic medium is examined with consideration of spatial dispersion. The angular distribution of Cherenkov radiation intensity and exit of the radiation through the boundary of the medium are analyzed.

148. Photoproduction of Pi-Mesons

"Generalized Form of the Relation of the Pi-Meson Photoproduction Cross Sections of the Complex Nuclei to the Number of Nucleons," by A. S. Belousov, B. B. Govorkov, and V. I. Goldanskiy, Physics Institute imeni Lebedev, Academy of Sciences USSR; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 36, No 1, Jan 59, pp 244-248

A generalized formula is derived describing the relation of the pi-meson photoproduction cross sections of complex nuclei to the number of nucleons, account being taken of ordinary reabsorption processes as well as of two-nucleon absorption of mesons at the instant of creation. Two types of computations are presented: (1) computation for a given wave function of the nucleon pair assuming uniform distribution of nucleon density in the nucleus and (2) a phenomenological computation in which the wave function is not prescribed, but the nucleon density in the nucleus is assumed to be of the Fermi type.

149. The Liquid Drop Model

"Disruption of a Charged Liquid Drop and Nuclear Fission," by B. T. Geylikman, Moscow State Pedagogical Institute; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 36, No 1, Jan 59, 249-252

Disruption of a charged liquid drop is analyzed. The vibrational energies of the parts of the drop are computed and also the energy of their relative motion. The general results thus obtained are applied to fission of nuclei.

150. Multiple Particle Scattering

"Contribution to the Theory of Multiple Scattering," by M. L. Ter-Mikayelyan, Physics Institute, Academy of Sciences Armenian SSR; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 36, No 1, Jan 59, pp 253-257

A method for the computation of multiple scattering curves with account of finite nuclear dimensions is presented. Experimental results of scattering of fast electrons by nuclei are used for computing.

151. Mu-Meson Absorption

"Absorption of Polarized Mu-Mesons by Nuclei. Neutron Polarization," by L. D. Blokhintsev, Institute of Nuclear Physics, Moscow State University; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol. 36, No 1, Jan 59, pp 258-263

Formulas are derived for the polarization of neutrons produced as a result of absorption of polarized mu-mesons by nuclei. Estimations of O-16 and Ca-40 nuclei are presented.

152. Charge Symmetry

"Charge Symmetry Properties and Representations of the Extended Lorentz Group in the Theory of Elementary Particles," by V. I. Ogiyevetskiy and Chou Kuang-chao, Joint Institute for Nuclear Research; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 36, No 1, Jan 59, pp 264-270

The extended Lorentz group which includes the complete Lorentz group and charge conjugation operation is analyzed. It is shown that the use of irreducible projective representations of this extended group requires the existence of charge multiplets. Charge symmetry and pair production of strange particles follow from invariance under reflections, charge conjugation, and the laws of conservation of electric and baryon charges. The Pauli-Gursey transformation holds for free nucleons. The condition of invariance under this transformation also in the case of interaction leads to isobaric invariance in strong interactions of all particles.

153. Cyclic Motion of Charged Particles

"Cyclic Motion of Charged Particles in an Electric Field," by A. A. Kolomenskiy and Fang Shou-hsien, Physics Institute imeni Lebedev, Academy of Sciences USSR; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 36, No 1, Jan 59, pp 271-276

Formulas are derived for the expression of the cyclic motion of charged particles in an electric guide field. A field of this type can be created by a system of special lenses (strong or weak focusing). Resonance acceleration of the particles and in particular their phase stability (autophasing) which is similar to the familiar magnetic autophasing are analyzed. The effect of electromagnetic radiation (including quantum fluctuations) on the motion of the electrons in the electric field is analyzed. A case in which the particle moves part of the way in an electric field and a part in a magnetic field is discussed.

154. Mu-Meson in Mesic Atom Transitions

"Depolarization of the μ^- Meson in Mesic Transitions," by V. A. Dzhrbashyan, Physics Institute, Academy of Sciences Armenian SSR; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 36, No 1, Jan 59, pp 277-282

A method for the computation of the depolarization of μ^- mesons in mesic atom transitions is suggested. The estimation of the expected μ^- meson depolarization is in good agreement with available experimental data.

155. Nucleon-Antinucleon Interaction

"An Estimation of the Contribution of Nucleon-Antinucleon Interaction in the Dispersion Relation for Nucleon-Nucleon Scattering," by L. I. Lapidus, Joint Institute for Nuclear Research; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 36, No 1, Jan 59, pp 283-290

The relation between the scattering lengths and effective radii in the s- and p-states, as predicted by the dispersion relations for NN-scattering are analyzed. Estimations of the contribution of NN-interaction to the dispersion relations for NN-scattering have been derived from the experimental data on np and pp scattering at low energies. The NN-interaction contribution has been found to be small. Its magnitude substantially depends on the sign of the scattering path in the s-states.

156. Parity of Strange Particles

"A Possible Method for Determination of the Parity of Strange Particles," by S. M. Bilen'kiy, Joint Institute of Nuclear Research; Moscow Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 36, No 1, Jan 59, pp 291-292

It is suggested that parity of K mesons can be determined by investigation of the left right asymmetry in the $\pi(K) + p \rightarrow Y + K$ (π) reactions with a polarized proton target.

