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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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1. Irradiation Effects on Plant Activity of Meristematic Tissue

"The Effect of Ionizing Radiation on the Metabolism of Reserve Organs of Plants," by B. A. Rubin and L. V. Metlitskiy, Institute of Biochemistry of the Academy of Sciences USSR; Moscow, Zhurnal Obshchey Biologii, Vol 19, No 5, Sep/Oct 58, pp 387-396

The aim of this research was to study the possibility of using radioactive isotopes and emission products of heavy nuclei for prolonging the period of vegetable storage. Potato tubers irradiated with gamma rays were used in studying metabolic phenomena involved in the dormant state, germination, growth, and sensitivity to microorganisms.

Topics discussed include the morphological and anatomical changes in growth zones of the tubers due to the effect of ionizing radiation, and the effect of ionizing radiation on nucleic acid metabolism.

Results indicate that irradiation delays tuber germination because of the following: altered state of cellular colloids, shifts in the isoelectric zone of proteins toward the acid side, delayed synthesis of nucleic acids in the growth points, decreased activity of a number of oxidizing enzymes in the mitochondria, and, consequently, decreased rate of respiration. As a result of these changes the meristematic tissue in the eyes of irradiated potato tubers loses its capacity to divide. These same changes are produced by physical factors such as low temperature or chemical preparations because they delay oxidation processes in the tubers.

The author concludes that irradiation makes it possible to prolong the potato storage period.

II. CHEMISTRY

Chemistry and Technology of Fuels and Propellants

2. The Theory of the Chemical Stability of Explosives

"On the Problem of the Theoretical Basis for the Determination of the Chemical Stability of Explosive Substances," by K. K. Andreyev, Moscow Chemicotechnological Institute imeni D. I. Mendeleyev; Moscow, Nauchnyye Doklady Vysshey Shkoly -- Khimiya i Khimicheskaya Tekhnologiya, No 4, Nov 58, pp 635-639

The chemical transformation of explosives is usually a complex process which consists of a number of consecutive and parallel reactions the relative weight of which changes with changes in the temperature. For this reason the evaluation of stability in the low-temperature region on the basis on the dependence of reaction velocity on temperature in the high-temperature region is most reliable when the two temperature regions are close to each other.

The stability of explosives is determined by the interrelationship of three characteristics: (1) the initial velocity of the spontaneous chemical transformation; (2) the development of self-accelerating reactions, specifically the maximum velocity of these reactions; and (3) the effect of admixtures or impurities on these reactions.

One may distinguish between two types of the thermal decomposition of explosives; one type of decomposition is characterized by a strong acceleration of the decomposition under the effect of decomposition products or some other admixtures (e.g., decomposition of nitroglycerin and of other nitric acid esters or of explosives which decompose in the solid state) while a relatively weak acceleration is typical for the other type of decomposition (e.g., decomposition of nitramines and aromatic nitrocompounds). In the case of the first type of decomposition its self-acceleration and the presence of admixtures which contribute to this self-acceleration play the principal role; in the second type of decomposition these factors play a relatively less important role and the initial velocity of the chemical transformation is of greater importance.

3. Some New Results in the Investigation of Detonation Waves

"Optical Investigation of Transverse Detonation Waves," by B. V. Voytsekhovskiy, B. Ye. Kotov, V. V. Mitrofanov, and M. Ye. Topchiyan, Siberian Department, Academy of Sciences USSR; Novosibirsk, Izvestiya Sibirskogo Otdeleniya Akademii Nauk SSSR, No 9, Sep 58, pp 44-50

On the basis of the experimental investigation described, the following physical model of a detonation wave is proposed:

A shock wave propagates ahead of the combustion front. This shock wave heats the gas to a high temperature. Because of the instability of the flat front of combustion, transverse detonation waves begin to propagate through the gas compressed and heated by the shock wave. These detonation waves crisscross the whole surface of the shock wave in different directions with a network of lines, forming a system of cells which change with time.

Every transverse detonation wave consists of a shock wave followed by a combustion front. The pressure at the Jouguet point behind its front is approximately four times greater than that at the chemical peak of the principal detonation wave. At points of double collisions and particularly of triple collisions between transverse detonation waves, the pressure is several times higher than behind the front of the propagating shock wave.

The stability of transverse shock waves is explained by a sharp increase in the rate of combustion (determined by the factor $\rho^2 e^{-\frac{A}{RT}}$) after the secondary shock compression.

In a normal detonation wave the total quantity of gas passes through the stage of a secondary shock compression.

The dimensions of the detonation cells (in detonations according to Jouguet) are determined by the composition and pressure of the gas mixture; they depend only to a small extent on the diameter of the detonation tube, increasing somewhat at small diameters.

A transition from a normal detonation to a spin detonation takes place when the diameter of the tube does not differ greatly from the dimensions of the cell. Under these conditions a transverse detonation wave is preserved solely along the walls of the tube, where detonation is facilitated because of additional heating of the gas due to friction. Thus, in spin detonation the layer of gas adjacent to the walls burns in a transverse detonation wave while the gas within the inner volume burns by virtue of turbulent combustion.

The scheme for the calculation of the characteristic angles of a single transverse detonation wave in normal detonation does not differ from the scheme for the calculation of a spin transverse detonation wave.

Chemistry and Technology of Nuclear Fuels and Reactor Construction Materials

4. Solvent Extraction of Nuclear Fuels

"General Conference of the Department of Chemical Sciences, Academy of Sciences USSR, Held 22-23 May 1958" (unsigned article); Moscow, Izvestiya Akademii Nauk SSSR, Otdeleniye Khimicheskikh Nauk, No 11, Nov 58, pp 1399-1401

V. M. Vdovenko, Corresponding Member, Academy of Sciences USSR, gave a report entitled "Investigation of the Distribution of the Nitrates of Some Radioactive Elements Between Two Immiscible Solvents." He brought out that in present-day radiochemistry extraction processes based on the distribution of radioactive elements between two immiscible solvents are used extensively for the separation of radioactive isotopes. Extraction with organic solvents of uncharged inorganic complexes, often present in the form of acido-complexes, is one of the principal methods for the separation of radioactive isotopes. Vdovenko's report discussed results of systematic investigations concerning the distribution of the nitrates of uranyl, neptunyl, and plutonyl. Furthermore, data on the distribution of a number of nitrates of other elements between aqueous solutions and some oxygen-containing organic solvents were presented. The author of the report succeeded in establishing a number of relationships which are interesting and important from the practical standpoint. These relationships correlate the efficiency of the salting-out effect of nitrates not only with the concentration of the nitrate ion, but also with the characteristics of the cation introduced into the solution (its radius and the magnitude of its charge).

The results of the work that has been done on the subject made it possible to apply the extraction method for the separation of uranium and plutonium from aqueous solutions and the purification of these elements from splinter elements. The basic principles have been investigated of the extraction method for the treatment of irradiated uranium with the use of a solvent which is safe as far as danger of explosions is concerned. The processes of distribution were investigated in the presence of calcium nitrate functioning as a salting-out agent. Application of this process makes it possible to separate from irradiated uranium approximately 99% of the plutonium present in it. The extraneous radioactivity is reduced by a factor of 80,000. In this process, more than 99% of uranium is separated and the content of splinter elements in this uranium is reduced by a factor of one million.

5. Myricitrin as a Reagent for the Determination of Uranium

"Investigation of Complex Compounds of Uranium With Myricitrin," by P. A. Zagorets, Chair of Chemical Physics, Moscow Chemico-Technological Institute imeni D. I. Mendeleyev; Moscow, Nauchnyye Doklady Vysshey Shkoly -- Khimiya i Khimicheskaya Tekhnologiya, No 4, Nov 58, pp 680-684

Curves of the absorption by myricitrin and complexes of uranium with myricitrin in the visible and ultraviolet regions of the spectrum were taken. Specrophotometric determinations indicated that there are three complex compounds of uranium with myricitrin with ratios of uranium to that substance equal to 1/1, 2/1, and 3/1. Direct chemical analysis indicated the formation of compounds with the ratios of 1/1 and 3/1.