157. Superfluidity of a Nucleus

"Superfluidity Condition of an Atomic Nucleus and the Phase Transition Temperature," by V. G. Solov'yev, Joint Institute for Nuclear Research; Moscow Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 36, No 1, Jan 59, pp 293-294

The conditions for appearance of a superfluid state in an atomic nucleus are derived with the help of a variational principle suggested by N. N. Bogolyubov. The superfluidity condition reduces to the requirement of predominance of attraction forces between protons located in the same shell at an energy equal to the Fermi energy. If at zero temperature the nucleus is in a superfluid state, a transition from the superfluid to normal phase will take place with increase of temperature. The critical temperature of the transition has been determined.

158. Multiparticle Inertia Moment

"The Moment of Inertia of a Multiparticle System. I," by Yu. K. Khokhlov, Physics Institute imeni Lebedev, Academy of Sciences USSR; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 36, No 1, Jan 59, pp 295-299

The problem of determination of the moment of inertia is analyzed. The simplest consequence of the formula obtained is that the moment of inertia does not vanish and is not very small (as compared with the moment of inertia of a solid body) even in the case of a spherically symmetrical system.

159. Peripheral Particle Interaction

"On Peripheral Interactions Between Elementary Particles," by L. B. Okun' and I. Ya. Pomeranchuk; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 36, No 1, Jan 59, pp 300-312

Peripheral interaction between strongly interacting elementary particles can be phenomenologically described in an adequate manner by existing meson theory. It is suggested that the contribution of peripheral interaction can be assessed by determining from experiment the amplitudes of various processes corresponding to large orbital angular momenta since the latter

correspond to large impact parameters. Comparison of the amplitudes found experimentally with those computed theoretically should permit one to obtain some important quantities characterizing strong interactions of elementary particles. Some quantities of this type are the renormalized coupling constants for interaction of pi-mesons with nucleons and hyperons, the renormalized coupling constants for interaction of two pi-mesons, pi-meson and k meson, etc.

160. Fragments of U-238 Photofission

"Energy Spectrum of U-238 Photofission Fragments," by B. S. Kovrygin, M. Ya. Kondrat'ko, and K. A. Petrzhak, Leningrad Technological Institute; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 36, No 1, Jan 59, pp 315-317

An attempt is made to establish the energy spectrum of U-238 photofission fragments induced by the maximum energy of gamma emission of a 12.5-Mev betatron. The measuring equipment used consisted of a differential pulse ionization chamber, an amplifier stage, and an electron pulse oscillator with a photorecorder. The results are shown in graphs. The most probable energy values found for photofission fragments were 55.1 ± 1 and (86.9 ± 1) Mev for heavy and light fragments, respectively. The obtained photofission spectrum is compared with the spectrum of spontaneous fission of U-238 obtained by B. S. Kovrygin and K. A. Petrzhak (in Atomn. Energiya, 4, 547, 1958). The comparison of the two spectra shows that they differ by the ratio of heights of the minimum to the peak of the light fragments. This magnitude is 0.60 for the spectrum of photofission and 0.33 for that of spontaneous fission.

161. Beta-Spectra of F-20 and F-17

"Beta-Spectra of F-20 and F-17," by S. S. Vasil'yev and L. Ya. Shavtalo; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 36, No 1, Jan 59, pp 317-318

The beta-spectrum of F-20 was investigated by means of a spectrometer with a magnetic lens. A 4-Mev deuteron beam, accelerated on the cyclotron of the Scientific Research Institute of Nuclear Physics, Moscow State University, was injected into the chamber of the beta spectrometer as described by the authors (Izv. AN SSSR, Seriya Fizich., 22, 788 1958). The irradiated beta-spectrum under investigation was a superposition of F-20 beta-spectrum obtained from the reaction F-19(d,p)F-20 on the beta-spectrum of Li-8 obtained from the reaction Li-7(d,p)Li-8. The investigated F-20 spectrum was obtained by deducting the Li-8 spectrum from the superposition of F-20

and Li-8 spectra. The plotted F-20 beta-spectrum was found to be rectilinear. Its upper limit was (5.45 ± 0.05) Mev. The half-life around 1,840 keV gave a value of (12.5 ± 2) sec. The obtained results are in good agreement with those by C. Wong (Phys. Rev., 95, 761, 1954), D. F. Alburger (Phys. Rev., 88, 1257, 1952), and R. M. Littauer (Phil. Mag., 41, 1214, 1950).

162. The Mott Exciton

"The Energy Spectrum of the Mott Excitons in Ionic Crystals," by S. A. Moskalenko and K. P. Tolpygo, Physics Institute, Academy of Sciences Ukrainian SSR; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 36, No 1, Jan 59, pp 149-163

A qualitative study of Mott exciton levels in ionic crystals is made on the basis of the multielectron theory. A multielectron investigation of the exciton is reduced to the problem of motion of two quasi-particles which interact with Coulomb forces in the case of triplet states (ortho-exciton) and with Coulomb and exchange forces in the case of singlet states (para-exciton). The above-mentioned forces are approximately computed with the aid of a model which assumes a spherical symmetry of the state of an electron at the cation side and of the vacant state in the anion. The ortho- and para-exciton series of an upolarizable exciton of large radius are computed by the generalized effective mass method. The influence on splitting of deviation of the potential from a point coulomb potential is estimated. A general level scheme of the exciton for $K = 0$ is presented for the O_h group on basis of group considerations and the results are compared with the yellow exciton series in the Cu_2O crystal. The properties of an exciton in a magnetic field are analyzed.

163. Resonance Interaction of Mesons

"Account of Resonance of $\pi^- \pi^-$ Interaction Within the Framework of Fermi's Statistical Theory of Multiple Particle Production," by V. I. Rus'kin, Institute of Nuclear Physics, Academy of Sciences Kazakh SSR; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 36, No 1, Jan 59, pp 164-168

An attempt is made to take into account the resonance interaction between two π^- mesons on the basis of Fermi's statistical theory. The concrete case of $\pi^- - p$ -scattering at an energy of 4.5 MeV is analyzed. Production of strange particles is taken into account. For comparison with experimental data works by G. Maenchen et al. (Phys. Rev., 99, 1619, 1935; ibid., 108, 850, 1957) were used. Some agreement as well as discrepancies were noticed.

164. Unified Model of Light Nuclei

"Genealogical Coefficients in the Generalized Nuclear Model,"
by V. G. Neudachin and Yu. F. Smirnov, Institute of Nuclear
Physics, Moscow State University; Moscow, Zhurnal Eksperi-
mental'noy i Teoreticheskoy Fiziki, Vol 36, No 1, Jan 59,
pp 186-192

The construction of a wave function of a system of n nucleons with prescribed values of the isobaric spin T from the wave functions of individual N_1, N_2, \dots, N_n not coupled vectorially is analyzed. The number of independent states with a given T is determined by algebraic methods. The problem is primarily of interest in relation to the unified model of light nuclei.

165. Mass Spectroscopic Measurements

"Masses of Isotopes Th-232, U-234, U-235, and U-238," by R. A. Demirkhanov, T. I. Gutkin, and V. V. Dorokhov; Moscow, Doklady Akademii Nauk SSSR, Vol 124, No 2, 11 Jan 59, pp 301-303

The measurement of masses of the isotopes Th-232, U-234, U-235, and U-238 facilitates the determination of the nucleon energy bond not only of these isotopes but also of a number of radioactive isotopes bound by natural radioactive series $4n$, $4n + 2$, and $4n + 3$. Accurate values of these isotopes were not yet directly established. The mass spectroscopic equipment used for the isotope measurements was described previously by the authors (Atomnaya Energiya, 2, 21, 1956). The resolving power of the equipment determined from doublets was of the order of 60 - 70 thousands. The mass determination was carried out by means of direct comparison with the corresponding mass of organic compounds containing isotopes H¹, Cl², and N¹⁴, the masses of which were sufficiently well known from previous studies. The data obtained are tabulated and show that values available from nuclear reactions (J. R. Huizenga, Physica, 21, No 5, 410, 1955) are somewhat lower.

166. Pion Production in Radiochemical Reactions

"Radiochemical Study of Nuclear Reactions, Producing Pi-Mesons," by A. K. Lavrukina, I. M. Grechishcheva, and B. A. Khotin; Moscow, Atomnaya Energiya, Vol 6, No 2, Feb 59, pp 145-151

The study of nuclear reactions leading to pi-meson production are of major importance for the knowledge of the nature of nuclear forces (Si. C. Fung and A. Turkevich, Phys. Rev. 95, 176, 1954). To reveal such reactions the radiochemical method is applied, permitting the determination of reaction cross sections, occurring with low probability. The reactions of the type (p, π^{\pm}) and $(p, p\pi^{\pm})$ were studied on nuclei of medium atomic weight. It was found that their cross section equals $- 10^{-30} \text{ cm}^2/\text{nucl}$ at proton energies of 480-660 Mev. A noticeable increase of cross sections is observed in the energy range of 110-480 Mev. Such reactions could not be revealed in nuclei of heavy elements. Successful identification of the reaction products $(p, 2\pi^{\pm})$ for copper was not accomplished. The problem of the possibility of the reaction (p, π^{\pm}) at particle interaction with complex nucleons in the nucleus is discussed. The knowledge obtained contributes to a more profound understanding of processes occurring at high energy particle interaction with complex nuclei and the results are better than from the theory of nucleon-nucleon collisions.

167. Neutron Scattering

"Neutron Scattering in Para- and Orthohydrogen," by E. A. Chistova, and S. I. Drozdov; Moscow, Atomnaya Energiya, Vol 6, No 2, Feb 59, pp 152-161

The characteristics of neutron scattering on hydrogen were computed. They are used for the computation of the spectrum of slow neutrons in a moderating medium. The relation of the total cross section, the mean scattering asymmetry, and the mean energy loss at one collision in the gas of para- or orthohydrogen to the neutron energy and to the temperature of the moderator was found. The results are expressed in formulas and graphs obtained on the electronic computer of the Computer Center of the Academy of Sciences USSR. The energy range above the gas temperature, when the thermal motion of molecules can be neglected, is analyzed. The excitation of rotational levels and the zero oscillations of the nuclei in the molecule are taken under consideration.