6. Spectrophotometric Determination of Thorium

"Fluorometric Determination of Sulfate Ions and Spectrophotometric Determination of Thorium With the Aid of Derivatives of Trihydroxyfluorone," by V. A. Nazarenko and M. D. Shustova, Institute of General and Inorganic Chemistry, Academy of Sciences Ukrainian SSR; Moscow, Zavodskaya Laboratoriya, Vol 24, No 11, Nov 58, pp 1344-1346

Derivatives of 2,3,7- trihydroxy 6-fluorone substituted in the 9-position were used as spectrophotometric reagents for the determination of thorium. It was found that the 9-(o-hydroxphenyl)-trihydroxyfluorone is best suited for determinations of this type. This substance forms a bright red complex compound with thorium at pH values greater than 2. Reagents of this type can also be used for the determination of the sulfate ion by the fluorometric method, because thorium enters into a sulfate complex, thereby freeing a part of the fluorone derivative, which fluoresces in ultraviolet light.

7. The System $BeCl_2$ - BeF_2

"Thermal Analysis of the System $BeCl_2$ - BeF_2," by O. N. Kuvyrkin, O. N. Breusov, and A. V. Novoselova, Chair of Inorganic Chemistry, Moscow State University imeni M. V. Lomonosov; Moscow, Nauchnyye Doklady Vysshey Shkoly -- Khimiya i Khimicheskaya Tekhnologiya, No 4, Nov 58, pp 660-663

A thermal analysis of the system $BeCl_2$ - BeF_2 was carried out. It was established that this system forms a simple eutectic which contains 72.5 mol% of BeF_2 and melts at 306°.

8. The Characteristics of Benzoylacetone as an Agent for the Extraction of Radioactive Isotopes

"The Dissociation Constant of Benzoylacetone and the Coefficients of the Distribution of This Compound Between Some Organic Solvents and the Aqueous Phase, by I. Stary and N. P. Rudenko, Institute of Nuclear Physics, Moscow State University imeni M. V. Lomonosov; Moscow, Nauchnyye Doklady Vysshey Shkoly -- Khimiya i Khimicheskaya Tekhnologiya, No 4, Nov 58, pp 624-629

The results of a determination of the dissociation constant of benzoylacetone and of the coefficients of the distribution of this substance between benzene, chloroform, or carbon tetrachloride forming the organic phase and an acetate buffer solution forming and aqueous phase are reported. The properties of benzoylacetone were investigated because this substance, which forms inner complex salts with a great number of elements, may serve as an effective agent for the extraction of radioactive isotopes. The properties of benzoylacetone are compared with those of acetylacetone, which were determined in previous work done by the authors.

9. Elimination of Strontium Ions From Solutions With the Aid of Half-Calcined Dolomite

"Interaction of Half-Calcined Dolomite With Strontium Ions in Aqueous Solutions," by S. A. Voznesenskiy (deceased), V. F. Bagretsov, and V. V. Pushkarev, Ural Polytechnic Institute imeni S. M. Kirov; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 3, No 12, Dec 58, pp 2801-2804

An investigation of the interaction between half-calcined dolomite and strontium ions contained in aqueous solutions, which has been carried out under static conditions, showed that strontium present in microconcentrations can under definite conditions be eliminated from these solutions rather efficiently by means of half-calcined dolomite, i.e., "magnomass." On the basis of data obtained under static conditions, two mechanisms for the interaction of strontium with the magnomass were proposed, namely, (1) chemosorption on the surface of grains and coprecipitation on recrystallization of the magnomass and (2) coprecipitation accompanying new precipitation of difficultly soluble calcium and magnesium slats (cf. V. F. Bagretsov, Zhurnal Neorganicheskoy Khimii, Vol 1, No 1, January 1956, p 179).

The purpose of the present work was an experimental investigation of the interaction between half-calcined dolomite and strontium ions in aqueous solutions under dynamic conditions, i.e., during the filtration of the solution through a column filled with dolomite.

Solutions containing Sr^{89} were used in the work described.

It was found in experiments carried out at room temperature that at pH $\leq$ 5.0 of the initial solution a constant value of adsorption of strontium is established rather rapidly under the experimental condition. This value depends on the time of contact of the solution with the dolomite. When solutions of strontium in 1 N NH_4 OH are used, a constant value of adsorption is established after filtration has been carried out for a considerably longer time. When the strontium is contained in 1 N NaOH solutions, the adsorption gradually drops to zero. It was furthermore found that the presence in the solution of anions that form difficultly soluble salts with strontium considerably increases the amount of adsorption of this element.

Industrial Chemistry

10. The Use of Polystyrene Vessels as Containers for Liquid Air

"The Application of Polystyrene in Low-Temperature Technology," by Ruzicka; Prague, Strojirenstvi, No 4, 1958, pp 298-301 (reported by Engr A. A. Trokhin in Kislorod, Moscow, Vol 11, No 5, Sep-Oct 58, pp 62-64)

In experiments carried out at the Institute of Nuclear Physics, Czechoslovak Academy of Sciences, applications of polystyrene as a heat-insulating material and material for vessels to be used as containers for liquid air have been investigated. Glass Dewar flasks are dangerous because of the possibility that they may crack. Metal Dewar flasks are safer, but are not a satisfactory substitute for glass flasks. Unbreakable vessels made of foam polystyrene were found to be satisfactory for the storage and handling of liquid air. The results obtained in the work described make it possible to assume that foam polystyrene will find extensive application not only as a material for laboratory equipment but also as an insulating material at low-temperature industrial installations.

11. Ftoroplast-4

"The Rolling of Ftoroplast-4 Film," by I. M. Meyerovich, Moscow, Byulleten' Tekhniko-Ekonomicheskoy Informatsii, Vol 11, No 11, Nov 58, pp 20-22

The properties of ftoroplast-4 (polyfluoroethylene) are described. It is stated that this polymer can be used at temperatures from minus 269° to plus 250° C. The rolling of ftoroplast-4 films on equipment designed by the Central Design Bureau of Metallurgical Machine Building (TsKBMM), Central Scientific Research Institute of Technology and Machine Building (TsNIITMASh), is discussed.

12. Development of Carboxyl Rubber in the USSR

"Carboxyl Rubber," by V. N. Reykh; Moscow, Byulleten' Tekhniko-Ekonomicheskoy Informatsii, Vol 11, No 11, Nov 58, pp 14-15

The Institute of High-Molecular Compounds, Academy of Sciences USSR, and the All-Union Scientific Research Institute of Synthetic Rubber imeni Academician S. V. Lebedev have developed a method for the production of carboxyl-containing elastomers by the copolymerization of butadiene or other monomers with a small quantity of methacrylic acid (0.5-2%). The process of polymerization can be carried out in emulsion, in an acidic medium, and in the presence of redox systems.

The presence of carboxyl groups in the polymer chain makes it possible to vulcanize the rubber by reacting the carboxyl groups with oxides of divalent metals (e.g., magnesium oxide or zinc oxide) or metal hydroxides (e.g., magnesium hydroxide of calcium hydroxide).

At high temperatures the capacity of vulcanized carboxyl rubber for elastic recovery drops (i.e., its yield point is lowered). This is due to melting of the crystalline phase. The yield point can be raised by forming strong intermolecular C-C bonds. This can be achieved, for instance, by using a small quantity of thiuram.

The tensile strength of carboxyl rubber is no lower than that of natural rubber and is much higher than that of analogous synthetic elastomers which do not contain carboxyl groups. Because sulfur bonds are absent, vulcanized carboxyl rubber is much more resistant to heat-aging than natural or synthetic rubber vulcanized with sulfur.

The most important characteristic of carboxyl rubber is its high notch resistance: notches on rubber of this type do not increase in size even after 360,000 deformation cycles, while analogous rubber from butadiene-styrene rubber is severed after 130,000-140,000 cycles and natural vulcanized rubber after 300,000 cycles.

One of the drawbacks of mixtures based on carboxyl rubber is a tendency toward premature structure formation ("scorching"), which results in a considerable lowering of the plasticity of the mixtures during processing. This is due to reactions between the carboxyl groups of the polymer chains and metal oxides. The reactions in question can be inhibited to a certain extent by the introduction of some acids or anhydrides, the addition of softeners, lowering of the temperature of processing, and the application of apecial procedures, among which one may mention screening of the surface of the metal oxide with a protective high-melting film.

The most effective procedure is the application of hydrates of salts in combination with metal oxides. For instance, calcium oxide does not exert a vulcanizing effect at the temperature used for vulcanization, whereas calcium hydroxide is a good vulcanizing agent. When hydrates of salts are used which split off water at temperatures close to that of the temperature of vulcanization, the calcium oxide introduced into the mixture is transformed into calcium hydroxide under the conditions in question.