168. Computation of a Reactor's Criticality

"Computation of the Effect of Variation in Dimensions on the Critical Mass of a Fast Reactor by Means of the Perturbation Theory," by S. B. Shikhov; Moscow, Atomnaya Energiya, Vol 6, No 2, Feb 59, pp 162-168

A method by which the critical mass of a reactor may be computed in relation to the composition of the active zone and its dimensions in the case of a sufficiently thick reflector is analyzed. The operational formula is obtained by applying similarity theory to the usual scheme of first approximation of the perturbation theory. For the computation of the coefficients of the formula the space-energy spectra of neutron flux and weights are required, computed numerically for a certain specified volume of the active zone with a sufficiently thick reflector. By means of the coefficients of the formula obtained this way, the prediction of the critical mass in a wide interval of dimensional variations of the active zone (nearly twice) was made possible. If the dimensions of the active zone trespass the limits of the studied interval, a new computation of spectra has to be carried out for the new dimension coefficients.

A formula is presented with coefficients computed according to a certain typical spectrum of a fast reactor for a number of isotopes, forming part of the active zone. The formula is verified by nine-digit numerical computation for dimensions of the active zone from 200 to 1,000 dm³. The nine-digit constants were compiled from domestic and foreign data published since 1955.

169. Electrostatic Particle Accelerators

"Electrostatic Accelerators of Charged Particles," by V. N. Glazanov; Moscow, Atomnaya Energiya, Vol 6, No 2, Feb 59, pp 174-186

A review of electrostatic particle accelerators is given. Particular attention is paid to the problem of energy increase of the accelerated particles and the beam power in electrostatic generators. Various methods of voltage stabilization are presented. Multistage generators intended for high power beam are described.

170. The Stereotron, a Variety of the Betatron

"The Stereotron-Betatron With a Spatial Equilibrium Orbit," by B. N. Rodimov; Moscow, Atomnaya Energiya, Vol 6, No 2, Feb 59 pp 200-202

The stereotron is a variety of the betatron with a constant guiding field, in which the accelerated electron shifting in an axial direction passes into stronger fields without increase of the radius of the trajectory. With a constant guiding field sufficiently high-frequency current may be applied to the winding of the central coil. The capture of electrons into the accelerating field is also more efficient than in the usual betatron. In this way a higher radiation intensity should be secured. The extraction of the electron beam is also facilitated and the weight of the equipment is reduced.

171. Beam Extraction From a Cyclotron

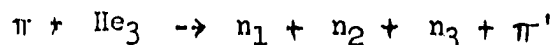
"An Application of a Nonuniform Electric Field for the Extraction of Charged Particles From a Cyclotron," by A. A. Arzumanov and Ye. S. Mironov; Moscow, Atomnaya Energiya, Vol 6, No 2, Feb 59, pp 202-203

The extraction of the accelerated beam from a cyclotron by means of a nonuniform electric field satisfies the conditions required for sharp focusing. This problem was previously analyzed by N. D. Fedorov. Parameters are derived which reduce the angle of horizontal spread of the beam nearly fivefold without current losses and without increase of the vertical spread.

172. Scattering of π -Mesons

"Scattering of π -Mesons on He-3 and He-4," by N. V. Dushin, Leningrad Polytechnic Institute; Moscow, Nauchnyye Doklady Vysshey Shkoly, Fiziko-Matematicheskkiye Nauki, No 2, 1958, pp 162-165

An attempt is made to determine the cross section of the reaction:



as well as the same formula for He₄. The wave function of the initial state is considered to be a superposition of states with isotopic spin $T = 1/2$ and $3/2$. The wave function of the final state may be constructed from the wave function of a three-nucleon system (isotopic spin $t = 1/2$ and $3/2$) and from the wave function of the π -meson (isotopic spin equal to unity). The correlations between the differential cross sections are derived.

173. Strange Particles

"Pair Formation of K-Mesons at Collisions of π -Mesons With Nucleons and Deuterons," by N. V. Dushin, Leningrad Polytechnic Institute; Moscow, Nauchnyye Doklady Vysshey Shkoly, Fiziko-Matematicheskkiye Nauki, No 2, 1958, pp 166-168

Strange particles with strangeness $S = +1$ for K^+ and K^0 and with strangeness $S = -1$ for K^- and \bar{K}^0 are analyzed. Reactions in which K-mesons with strangeness $S = +1$ occur should also contain a particle with strangeness $S = -2$. By taking into consideration the conservation law of the number of particles, a particle with $S = -2$ may be only a cascade hyperon (Ξ^-). The differential cross section of the process $\pi + n \rightarrow \Xi^- + K^+ + K^0$ is determined and correlations between total cross sections of π -mesons on nucleons and deuterons are derived.

174. Lambda Particles in Light Hypernuclei

" Λ -Nucleonic Forces and Bond Energy of a Λ -Particle in Light Hypernuclei," by V. A. Filimonov, Moscow State University imeni Lomonosov; Moscow, Nauchnyye Doklady Vysshey Shkoly, Fiziko-Matematicheskkiye Nauki, No 2, 1958, pp 174-180

On the basis of Lagrangian barion interaction with π and K mesonic fields of B. D. Espagnat and J. Prentki (Nucl. Phys., 1, 38, 1956) computation is carried out of the forces between the Λ -particle and the nucleon, bound by the exchange of one K with two K-mesons, two π , K and π . The forces obtained are used for the computation of the energy of hypernuclei ΔH^3 , ΔH^4 , ΔH^4 , ΔH^5 : The results of the theoretical computations agree with the energies of hypernuclei obtained experimentally.

175. Nuclear Research on Lithium

"The Overhauser Effect (A. W. Overhauser, Phys. Rev., 92, 411, 1953) in Metallic Lithium," by Ye. I. Kondorskiy and N. A. Bekeshko, Moscow State University imeni Lomonosov; Moscow, Nauchnyye Doklady Vysshey Shkoly, Fiziko-Matematicheskkiye Nauki, No 2, 1958, pp 204-207

To clarify the relation of polarization of nuclei to the saturation degree of resonance, bound to conducting electrons, the amplitude of the signal of nuclear resonance at various strengths of the high-frequency magnetic field of the oscillator was measured. Apparatus and methods applied were described by the authors in previous articles (Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, 32, 611, 1957; FMM, to be published). The results obtained are plotted in graphs. They show that the amplitudes of the signal of the nuclear resonance increase when the frequency varies from 77 to 83.6 Mc, but decreases thereafter.

176. Air Showers

"A Hodoscope Investigation of the Penetrating Component of Extensive Air Showers," by R. Ye. Kazarov, Physics Institute, Academy of Sciences Georgian SSR; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 36, No 1, Jan 59, pp 49-51

A relation of the type $N_{\mu} \sim E_0^{\alpha}$ for the flux of mu-mesons possessing energies ≥ 0.41 Bev and moving at a distance from 0 to 24 m from the axis of extensive air showers has been investigated. It is shown that for energies $1.51 \cdot 10^{14} \leq E_0 \leq 3 \cdot 14 \cdot 10^{15}$ eV the exponent is $\alpha = 0.42 \pm 0.14$.

177. Air Ionization

"Ionization of Air by H^+ and H_2^+ Ions," by R. N. Il'in, V. V. Afrosimov, and N. V. Fedorenko, Leningrad Physicotechnical Institute, Academy of Sciences USSR; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 36, No 1, Jan 59, pp 41-49

The composition of secondary ions produced in single collisions between 5 - 180 keV H^+ and H_2^+ ions and air molecules has been studied. The following secondary ions have been detected: N_2^+ , O_2^+ , N^+ , O^+ , N^{++} , O^{++} , and Ar^+ . The cross section for secondary ion formation and the cross section for electron capture by H^+ and H_2^+ ions and total cross section for ionization of air have been measured.

178. Scattering of Beta-Mesons

"Scattering of Beta Mesons in Lead," by A. I. Alikhanyan and F. R. Arutyunyan, Physics Institute, Academy of Sciences Armenian SSR; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 36, No 1, Jan 59, pp 32-40

The scattering of mu-mesons possessing momenta between 1.0 and $1.8 \cdot 10^8$ eV was studied in 7-mm-thick lead plates. The experimental angular distribution is compared with the theoretical multiple scattering curve which takes into account the finite nuclear dimensions. It is shown that after introduction of all relevant corrections the experimental results satisfactorily agree with the computations.

179. Positron Showers

"Showers Produced by 100 to 400 Mev Positrons," by Yu. D. Prokoshkin and T'ang Hsiao-Wei, Joint Institute for Nuclear Research; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 36, No 1, Jan 59, pp 10-16

Cascade curves for 101, 294, and 407 Mev positrons in lead and copper have been measured. The curves obtained are in agreement with shower curves computed by the Monte-Carlo method. Functions approximating the cascade curves have been found.

180. Core of Cosmic Ray Showers

"Cloud Chamber Investigations of the Cores of Extensive Atmospheric Cosmic Ray Showers," by O. I. Dovzhenko, S. I. Nikol'skiy, and I. V. Rakobol'skaya, Physics Institute imeni Lebedev, Academy of Sciences USSR: Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 36, No 1, Jan 59, pp 17-23.

The results of an experimental investigation of the structure of the core of extensive atmospheric cosmic ray showers are presented. Photographs of cores of extensive shower cores traversing the chamber are given.

181. The First Polish Experimental Reactor WWR-S

Pierwszy w Polsce Reaktor Jadrowy (The First Polish Nuclear Reactor), by L. Labno and K. Zarnowiecki; Warsaw, 1958, 106 pp

This booklet describes the construction and operation of the first nuclear reactor in Poland of Soviet production. It was built for experimental purposes, for scientific research, and for the production of artificial radioactive isotopes.