Tests conducted at the Institute of the Tire Industry, the Institute of Synthetic Rubber, and the Yaroslavl' Tire Plant have shown that the butadiene-styrene rubber SKS-30-1, which contains carboxyl groups, can be used to advantage in the production of tires and is superior to analogous rubber not containing carboxyl groups. It was found that an addition of 20-30% of SKS-30-1 rubber to SKS-30 AM rubber increases the notch resistance of tire casings by a factor of 1.5-2.

Radiation Chemistry

13. Current Trends in Radiation Chemistry

"Radiation Chemistry -- Its Principal Trends and Problems," by N. A. Bakh, Doctor of Chemical Sciences, and P. I. Dolin, Doctor of Chemical Sciences; Moscow, Vestnik Akademii Nauk SSR, Vol 28, No 10, Oct 58, pp 20-33

A distinguishing characteristic of chemical reactions which take place under the effect of radiation is the participation in them of highly excited particles (ions, atoms, free radicals, and molecules) the energy of which greatly exceeds that of the chemical bond. In ordinary thermochemical and photochemical reactions, only a few particles of this type are present. As a result of the development of nuclear technology, radiation chemistry originated and the scope of research in this field increased greatly. In the initial phase of the development of research on radiation chemistry, problems pertaining to the protection of various substances and materials from the harmful effects of radiation predominated. At present stress is placed on applications of radiation for the purpose of conducting chemical reactions that will result in the formation of valuable chemical products. Under conditions which form the subject of study in radiation chemistry, charged particles usually transmit their energy completely. Slow particles transmit a considerable portion of this energy. A knowledge of the relationships pertaining to the transmission of energy by slow electrons is necessary not only for the calculation of local doses (and consequently for the determination of the density of ionization along the track of particles) but also for a clarification of the type of excitation which is produced under the action of ionizing particles.

Ionization potentials can be calculated theoretically only for a simple gas. For other substances, values of the ionization potential are used which are derived from experiments in which the free path of charged particles was determined for the substance of question. The theory of the transmission of radiation energy by molecules of a medium has been developed only for gases. The problem of applying this theory to condensed systems remains open; one should do further work on this subject, particularly as far as effects produced by slow electrons are concerned.

Radiation-chemical transformations also depend on processes of transmission of energy from particles which have acquired energy (atoms, molecules, ions, and radicals) to molecules of the surrounding medium.

The primary chemical reactions which follow ionization and excitation are of importance. Mass-spectrometric investigation of products formed as a result of the impact of electrons on molecules of various compounds in being conducted in the USSR (V. L. Tal'roze, N. I. Tumitskiy). Investigation of radicals which form in the radiolysis of organic compounds has been started. The study of these radicals is conducted by the method of paramagnetic resonance (V. V. Voyevodskiy). It is desirable to expand research in this field by applying different methods, for instance, pulse irradiation, for the determination of the half-life of short-lived intermediate products.

Research on reactions taking place with the participation of hot atoms and radicals (that are formed in nuclear reactions) is related to the field of investigation mentioned above. A characteristic trait of particles of this type is that they may enter into reactions which are thermodynamically impossible for ordinary cold particles. The investigation of hot particles will make it possible to clarify the role played by them in radiation chemistry and nuclear chemistry. Work on this subject is being conducted on an extensive scale outside the USSR, while insufficient attention is being paid to this subject in the USSR.

As far as radiation-chemical reactions of simple inorganic substances are concerned, the underlying relationships can be best investigated on the simplest reactions such as the formation of ozone, the oxidation of nitrogen, and the formation and decomposition of hydrogen peroxide. In work done by S. Ya. Pshezhetskiy on the formation of ozone and of nitrogen oxides as a result of electron impacts, it was established that the principal role in the first transformation is played by excited molecules of oxygen and in the second by ionized molecules of nitrogen. To establish the general relationships that are valid in this field, one must investigate a large number of simple substances in different states after these substances have been subjected to the action of different kinds of radiation. Some reactions of this type may be of interest from the standpoint of the application of nuclear radiation as a means of accomplishing chemical reactions which require a large amount of energy (for instance, the oxidation of nitrogen).

A considerable amount of work has been done on radiation-chemical reactions taking place in water and in aqueous solutions, because water is used in nuclear reactors as a moderator and heat-transfer agent and because products of nuclear fission are isolated from aqueous solutions. In all the cases mentioned, nuclear radiation exerts a strong effect on water and aqueous solutions, so that radiation-chemical reactions play an important role. These reactions must be investigated in order to solve general problems pertaining to the chemical effects of radiation. At present, using principally data obtained in research on processes taking place in aqueous media, attempts are being made to determine the role of ionization and excitation, to clarify the nature of tracks over which ionizing particles of different types pass, and to investigate processes which take place in the vicinity of these tracks in the surrounding medium. Active intermediate products that are formed under the action of radiation on matter are also being investigated.

The very extensive experimental data that have been obtained on the radiolysis of aqueous solutions are adequately explained by the assumption that not only the radicals OH and H but also the molecules H_2O_2 and H_2 represent primary products of radiolysis.

Radiation-chemical reactions may proceed in different directions. The radicals OH and H react with the substances dissolved in the water and also recombine with each other, yielding H_2O_2, H_2, and H_2O. The recombination is most probable along the tracks of ionizing particles, where the concentration of radicals at the first moments after the passage of particles is many times greater than in the surrounding medium. Light radiation (gamma and beta) and heavy-particle radiation (alpha, d, p, and n) induce the formation of radical and molecular products with different yields depending on the type of radiation. As a result of the action of light radiation on water, about 80% of the water molecules are involved in chemical reactions in the form of radicals and only about 20% can be detected in the form of H_2O_2 and H_2. The corresponding yields in the case of heavy [particle] radiation comprise 10-15% of radicals and 85-90% of molecular products. The problem as to whether the molecular products are formed only by the recombination of radicals or may also form by some other mechanism has not been solved yet.

By introducing into the solution substances which interact energetically with one of the radical products of the radiolysis of water, one can utilize more extensively the other radical for some suitable reaction. Organic molecules containing mobile groups usually function as acceptor radicals of this type. Some substances, under the conditions brought about by irradiation, serve as carriers or transmitters of oxygen in the oxydation of some other substance, thus considerably increasing the reaction yield. This phenomenon is denoted as radiation sensitization. The idea in regard to the possibility of this phenomenon was advanced by M. A. Proskurnin, who together with his collaborators continues the investigation of the phenomena involved.

As far as radiation electrochemistry is concerned, it has been established by V. I. Veselovskiy that irradiation of an electrochemical system consisting of the solution of an electrolyte and a metal electrode leads to a disturbance of the thermodynamic equilibrium in this system both because electrochemically active substances are formed in the solution and because the electrons in the oxide layer of the electrode are excited. Electrochemically active products arise as a result of the transformations of the dissolved substance brought about by direct and indirect action of radiation and because of the radiolysis of water. Visible proof of a shift in the equilibrium of the system being irradiated is the generation of a stationary difference of potential between two electrodes which exhibit selectivity with regard to oxidizing and reducing products of radiolysis. Thus, the possibility of transforming radiation energy into electric energy in a galvanic system has been demonstrated. However, a practical application of this principle is connected with difficulties from both the technical and the scientific standpoints.

Under the action of radiation either activation or passivation of processes occurring at the electrode may take place. Intermediate products of radiolysis which are formed in the solution (radicals and intermediate electrochemically active products) participate in the processes involved. Furthermore, the properties of the electrode itself change as a result of the direct action of radiation on it. This refers particularly to semiconductor electrodes or electrodes the surface layer of which possesses semiconductor properties.

It has been established in a number of investigations by N. A. Bakh and V. I. Medvedovskiy that electrochemical methods (potentiometry, polarography, etc.) are suitable for the investigation of products of radiolysis formed in aqueous solutions. In some cases, these methods proved very effective. The investigation of radiation-galvanic processes must be developed intensively in many directions. It is necessary to investigate the behavior under the effect of radiation of a great number of different redox systems, the products of radiolysis formed by which may be electrochemically active. An important problem is that pertaining to the mechanism of the selective action of products of radiolysis on electrodes. The investigation of the processes taking place on metal and semiconductor electrodes will contribute to the more effective application of radiation in electrochemical processes and to an understanding of corrosion processes taking place in radiation fields. Methods for suppressing corrosion under these conditions will be found as a result of this work. One must use more extensively electrochemical methods in the investigation of products of radiation-chemical reactions and in work aimed at the clarification of the mechanism of these reactions.

Investigations in the field of the radiation chemistry of organic substances have not yet led to generally recognized concepts, as distinguished from the radiation chemistry of inorganic compounds in aqueous

solutions. However, research in this field progresses rapidly and is beginning to cover an ever-increasing diversity of reactions and types of compounds. Modern and very effective methods are being applied in the investigation of the reaction products. Under the circumstances one may expect that new and valuable experimental data will be obtained soon and that general concepts pertaining to this field will be formulated.

Work on the radialysis of hydrocarbons in the liquid and gas phases has been initiated in the USSR. Processes of the radiation-chemical oxidation of hydrocarbons and other organic compounds in the presence or absence of oxygen (in the latter case, by-products of the radiolysis of the solvent bring about oxidation) are being investigated systematically. A small number of investigations is being conducted on halogenation, amination, and other processes taking place under the action of radiation.

Although these investigations are of a predominantly qualitative nature and are concerned mainly with individual reactions, attempts are also being made at present to establish some general relationships pertaining to radiation-chemical reactions in which organic substances participate. Very valuable data from this standpoint have been obtained by V. L. Tal'roze and Ye. P. Frankevich in the mass-spectrometric investigation of products formed by the bombardment of molecules with electrons. It has been found that the principal reactions following the primary formation of ions consist of ion-molecule interactions in which transfer of hydrogen atoms or protons takes place with the result that new ions or radicals are formed. The energy balance of these interactions is positive and the reaction energy is retained in the radicals or ions as excitation energy.

The participation of radicals in radiation-chemical reactions of organic compounds can be established by the method of paramagnetic resonance. The presence of radicals in irradiated hydrocarbons has been detected by this method. Such radicals can be preserved for long periods of time in a frozen state at low temperatures (A. V. Topchiyev, L. S. Polyak).

Radiation-chemical oxidation, as distinguished from photochemical and thermochemical oxidation, takes place at room temperature. This is possible only because the primary radicals which form as a result of the action of ionizing radiation have at the time of their formation a considerable excess of energy, which is preserved in the RO_2 radicals. This makes it possible to carry out reactions which require a sizable energy of activation, but does not bring about the development of chains, because the radicals R* which are produced in reactions of the type

$$R^* \; O_2 + RH \longrightarrow R\,O\,O\,H + R^*$$

do not form peroxide radicals having a sufficient excess of energy. Peroxide radicals which are not capable of bringing about reactions that require an energy of activation may add radicals and form dialkyl peroxides. This process is typical for processes of radiation-chemical oxidation and is not observed in photochemical oxidations. Investigations in the field of the radiation chemistry of organic substances done with the purpose of developing methods for the production of valuable substances must be conducted on an extensive scale.

The distinguishing characteristic of radiation-chemical processes, which consists in the participation in them of excited radicals, ions, atoms, and molecules, can be utilized most effectively in chain reactions. In view of the fact that polymerization proceeds by a chain mechanism, there is a natural tendency to utilize radiation for the initiation of this process. Systematic research on the mechanism of radiation-polymerization is being conducted in the USSR under S. S. Medvedev's direction. Both structure formation in polymers and deterioration of polymers under the action of radiation are being studied. The first systematic investigations of the effect of radiation on polymers were carried out in the USSR by V. A. Kargin, P. A. Rebinder, and their collaborators. These investigations were concerned mainly with changes in the thermomechanical properties polymers under the action of radiation.

At present a number of USSR scientists (V. L. Karpov, V. L. Tsetlin, Yu. S. Lazurkin, and others) are conducting different investigations in regard to the action of radiation on polymers.

It is known that aromatic groups stabilized organic compounds to a considerable extent with respect to the action of radiation. This is due to the fact that the energy which accumulates in aromatic groups is not transmitted further along the chain, but is dissipated. Aromatic groups exert this effect in polymers as well as in other compounds. Thus, polymers which contain aromatic rings in the chain are not subjected to radiation vulcanization. Their deterioration under the effect of radiation is very slow.

The practical application of radiation to induce chemical transformations in polymers with the purpose of developing desirable properties in these polymers is in its very beginning. However, one can already mention a number of applications which are very promising, for instance, radiation vulcanization, the development of polymers which are stable to the effects of radiation, the synthesis of graft polymers, and improvement of the heat resistance of polymers. Introduction into polymers of protective substances makes it possible to increase the radiation stability of the polymer. However, in the majority of cases, one cannot yet control the effect of radiation on substances of this class.

Irradiation of solid substances brings about processes resulting in modifications of the chemical composition or of the structure. In crystalline substances, changes in the lattice constants are produced and also displacement of charges, displacement of structural elements from their normal position, and other changes. These processes can be observed because of changes in X-ray diffraction diagrams and alterations in the density and in the mechanical, optical, electrical, and other characteristics of crystals. Heavy particles exert the strongest effect on the characteristics mentioned. Modifications brought about in the characteristics of solids under the effect of radiation must be taken into consideration in connection with the use of structural materials in nuclear technology.

Research on structural changes in solids under the effect of radiation is carried out on a rather extensive scale. The results obtained in work of this type are usually published in physical journals. Very little work on chemical changes in solids subjected to the effect of radiation has been done either in the USSR or outside the USSR.

The chemical changes which develop in solids subjected to the action of radiation frequently remain in a latent state and become evident only when other factors act on the substance. The chemical changes in question may bring about very radical and thoroughgoing modifications in the properties of the solids in question and may even result in the complete destruction of the solid. Such phenomena take place, for instance, as a result of the initiation of chain reactions or processes brought about by scission or the formation of a new bond in very large molecules. But even processes which take place with ordinary yields may have a sharp effect on the specific characteristics of the substances, particularly as far as catalytic and semiconducter properties are concerned, because these properties depend to a very great extent on structural and chemical changes. Solid substances have the capacity of preserving for a long time thermodynamically unstable disturbances of the chemical composition and structure. By letting accumulate such disturbances or defects produced as a result of the action of radiation, one may control some properties of solids. By subjecting the solids to radiation that brings about nuclear reactions, one may introduce into the solid substance microimpurities consisting of neighboring elements. This method of precise dosage of microimpurities may prove effective as a method of modifying in a desired sense the characteristics of catalysts and semiconductors. The changes in properties of solids taking place under the effect of radiation have not yet been studied to a great extent; one may expect that systematic investigation of the phenomena in question will yield valuable results from the scientific and technological standpoint.

Radiochemistry

[For information on radiochemistry, see Items No 8 and 16.]

Organic Chemistry

14. Synthesis and Transformations of Chlorides of Organoboron Compounds

"General Conference of the Department of Chemical Sciences, Academy of Sciences USSR, held 22-23 May 1958" (unsigned article), Moscow, Izvestiya Akademii Nauk SSSR, Otdeleniye Khimicheskikh Nauk, No 11, Nov 58, pp 1399-1401

"A report entitled 'Synthesis and Transformations of the Chlorides of Organoboron Compounds' was presented by V. M. Mikhaylov, Doctor of Chemical Sciences. It was brought out in this report that the esters of organoboron acids react with phosphorus pentachloride, exchanging alkoxyl groups for chlorine atoms. This reaction is a general and simple method for the preparation of chlorides of organoboron compounds. When applied to esters of disubstituted boric acids, this method yields both symmetric and unsymmetric dialkyl and diaryl borochlorides as well as alkylaryl borochlorides. Esters of monosubstituted boric acids form, depending on the proportion of reagents, either esters of alkyl-(aryl) chloroboric aicds or alkyl-(aryl) borodichlorides. The report discussed results of the investigation of chemical properties of different classes of organoboron chlorides, which have become accessible because of the discovery of a simple method for their preparation. The reactions of compounds of this type with water, alcohols, organic acids, organic acid anhydrides, ammonia, and amines were investigated. It was established that the transformations of organoboron chlorides proceed over the stage of the formation of intermediate complex compounds. These transformations are often accompanied by symmetrization. The reactivity of the chlorides depends to a considerable extent on the nature of the organic radicals which enter into their composition and on the composition of the substances with which the chlorides react. The investigation of the reactivity of the chlorides led to the synthesis of different new types of organoboron compounds.

"The report was followed by a lively discussion, in which A. D. Petrov, Corresponding Member of the Academy of Sciences USSR; Academician M. M. Shemyakin; K. M. Gorbunova, Doctor of Chemical Sciences; and others participated. It was noted that organoboron compounds have already found important practical applications, so that work in this field is not only of theoretical but also of practical importance."