The reactor is of the tank type. It is immersed in a large aluminum tank filled with distilled water. The primary coolant is water and it is water-moderated. The fuel is 10% enriched uranium. The critical uranium weight is a few tens of kilograms. The fuel elements consist of thin tubular rods clad in aluminum. The rods are half a meter long and form a regular lattice of 17.5-mm spacing. The full charge consists of 800 rods containing 65 kg of uranium (hence 6.5 kg of U-235). For easier charging the rods are arranged in 52 clusters, suspended in aluminum matrices with 16 rods each. The clusters are set in a cage of aluminum, securing flow passage of the coolant between the rods. Nine holes run through the cage for control and safety rods. Around the core 8 isotope tunnels are built. In the core a neutron flux of $2 \cdot 10^{13}$ neutron/sec/cm² is produced; in the vicinity of the tunnels the flux is lower. But flux losses are not high, because the water inside the core serves also as reflector. Although the power of the reactor is only 2,000 kw, which is not much in comparison with plutonium producing reactors, the neutron flux of $2 \cdot 10^{13}$ is rather high. This paradox may be explained if we keep in mind that the whole power is released in a volume of 0.1 m³.

Besides the vertical tunnels for isotope production, nine horizontal experimental channels surround the core radially. They permit the extraction of gamma radiation or neutrons from the core for experimental purposes. These channels are opened or closed by remote control. A tenth channel is a thermal column filled with graphite and intended to provide strong thermal neutron beams.

A water circulation system serves for heat removal from the core. The water heated in the core is sucked out by three pumps of 120 kw power and a flow rate of 1,000 m³/hr. After passing heat exchangers the water is pumped back into the core. In the heat exchanger a second water loop cools the water. The second water loop is cooled in a sparge tank.

The cooling loops keep the water in the core at a temperature of 35°C, while the surface of the fuel elements have a temperature of 90°C. Such a low temperature does not produce deterioration of the fuel elements. To avoid the contamination of water by impurities, the cooling systems, the tubes, the pumps, the exchangers, and valves are made of stainless steel containing about 20% chromium and 10% nickel. The structural material used in the core is aluminum, which is resistant to activation by neutrons.

The activity of the water is permanently controlled by special equipment able to detect the least activity which would dissociate water into oxygen and hydrogen. To prevent an accumulation of these gases a part of the water circulates through a degasser -- a quick-dump arrangement and a gas sparge.

The core of the reactor is a powerful radiation source, equivalent to 1,000 kg of radium or one million curies. It requires strong shielding and this is provided by heavy concrete reinforced with limonite. Above the lattice the reactor is shielded by a layer of water and a thick concrete rotating cover provided with a charging mechanism. Under the floor of the reactor hall are the pumps and the hot chambers. The pump room is inaccessible during the operation of the reactor, because of contamination of the oxygen contained in the water. It has one-meter-thick shielding and locking bolts which are remote-controlled. On the pump floor four hot chambers are located, shielded by thick concrete walls. Each chamber has a window of several layers of lead glass. Hot materials are handled by slave units.

The minimum critical mass of the reactor requires 25 fuel clusters. The start-up of the reactor is done with 32 clusters (512 elements = 4.1 kg of U-235) Thus the reactivity is 0.05. To maintain this reactivity, one cluster has to be added at some time interval to compensate for neutron losses. It increases reactivity by 0.01. This operation is repeated until

full charge of the reactor, which provides for full operating power of the reactor during 600 days. The reactivity which was at the first charging 0.05 is compensated by six controlling rods, introducing when dropped into the lattice a negative reactivity -0.07. Three safety rods introduced also a negative reactivity of -0.06. Hence when all rods are dropped the coefficient of neutron multiplication is $k = 1 + 0.05 - 0.07 - 0.06 = 0.92$. The automatic control rod is of steel. The safety rods are of boron carbide.

Equipment for the start-up of the reactor consists of a ion chamber and a galvanometer measuring the current of the ion chamber starting with 10^{-11} amp. The chamber is located under cover of water near the core. After withdrawing the safety rods a few millimeters the galvanometer is read. This process is repeated several times until a pilot lamp on the galvanometer indicates the rising neutron beam. To operate the start-up from zero point an artificial neutron source, e.g., a mixture of radium and beryllium, is put inside the reactor. This source induces the reaction: $\text{Be}^9 + \alpha \rightarrow n + {}^6\text{C}^{12}$. Such a start-up practically avoids trespassing on the tolerance of reactivity (≈ 0.0075) at which the chain reaction develops on fast neutrons, which can promptly cause exceeding of the specified power and produce automatic action of the safety rods. At a slow start-up the neutron multiplication factor will be above unity by a very small amount and the right chain reaction will begin. It will increase the current of the ion chamber and the reading of the galvanometer which is calibrated to indicate the neutron flux. Calibration of the galvanometer is carried out by the method of radioactive indicators.

Besides the galvanometer a self-recorder of power, fed by the current of the chamber inside the water cover, indicates the power of the reactor. Connected in series with the self-recorder is a thermal energy measuring device.

The control system of the reactor includes an automatic power regulator keeping the power level steady within an accuracy of 1.5%. For more stability of the regulator the circuit has a negative feedback which supplies quick action. The automatic regulator may also be manipulated manually. A special system controls with great accuracy the introduction of samples for irradiation. The safety system signals a 10% increase of power and shuts down operation at a surge of 20%.

The operation of the reactor is considered completely safe.

The technological control concerns the following measurements: circulation of water and air, water level, pressures, subpressures, temperatures, and increase of temperature.

All important measurements are carried out by remote control.