Analytical Chemistry

15. A Seminar at Sverdlovsk on the Analytical Chemistry of Dispersed Elements

"A Seminar on the Analytical Chemistry of Dispersed Elements," by V. A. Oshman, Candidate of Chemical Sciences, and K. V. Ogorodnikov; Moscow, Zavodskaya Laboratoriya, Vol 24, No 11, Nov 58, p 1423

"An interoblast seminar on methods for the determination of rare elements was held on 23-28 June 1958 by the Sverdlovsk Division (Otdeleniye) of the All-Union Chemical Society imeni V. I. Mendeleyev, the Ural House of Technology, and other organizations in the City of Sverdlovsk.

"Fifty persons from 27 plants, mines, and research institutes of the oblast participated in the seminar.

"At plenary sessions that were conducted reports were heard on the application of dispersed elements in the national economy and the principal directions in the development of the analytical chemistry of rare and dispersed elements. Reports were also given on present-day methods for the determination of indium, gallium, germanium, selenium, tellurium, and thallium in fuels used for the generation of power, metallurgical and chemical raw materials, and products of the treatment of such materials.

"Furthermore, the participants in the seminar did practical work on the development of new analytical methods at laboratories of scientific research institutes and higher educational institutions.

"The participants in the seminar familiarized themselves with rapid methods for the separation of indium from complex mixtures with the aid of phytic acid combined with a polarographic determination at the end of the procedure, the colorimetric determination of indium with the aid of rhodamine 3 B, the amperometric determination of germanium, the polarographic determination of selenium and tellurium without preliminary separation, iodometric determination selenium and tellurium after their separation with potassium iodide, photocolorimetric determination of selenium and tellurium involving successive precipitation from a nitric acid solution with the application of a copper catalyst, etc."

16. Analysis by the Method of Reflected Beta Radiation

"Analysis of Complex Systems by the Method of Reflection of Beta Radiation," by S. N. Kryukov, B. S. Bokshteyn, T. I. Degal'tseva, and A. A. Zhukhovitskiy, Moscow Steel Institute imeni I. V. Stalin; Moscow, Zavodskaya Laboratoriya, Vol 24, No 11, Nov 58, pp 1305-1308

A method is described for the determination of the heavy component in systems also containing light elements. This method is based on measurement of the reflection of beta radiation. It has been proposed by N. A. Bogdanov and V. F. Funke (cf. Zavodskaya Laboratoriya, Vol 21, No 2, 1955). The basic principle of the method and the technique of applying it are illustrated on the analysis of the system Fe-Mo-W and the determination of the content of iron in iron ores. An equilibrium mixture of Sr^{90} and Y^{90} was used as the source of beta radiation.

Inorganic Chemistry

[For information on inorganic chemistry, see Item No 22.]

Miscellaneous

17. New Chemicotechnological Institute Opened in Karaganda, Kazakh SSR

"New Institute in Karaganda" (unsigned article); Moscow, Promyshlenno-Ekonomicheskaya Gazeta, 17 Oct 58

A new Chemicotechnological Institute (Khimiko-Tekhnologicheskiy Institut), Academy of Sciences Kazakh SSR, has been opened in Karaganda. The main aim of the institute is to develop the problem of the complex utilization of natural resources of Central Kazakhstan. The institute has 26 laboratories with which to conduct this research.

18. Czechoslovak Scientist Visits Hungary -- Gas Analysis Methods Changed

"Czechoslovak Experts Help Hungarian Researchers" (unsigned article); Budapest, Nepszabadsag, 12 Dec 58

Jaroslav Janek, chief of the Gas Chromatography Laboratory of the Czechoslovak Academy of Sciences, was recently the guest of the Hungarian Petroleum and Natural Gas Experimental Institute (Magyar Asvanyolaj es Fold-gazkiserleti Intezet), spending several days in Veszprem after his American and Chinese tours.

On the basis of his suggestions, the institute has changed its work methods. It is replacing its old gas analysis instruments with domestically produced, relatively cheap equipment. Scientific work will be simpler with the new equipment because it will be suitable for the examination of both natural gases and petroleum products.

19. Dissertations of Candidates of Chemical Sciences in Hungary

"Reports of the Scientific Qualifications Committee -- New Candidates, June 1958" (unsigned article); Budapest, Magyar Tudomany, Vol III, No 8-9, Aug-Sep 58

The Scientific Qualifications Committee has qualified the following as noted:

Geza Bodor, Candidate of Chemical Sciences, on the basis of his dissertation titled "The Connection Between the Internal Structure and the Properties of Several Fiber-Forming Polymers"; his opponents were Academician Zoltan Csuros and Peter Szor, Doctor of Chemical Sciences.

Kalman Burger, Candidate of Chemical Sciences, on the basis of his dissertation titled "Toward an Analytic Application of Delta-Positive Halogens" [sic]; his opponents were Zoltan Szabo, Corresponding Member [of the Hungarian Academy of Sciences] and Antal Vegh, Candidate of Chemical Sciences.

Gabor Foldiak, Candidate of Chemical Sciences, on the basis of his dissertation titled "Radiation-Chemical Changes Exerted in the Electric Industry on Hydrocarbons and Insulating Oils as a Result of the Action of Electric Fields"; his opponents were Gyorgy Varsanyi, Candidate of Chemical Sciences, and Laszlo Vajta, Candidate of Chemical Sciences.

Bela Lakatos, Candidate of Chemical Sciences, on the basis of his dissertation titled "A new Method for Calculating the Degree of Polarity of Chemical Bonds"; his opponents were Rezso Gaspar, Doctor of Physical Sciences, and Erno Pungor, Doctor of Chemical Sciences.

III. EARTH SCIENCES

20. Information Theory Used in the Interpretation of Geophysical Investigations

"The Information Theory of the Interpretation of Geophysical Data," by L. A. Khalfin, All-Union Scientific Research Institute of Prospecting Geophysics; Moscow, Doklady Akademii Nauk SSSR, Vol 122, No 6, Oct 58, pp 1007-1010

The information theory of the interpretation of geophysical data is considered. It differs from the general theory of information in that the idea of describing geophysical methods of research as systems of an information observation is the basis of the method. Former works of the author are referred to, namely, a course of lectures given at the Leningrad State University, 1956-1957 (in printing), and Dokl. na sektsii teorii informatsii, works presented at the information theory section at the all-union scientific session dedicated to the Radio Day, Moscow, 1957. Besides the theoretical information approach, the problems considered may be investigated on the basis of the classical theory of statistical estimates. The problem concerning the relation between the theoretical information theory and the theory of statistical estimates is at present, however, not completely solved.

As is known, the problem of interpretation of data of a geophysical method consists of determining according to the geophysical field $\varphi_\rho(r)$ (signal) the corresponding distribution of sources of that field ρ of communication (in the notation $\varphi_\rho(r)$ we designate the variable coordinates of the geophysical field by r). In doing this an inherent difficulty consists in the fact that for the given geophysical field $\varphi_\rho(r)$ reported by ρ it is possible to name only such a characteristic of the sources of that field, which is in one-to-one correspondence (theorem of uniqueness) with the given geophysical field (signal) $\varphi_\rho(r)$:

$$\varphi_\rho(r) \rightleftarrows \rho. \qquad (1)$$

In such a presentation the direct and inverse problems are natually subdivided.

It is evident that the interpretation may be either in squares or analytical. Under the square interpretation the following is understood: the given different ρ_i, are found by solution of the direct problems corresponding to $\varphi_{\rho_i}(r)$, such that tables of sheets divided into squares are obtained in the result:

$$\rho_i \rightarrow \varphi_{\rho_i}(r); \qquad (2)$$

Interpretation then consists in that according to the measuring field $\psi(r)$ the corresponding $\varphi\rho_j(r)$ are found in tables (2) (it is assumed that this is always possible to do if the sheets are sufficiently detailed), and consequently the sought-for ρ_j. In recent times the so-called analytical method of interpretation has been greatly divided. The essence of this method consists of the solution of the inverse problems (in particular of the theory of potential).

21. Developments in the Field of Semiconductor Chemistry in the USSR

"Some Problems of the Chemistry of Semiconductors," by M. P. Luzhnaya, Doctor of Chemical Sciences, and N. A. Goryunova, Candidate of Chemical Sciences; Moscow, Vestnik Akademii Nauk SSSR, Vol 28, No 11, Nov 58, pp 17-21

"During recent years the science of semiconductors has acquired exceptional importance. It is essential for the development of a large number of subdivisions of science and technology. In connection with this, one must regard as natural the close attention which is paid to semiconductors in the project of the Seven-year Plan for the development of the national economy of the USSR (the 1959-1965 plan), the index ('control') figures of which will be discussed at the 21st Congress of the CPSU.

"Further progress in semiconductors technology, which involves the application of new semiconductor materials and further development of the theory of this subdivision of science, is impossible without extensive application of chemistry with its total armamentarium of concepts and methods. There is a need for an intermediate link which would reduce the gap between the physics of the solid state and chemistry. This intermediate link is the chemistry of semiconductors.

"The beginning of a decisive turn of the science of semiconductors toward chemistry occurred in the first years following World War II. At that time physicists established the connection between electrical parameters of germanium and also of silicon that are important from the practical standpoint and the structure of these elements, as well as the type of chemical interaction between atoms in them. The first successful result in this field was the discovery of semiconductor properties in gray tin, which is an analagon of silicon and germanium (A. F. Ioffe, A. I. Blum, N. A. Goryunova).

"Soon a demand for new semiconductor materials arose in radio engineering, automatics, and other fields of technology in addition to the need for their connection with scientific research. As experimental data accumulated, the chemists who were engaged in the investigation of semiconductors began to use in an increasingly purposeful manner concepts on the nature of covalent bonds, crystal-chemical analogies, and ideas of physicochemical analysis which correlate changes in the characteristics of substances with changes in the composition of systems in which these substances are formed. The prediction of the existence of and actual detection of semiconductor properties in binary compounds with

a structure of the zinc blende type conclusively demonstrated the primary importance of physicochemical ideas in research on new semiconductors and that of the consideration of structure and type of electronic interaction between atoms of substances.

"Work along these lines was conducted in the USSR under the direct influence of A. F. Ioffe's ideas. Ioffe expressed in 1950 the idea concerning the decisive role played by the near order (i.e., the chemical nature of the atoms, their arrangement, and the distances between them) in determining the electrical properties of semiconductors. The significance of chemical factors connected with the near order was demonstrated most convincingly in A. R. Regel's work on semiconductors which preserve all typical semiconductor characteristics on melting. This phenomenon could not be explained on the basis of the theory of semiconductors current at the time, which was based on concepts postulating a periodic recurrence of elements of the near order without considering their chemical specificity.

"From a purely formal standpoint the new science, i.e., the chemistry of semiconductors, originated in the USSR at the time when a special section on this subject was instituted at the eighth all-union conference on semiconductors held in 1955 at Leningrad.

"The decisions of the May 1958 Plenary Session of the Central Committee of the CPSU helped chemists working in the field of semiconductors to concentrate their efforts on the solution of the most important theoretical and practical problems in this comparatively new field of science.

"The directions of research in the field of the chemistry of semiconductors have not yet received their final formulation. However, one may already discuss at this stage certain problems which should be solved.

"The development of new fields of technology in which the application of semiconductors appears promising (e.g., high-temperature technology and rocket technology) brings up the problem of finding semiconductors which are capable of functioning at much higher temperatures than germanium and at the same time have a mobility of current carriers, i.e., electrons and holes, which is no lower than that of germanium or silicon. For a number of technical applications, semiconductors are required which have a high electric conductivity and a high thermoelectric motive force combined with a low heat conductivity, substances with a low electrical conductivity and at the same time a high sensitivity to light in the region of long waves, etc.

"A prerequisite for the development of new semiconductors with definite predetermined properties is a thorough understanding of the chemical nature of semiconductors, above all knowledge acquired as a result of the investigation of electron interactions between atoms. Thus, the principal problem in the chemistry of semiconductors is that of the chemical bond.

"Recently, several investigations have been published outside the USSR which deal with problems pertaining to the nature of the chemical bond in semiconductors (H. Krebs, E. Mooser and V. B. Pierson, Ch. H. Goodman, and others). In the USSR research in this field is in its early stages (A. G. Samoyolovich, A. I. Gubanov, Ya., K. Syrkin).

"The available experimental data on the electrical and physicochemical properties of semiconductors (particularly those of the zinc blende type) already form an adequate basis for the formulation of an outline of a qualitative theory. At present, these data suggest that semiconductors are substances with predominantly covalent bonds and saturated valencies. Very valuable direct data on the nature of the distribution of the electron density in semiconductors can be obtained by applying electronography (Z. G. Pinsker), X-ray structural analysis, and X-ray spectroscopy.

"The investigations that have been conducted are not conclusive as far as transitional states in actual semiconductors are concerned. These states are characterized by the presence of a certain degree of ionicity simultaneously with interaction of the covalent type and also a metallization of the chemical bond as well as mutual transitions between different types of chemical bonds.

"Of interest is the problem in regard to the nature of chemical bonds in substances forming molecular lattices or polymer chains (e.g., sulfur and selenium).

"To clarify the role played by directed valencies and by the unequal length of chemical bonds between the same atoms requires investigation of some typical complex compounds, particularly complex compounds representing limiting cases of directed chemical bonds.

"It is obvious that quantum chemistry, the possibilities of which appeared to be exhausted at one time because of the unwieldy natures of the mathematical apparatus involved, will receive a new and powerful impetus for its further development if the qualitative and semiquantitative relationships based on experimental data pertaining to semiconductors will be utilized.

"The properties of semiconductors present in thin layers forming boundaries with other substances are of decisive importance from the standpoint of the application of semiconductors in various instruments and devices. Up to now, processes were investigated which take place

at the boundary between two semiconductors or the boundary between a semiconductor and a metal. Research has been begun on boundaries between semiconductors and gases. Results obtained in this field have demonstrated that there is a significant correlation between a number of the most important properties of semiconductors and the interaction of semiconductors with gaseous media. Investigation of the characteristics of the boundary between semiconductors and liquids, for instance, electrolyte solutions, has made it possible to employ in work on the theory of semiconductors extensive data on electrical phenomena at phase boundaries which have been accumulated in electrochemistry.

"Many electrical characteristics of semiconductors can be changed in the desired sense if the semiconductor material is purified or a controlled quantity of impurities is introduced into it. However, some of the characteristics of this type depend on the nature of the semiconductor itself and for that reason must be regarded as an indigenous parameter of the substance in question. Among these characteristics is the width of the forbidden zone, which determines the maximum permissible operating temperature of the semiconductor in an instrument and thus indicates the limits within which semiconductor materials can be applied.

"Most often practical applications impose requirements as far as combinations of characteristics are concerned rather than individual properties. These combinations of characteristics in turn depend on the nature of the substances used.

"The underlying problem can be solved only by an investigation of the inherent electric and physicochemical properties of semiconductors as well as of relationships pertaining to changes in them depending on the composition. With the aid of such investigations one may formulate concepts in regard to the specific nature of the near order in different crystal-chemical classes of substances. The results of investigations of this type will obviously form a scientific basis for the development of new semiconductors and the formulation of a theory of chemical bonding in them.

"Physicochemical analysis, the principles of which are applicable to the fullest extent to semiconductors, will be an efficient tool in work on the problems mentioned. At the same time, the specific nature of the objects of investigation, related to characteristics traits in the type of electron interaction, will in turn enrich the methods of physicochemical research and expand the possibilities of research of this type. Within individual crystal-chemical groups of semiconductors, one clearly perceives the common nature of constitutional diagrams in these groups. The types of these diagrams change according to definite laws depending on the position of the elements in the periodic system. To construct the diagrams correlating the composition with properties, one can in some cases use newly investigated characteristics (for instance, the position

of the maximum of spectral sensitivity, etc.). These not only make it possible to derive conclusions concerning the nature of the interaction between components, but also give a direct indication in regard to the practical value of the substances being investigated.

"The nature of the chemical bond in semiconductors determined the specific approach to the investigation of semiconductor systems more complex than those consisting of two components. In the investigation of ternary systems of the metallic type, particular attention was paid to the apexes of concentration triangles. Pseudobinary sections proved the most important for the investigation of substances of the semiconductor type in ternary systems. Solid solutions of the substitution type most frequently form along the line of such sections (e.g., the section AlSb-GaSb in the system Al-Ga-Sb). Solutions of this type are of great interest, because their properties can be varied continuously within wide limits. Concentrated research along this line is being conducted outside the USSR (O. Fullbert, G. C. Wooly, etc.). In the USSR research in this field was begun at the Physico-technical Institute and the Institute of Metallurgy imeni A. A. Baykov, Academy of Sciences USSR. This research will be expanded at chemical institutes, primarily the Institute of General and Inorganic Chemistry imeni N. S. Kurnakov, where a Laboratory of Physicochemical Analysis of Semiconductor Substances was organized in 1958.