The most important measurement is that of the primary water loop passing through the active reactor zone. It is the cooling circuit of the fuel elements. The signals of the water flow rate are connected to the safety equipment which act automatically in case of too low a water flow rate.

The lowering of pressure in the primary circuit also activates the safety rods.

The pump system is also under automatic surveillance.

In ten locations of the building special equipment is installed to indicate contamination of clothing or hands by minimal quantities of radiation. In addition, the exits have signaling gates containing 2^4 Geiger-Mueller counters. To avoid contaminated dust, the air is sucked by vacuum pumps and analyzed in ionization chambers. There are also mobile dosimeters.

Plasma Physics

182. Plasma Oscillations

"Oscillations in Electron-Ion Plasmas," by M. F. Shirokov and O. V. Prudkovskaya, Moscow State University imeni Lomonosov; Moscow, Nauchnyye Doklady Vysshey Shkoly, Fiziko-Matematicheskoye Nauki, No 2, 1958, pp 192-199

A system of equations of plasma motion is derived, permitting evaluation of the domain of application to available theories. It is shown on the basis of this system that three fundamental types of oscillations exist in plasmas. The analysis of the general dispersion equation for small periodic perturbations of density and temperature of plasma components permitted deriving the equation of diffusion oscillations of electron-ion gas and the familiar equation of acoustic oscillations of a neutral gas.

183. Gas Discharge

"Some Optic Studies of Intense Pulse Discharge in Hydrogen," by P. S. Kireyev and A. A. Yuzefovich, Chair of Atomic Physics and Electronic Phenomena; Moscow, Vestnik Moskovskogo Universiteta, Seriya Matematiki, Mekhaniki, Astronomii, Fiziki, Khimii No 5, 1958, pp 105-110

The discharge radiation in a glass cylinder was studied on a Steingel spectrograph. The spectral pattern sharply depends on the gas pressure of the chamber. The half-width of the H-alpha line is $11.9 \pm 0.1 \text{ \AA}$ at 5 mm Hg pressure and $3.7 \pm 0.1 \text{ \AA}$ at 10^{-12} mm Hg pressure. In measuring the temperature of the plasma by the Doppler effect much caution should be taken. The Doppler profile during observations perpendicular to the discharge pinch is complicated by the Doppler effect due to pulsations of the discharge pinch which usually occur during intense discharges due to the electrodynamic pinch.

Solid State Physics

184. Resonance of F-Centers

"Paramagnetic Resonance of F-Centers in Static Magnetic Fields of Arbitrary Strength," by M. F. Deygen and A. B. Roytsin, Physics Institute, Academy of Sciences of the Ukrainian SSR; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 36, No 1, Jan 59, pp 176-185

The hyperfine interaction of an F-center electron with the magnetic moment of nuclei of the first coordinational sphere surrounding a vacancy is examined for the case when a static field of arbitrary strength is present.. The hyperfine splitting has been evaluated for F-centers in a KCl crystal. Transitions between hyperfine levels induced by a radio-frequency field are considered. In the absence of an external static field these transitions are found to be allowed.

Paramagnetic resonance of F-centers of which one of the nuclei of the first coordinational sphere has a magnetic moment is specially treated. In this case the frequencies and intensities of paramagnetic resonance absorption depend on the orientation of the crystal in the static magnetic field. The absorption intensity also depends on the orientation of the crystal with respect to the vector of the magnetic field of the wave incident on the crystal.

185. Relaxation in Ferrodielectrics

"The Theory of Relaxation Processes in Ferrodielectrics at Low Temperature," by A. I. Akhyezer, B. G. Bar'yakhtar, and S. V. Peletminskiy, Physicotechnical Institute, Academy of Sciences Ukrainian SSR; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 36, No 1, Jan 59, pp 216-223

A relaxation theory of the magnetic moment of ferrodielectrics is presented. It is shown that, owing to exchange interaction between the spin waves at first, a Bose distribution is established for spin waves with given nonequilibrium values of the square and projection of the magnetic moment on the axis of preferred magnetization. Because of magnetic interaction and interaction due to the anisotropy energy, the equilibrium values of these quantities are gradually attained. The relaxation times are computed.

186. Kinetic Processes in Ferromagnetics

"Contribution to a Phenomenological Theory of Kinetic Processes in Ferromagnetics. II. Interaction Between Spin Waves and Phonons," by M. I. Kaganov and V. M. Tsukernik, Physicotechnical Institute, Academy of Sciences Ukrainian SSR; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 36, No 1, Jan 59, pp 224-232

The interaction between spin waves and phonons is analyzed. The time necessary for the establishment of equilibrium between the phonons and the spin waves is computed.

Spectroscopy

187. Research on Spectroscopy and Luminescence in the Belorussian SSR

"Work of Belorussian Scientists on Spectroscopy and Luminescence", by Academician B. I. Stepanov, Academy of Sciences Belorussian SSR; Moscow, Vestnik Akademii Nauk SSSR, Vol 29, No 1, Jan 59, pp 68-76

Research on spectroscopy and luminescence has expanded in the Belorussian SSR to a great extent during recent years. Work on the subject is being done at the Institute of Physics and Mathematics, Academy of Sciences Belorussian SSR, and the Physical Faculty of the Belorussian University.

Academicians B. I. Stepanov, A. N. Sevchenko, and M. A. Yel'yashevich of the Academy of Sciences Belorussian SSR and F. I. Fedorov, Corresponding Member of the Academy of Sciences Belorussian SSR, are in charge of the work in question.

Early advances in spectroscopy, particularly after Kirchhoff's law had been formulated, were based on the investigation of equilibrium emission of radiation. However, only processes which are basically of the nonequilibrium type were considered subsequently. It was not taken into consideration that the nonequilibrium process arises against the background of a preceding state of equilibrium and that factors which strive to restore the equilibrium are continuously active. As late as 1944, S. I. Vavilov re-emphasized that luminescence and dispersion represent an excess over and above the thermal radiation emitted by matter. However, no practical conclusions were drawn from this and the thermal background was still not considered. Nevertheless, this background is of primary importance for the interpretation of experimental data and above all of the temperature dependence of spectral phenomena.

Starting from these considerations, the author of this article subjected to systematic scrutiny problems pertaining to the effects of the background on equilibrium radiation emission. He initially formulated in research done together with co-workers at the Physics Institute imeni P. N. Lebedev expressions for the luminescence yield which bear an evident relation to the temperature of the medium. Analysis of relevant phenomena indicated that in some cases the luminescence yield may exceed unity or may even be below zero. In the first case, a part of the thermal energy of the gas being investigated is transformed into radiation. The result that was obtained made it possible to approach an interpretation of the nature of anti-Stokes fluorescence. In the second case, the system subjected to irradiation transforms into heat not only the total external radiation received, but also a part of the surrounding equilibrium radiation. In connection with this, the concept of negative luminescence was formulated and also of the negative photo-effect. The existence of negative luminescence indicates that the optical excitation of a system may result at certain frequencies in a reduced emission as compared with the thermal emission that took place before the excitation.

Subsequently, the general principles of the spectroscopy of negative fluxes were developed. They were applied in experimental investigations conducted by B. I. Stepanov and Ya. S. Khvashchevskaya, who made use of the capacity of receivers of infrared radiation to record insignificant changes of temperature occurring not only in the light source, but also

within the vessel holding the substance being investigated and even in the receiver itself. In view of the fact that changes in the thermodynamic equilibrium of the receiver may take place in two directions, it was possible to record absorption spectra and spectra of dispersion by matter after the ordinary (hot) source of infrared radiations was replaced by any cooled source whatsoever.

Of fundamental importance for the clarification of the nature of intramolecular migration of energy is work done by A. N. Sevchenko and V. V. Kuznetsova on the luminescence of complex compounds of rare-earth elements. They established the effect of the organic part of the molecules and of the solvent on the distribution of energy in the emission spectra of ions of rare-earth elements and also established that there is a pronounced dependence of the quantum yield on the temperature.

Work on the spectroscopy of uranyl compounds and crystal phosphors is centered at the Belorussian University. The presence of fine structures in the spectra of absorption and luminescence of uranyl compounds and also the high sensitivity of these spectra to changes in the physicochemical characteristics of the medium and to the presence of impurities make it possible to develop reliable methods for the analysis of uranyl compounds. Furthermore, the investigation of the spectral characteristics of uranyl compounds is of fundamental scientific importance. Hexavalent uranium forms stable complexes with molecules of the solvent: the properties of the complex compounds that are formed exert an influence on all spectroscopic characteristics which can be observed (i.e., the spectra themselves, the spectral yield, the duration [of fluorescence emission], and polarization). Research done by A. N. Sevchenko and L. V. Volod'ko made it possible to obtain valuable data on the structure of complexes and the nature of the forces of intermolecular interaction. At the same time, extensive work was done on the compilation of catalogs of spectra and the interpretation of spectra.

Scientific research on the luminescence of crystal phosphors is not being conducted on an adequate scale: work in this field must be expanded. Up to now, results have been obtained in research done by I. P. Shapiro, who systematically investigated the optical and electrical properties of some crystal phosphors. For instance, interesting information has been obtained in work on the thermal de-excitation of cooled phosphors.

A. P. Prishivalko and B. I. Stepanov formulated a theory of dispersion by filters based on the consideration of interference phenomena taking place in two-phase systems. Experimental research on light-dispersion

filters for use in the infrared region was conducted in a systematic manner by N. A. Borisevich, Ya. S. Khvashchevskaya, and I. F. Laptsevich. These investigators developed a number of new light filters and investigated the effect of particle size, the thickness of the layer, the nature of the ambient medium, and the temperature on transmission through these filters.

The rapid advancement of spectroscopy in Belorussia is closely connected with the general advancement of this branch of science in the USSR. The research done in the Belorussian SSR is conducted in close collaboration with work done at Moscow, Leningrad, Kiev, Tartu, Saratov, and other cities of the USSR. Work in this field is being coordinated by the Commission on Spectroscopy, Academy of Sciences USSR (S. L. Mandel'shtam), and the Scientific Council on the Problem of Luminescence and Its Applications (V. L. Levshin). The Eighth Conference on Luminescence will be held in 1959 at Minsk.

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