"Particularly interesting from the standpoint of the nature of the chemical bond are thermochemical investigations of semiconductors. These investigations are capable of giving information on the energy characteristics of bonds. For this reason, a particularly important measure is the organization of the Laboratory of Semiconductor Chemistry at the Institute of Physics and Mathematics, Academy of Sciences Azerbaydzhan SSR. The principal task within the field of activity of this laboratory will be investigation of the thermochemistry of some semiconductors. Of great importance also is the investigation of the mechanical properties of semiconductors. Research of this type will soon be advanced at the Institute of Semiconductors, Academy of Sciences USSR. Investigation of the correlation between the properties of substances and their Debye temperatures will also supplement to a significant extent our concepts in regard to semiconductors.

"One should intensify physicochemical investigation of the properties of semiconductors at high temperatures. From the standpoint of practical application, the investigation of high-melting semiconductors, for instance, titanium dioxide and silicon carbide, is of great importance. Of major scientific and practical importance is the investigation of substances with a spinel structure, viz., a class of semiconductors which have very special properties (G. A. Smolenskiy).

"Many moot points exist as far as the interpretation of results of the physicochemical investigation of semiconductors is concerned. In the first stages of investigations of this type, the method of correlations is very productive. With the aid of this method, it is possible to establish causative relationships between the phenomena involved (V. P. Zhuze).

"The variety of substances which exhibit semiconductor properties is truly unlimited.

"Substances of the type of zinc blende and chalcogenides of elements of the Vth group with chain or laminar structures appear most promising as far as investigation from the theoretical standpoint and from the standpoint of practical applications is concerned. Of great interest is the investigation of solid solutions based on compounds of this type.

"In vitreous semiconductors the far order in the arrangement of atoms is totally absent or has been considerably disturbed. This is similar to the situation with regard to liquid semiconductors. Because of this, the physicochemical analysis of semiconductor materials of this type should yield information of value not only from the standpoint of the solution of the problem of the chemical bond, but also from the standpoint of clarification of conditions underlying vitrification.

"Physical phenomena in semiconductors which are connected with the movement of electrons and the dispersion of electrons depend to a considerable extent on the nature and quantity of impurities, the distribution of these impurities in the volume of the substance, and the degree of perfection of the crystalline structure of the semiconductor. From this standpoint, the development of methods for the production of semiconductor substances of a high degree of purity in the form of perfect single crystals with a homogeneous distribution of the required impurity throughout the whole volume of the substance is of great importance (D. A. Petrov, M. S. Mirgalovskaya). In connection with this complex problem, a number of problems arise some of which are physical and technical and others purely chemical. Among them are those pertaining to the investigation of the physicochemical properties of volatile and complex compounds of substances having semiconductor characteristics, perfection of methods such as extraction, electrolysis, and decomposition, and preparation of substances of very high purity (I. V. Tananayev, A. V. Novoselova).

"These problems bear a close relationship to work in the field of analytical chemistry (I. P. Alimarin), in which the new objects of investigation, viz., semiconductors, require a considerable improvement of available methods for the concentration of impurities and analysis as well as the development of new highly sensitive and very specific reactions for elements which enter as impurities into the composition of

the substances investigated. Specifically, it is necessary to develop methods for the determination of traces of impurities of the order of $1 \times 10^{-9} - 10^{-10}$%. The chemical analysis of semiconductor materials is particularly difficult because elements such as oxygen and hydrogen may also function as microimpurities which affect the properties of the semiconductor. In addition to that, it is necessary to conduct precise determinations of macroquantities of elements present in combinations which are somewhat unusual for practical analytical chemistry. Combinations of this type (e.g., indium-gallium-arsenic or thallium-arsenic-selenium) are encountered in semiconductors of complex composition, the investigation of the properties of which is being conducted on an extensive scale at present.

"Finally, it is of great importance to develop methods for the determination with great precision (of the order of $1 \times 10^{-9} - 10^{-10}$%) of deviations of the composition of semiconductors from the stoichiometric.

"Obviously, special attention must be paid to the development of materials for chemical ware that will be used in analytical work on semiconductors. As far as analysis and purification of chemical reagents for all the operations involved are concerned, this is definitely a still more difficult and complex problem. The problems enumerated above are not the only ones which must be solved in connection with the development of the chemistry of semiconductors. Problems pertaining to the catalytic activity of semiconductors, processes of diffusion in semiconductors, and many other aspects of the behavior and application of semiconductors are being successfully investigated in work accomplished through the joint effort of physicists and chemists in the USSR and outside the USSR. At the Academy of Sciences USSR, the affiliates of the academy, and the academies of sciences of union republics all prerequisites exist, because of the broad nature of the work being done at the institutes, for an advancement of the chemistry of semiconductors, which is an important scientific field of major significance for the development of the new technology."

22. The Seventh All-Union Conference on Luminescence

"The Luminescence of Crystal Phosphors and Its Applications," by V. V. Osiko and M. V. Fok; Moscow, Vestnik Akademii Nauk SSSR, Vol 28, No 11, Nov 58, pp 121-122

"The Seventh All-Union Conference on Luminescence, which was held at Moscow from 26 June to 3 July 1958, was organized by the Physical Institute imeni P. N. Lebedev, Academy of Sciences USSR, and the Scientific Council on Luminescence. It dealt with the luminescence of crystal phosphors and its applications. More than 350 persons from the USSR and some foreign scientists participated in the conference. Approximately 100 reports were presented.

"The greatest number of reports dealt with the luminescence of alkali halide crystal phosphors. Papers by F. D. Klement, I. A. Parfianovich, L. M. Shamovskiy, L. L. Kats, and Ch. B. Lushchik discussed the kinetics of the luminescence of these phosphors, exciton phenomena and ionic processes taking place in them, and the problems to whether the centers of luminescence are distributed in the volume or on the surface. An animated discussion took place on the subject matter of the reports.

"There was a greater number of papers on electroluminescence than at the last conference on crystal phosphors, held at Tartu in 1957. In addition to communications on the mechanism of electroluminescence, such as those presented by E. Nagy of Hungary, V. V. Antonov-Romanovskiy, and others, and on the preparation of electroluminophores (F. M. Pekerman), two reports on practical applications of electroluminescence were presented (I. N. Orlov and others) and a model of two-layer electroluminescence amplifier of images was demonstrated.

"Work on the preparation of single crystals of zinc sulfide (Ye. I. Panasyuk) and results of an investigation of the electroluminescence of these crystals (V. Ye. Oranovskiy and V. T. Fedyushin) were reported for the first time.

"Research on the photoluminescence of zinc sulfide liminophores dealt mainly with the kinetics of luminescence (N. A. Tolstoy and collaborators; P. B. Jaszczyn of Poland; M. V. Fok; K. S. K. Rebane; F. I. Vergunas; and others).

"The papers by F. I. Vergunas and her collaborators were subjected to sharp criticism, particularly because the motion of holes in the crystal lattice of luminosphores was not considered in their work.

"Several communications were concerned with scintillation phenomena and cathodic luminescence.

"One notices the decreased number of investigations on the nature of luminescence centers in zinc sulfide luminophores. This does not by any means indicate reduced interest in the subject; it is merely indicative of the complexity of the problem involved and a more serious approach to it. The new approach was expressed in a tendency to take into consideration certain factors of a chemical and physicochemical nature, including those pertaining to the structure and mechanism of the formation of the basis of the luminophores, processes of the interaction of the luminophore with the gas phase, interaction of the basis with the flux, and several others. It is becoming obvious at present that without a preliminary consideration of these factors a correct interpretation cannot be given of luminescence characteristics and of the structure of luminescence centers in zinc sulfide luminophores.

"A great number of reports was concerned with the synthesis of new luminophores and the improvement of the synthesis of luminophores that are already known. To give an example, N. A. Gorbacheva synthesized fluorophosphate luminophores of a new type and Yu. S. Leonov prepared mixed tungstates activated with uranium. In addition to being of use from a purely practical, applied standpoint, some of these luminophores are of considerable theoretical interest. It is sufficient to mention work done by M. Yu. Alsalu, who discovered that strontium metaantimonate containing manganese emits a blue luminescence which is unusual for manganese.

"An increasing thoroughness in subjecting to many-sided investigation correlations between luminescence characteristics and the chemical and physicochemical properties of luminophores was apparent. The papers which were given indicated that their authors did not limit themselves to correlating the luminescence characteristics with the chemical composition of the luminophore: the phase composition of the luminophores and the composition and structure of the luminescent phases were also studied.

"Present-day chemcial and physicochemical methods of analysis are being employed to an increasing extent. This applies particularly to the methods of thermographic and X-ray analysis. For instance, thermographic analysis was applied for the first time in the investigation of zinc sulfide luminophores (Ye. G. Vasil'yeva and S. A. Fridman).

"Notwithstanding the extensive range of problems covered by the reports, the discussion on some problems indicated that work on applications is not being conducted to a sufficient extent, particularly as far as the synthesis of luminescent compositions with a prolonged activity is concerned. One must also note that not all types of luminophores which are of practical importance have been investigated from a theoretical standpoint; this refers particularly to luminophores used in /fluorescent/ lamps.

23. Chemical Demineralization of Water

"Application of Chemical Demineralization of Water in Thermal Engineering," by F. G. Prokhorov, Moscow, Teploenergetika, No 12, Dec 58, pp 3-12

CPYRGHT

The article contains the following passages:

"On the basis of experience obtained, it can be stated that chemical demineralization will safely permit obtaining suitable feed water in any quantity for steam boilers of any rated pressure and design, and regulation of the temperature of superheated steam in drum-type boilers by injecting feed water from the general main. Such a conclusion is based not only on the analysis of demineralized water, but also on more than 3 years of operating experience of GRES-19 Mosenergo (180 atm) drum-type boilers and on a successful 4-month exploitation of the TETs-9 Mosenergo (140 atm) uniflow separatorless boiler with an addition of up to 40% of demineralized water.

"Chemical demineralization of feed water sometimes can be replaced by the method of 'removal of silicon dioxide with calcium and magnesium oxides, followed by two-stage Na-cationization,' when capital investment for a chemical demineralization installation is much higher than that of a magnesium silicon-removal installation.

"One of the hindrances to wider utilization of chemical demineralization of water is the unreasonably high market price of anion-exchange reagents and the restricted volume of their production.

"Anticipating the extensive development of the chemical industry in accordance with the resolutions of the 20th Congress of the CPSU, especially in the field of plastic materials, Gosplan USSR should reconsider the previously proposed plan for manufacture of ion-exchange resins in such a manner as to be able to satisfy the needs of principal consumers of such materials, appreciably lower the production cost, expand their grade assortment, and organize the manufacture of new, more efficient grades. Only by fulfilling these conditions can the power-generation development plan, which calls for putting into operation 80-100 demineralization installations, be successfully and economically carried out. Only by the combined efforts of chemists-power engineers and chemists engaged in the development and production of ion-exchange resins can the problems connected with wide utilization of these materials in various branches of industry be solved."

24. Algorithms Described by New Method

"On Operator Algorithms," by A. P. Yershov, Computer Center, Academy of Sciences USSR; Moscow, Doklady Akademii Nauk SSSR, Vol 122, No 6, Oct 58, pp 967-970

A new method for the formal description of algorithms is presented, on the basis of which, in the opinion of the author, it is possible to develop a mathematical formalism for the solution of a series of problems of theoretical programing. In connection with this, the concept of an operator algorithm is defined and the relation between operator algorithms and partially recurrent functions and normal algorithms is established.

Each concrete class of operator algorithms is constructed proceeding from a certain potentially infinite set V of variables and a certain list S of operations. A variable is expressed by words in a particular alphabet. For each variable $x \in V$ all the constructional objects which may become values of the variable x are described. Each k-place (k greater than zero) operation is expressed by the words $A_0 (\ ) A_1 (\ ) \ldots (\ ) A_k$, where $A_0, A_1, \ldots, A_k$ are words in a particular alphabet. The i-th pair of parentheses from the left is called the i-th place operation of $A_0 (\ ) A_1 (\ ) \ldots (\ ) A_k$. Each k-place operation gives, for particular collections of constructional objects $\mu_1, \ldots, \mu_k$, an effective method of obtaining a new constructional object ν called resultant application of the operation to the collection of constructional objects, $\mu_1, \ldots, \mu_k$. The result of applying the operations $A_0 (\ ) A_1 (\ ) \ldots (\ ) A_k$ to the collection $\mu_1, \ldots, \mu_k$ will be designated by $A_0 (\mu_1) A_1 (\mu_2) \ldots (\mu_k) A_k$.

After this introduction, the following notions were defined by inductions: an expression, argument of the expression, and the value of the expression for given values of the arguments.

25. Functional Equations and Continuous Analogs of Iteration Methods

"Nonlinear Functional Equations and Continuous Analogs of Iteration Methods," by M. K. Gavurin, Leningrad State University imeni A. A. Zhdanov; Kazan', Izvestiya Vysshikh Uchebnykh Zavedeniy Matematika, No 5 (6), Sep/Oct 58, pp 18-31

In the first part of the work a group of methods is considered in which the finding of a solution of a functional equation is accomplished by means of solving a Cauchy problem for a particular abstract differential equation on an infinite interval.

Theorems of existence, valid for weaker assumptions, are presented in the second part. However, the proofs employed there do have a constructive character. In the second part there is also presented a certain theorem concerning the uniqueness of a root.

26. Approximate Solution of a Polyharmonic Problem

"Concerning the Approximate Solution of a Polyharmonic Problem," by A. F. Zolin, Institute of Mathematics and Mechanics imeni V. I. Romanovskiy, Academy of Sciences Uzbek SSR; Moscow, Doklady Akademii Nauk SSSR, Vol 122, No 6, Oct 58, pp 971-973

The fundamental boundary value problem for the equation

$$\Delta^p U = \sum_{\substack{\alpha,\beta = 0,p \\ \alpha+\beta = p}} p!/\alpha!\,\beta!\,\frac{\partial^{2p} U}{\partial x^{2\alpha}\,\partial y^{2\beta}} = 0. \qquad (1)$$

is approximately solved. The function U, keeping in mind the equation (1) must satisfy the conditions

$$U\big|_\Gamma = f_0(s),\ \partial U/\partial\gamma\big|_\Gamma = f_1(s),\ldots,\ \partial^{p-1} U/\partial\gamma^{p-1}\big|_\Gamma = f_{p-1}(s),$$

where $f_0, f_1,\ldots, f_{p-1}$ are given continuous on the boundary Γ of a given simply connected region Ω of the function; γ is the direction of the upper normal to Γ.

It was assumed that the boundary Γ consists of a finite number of piecewise continuous curves.

27. Galerkin Method Employed for Ordinary Differential Equations

"Concerning the Rapidity of Convergence of the Galerkin Method for Ordinary Differential Equations," by I. K. Daugavet, Leningrad State University imeni A. A. Zhdanov; Kazan', Izvestiya Vysshikh Uchebnykh Zavedeniy Matematika, No 5 (6), Sep/Oct 58, pp 158-165

The boundary value problem

$$(1)\quad Lx = d^{2k}/dt^{2k}\,x + \lambda\left[\alpha_1(t)\,d^{2k-1}/dt^{2k-1}\,x + \ldots + \alpha_{2k}(t)\,x\right] = y(t),$$

$$(2)\quad \begin{cases} x(-1) = x'(1) = \ldots = x^{(k-1)}(-1) = 0 \\ x(1) = x'(1) = \ldots = x^{(k-1)}(1) = 0. \end{cases}$$

The method of Galerkin is employed for the solution of this problem with algebraic coordinate functions, i.e., the "approximate solution" of $x_n(t)$ has the form

$$x_n(t) = \sum_{i=0}^{n} c_i \varphi_i(t); \quad \varphi_i(t) = (1-t^2)^k t^i,$$

and the coefficients c_i are found from the conditions

$$(3) \qquad \int_{-1}^{+1} L\, x_n \cdot \varphi_i(t)\, dt = \int_{-1}^{+1} y(t)\, \varphi_i(t)\, dt \qquad (i=0, 1, \ldots, n).$$

The purpose of the present work is to study how fast the "approximating solutions" $x_n(t)$ converge to the exact solution $x^*(t)$ with increasing n and the dependence on the properties of the "exact" solution. While doing this the question concerning uniform convergence of the functions $x_n(t)$ as well as of their derivatives up to and including those of order k is investigated. The basic results are contained in the following two theorems:

Theorem 1: Let the problem (1)-(2) not have λ as a proper value, the coefficients $\alpha_i(t)$ of the equation (1) be sufficiently smooth, $x^*(t)$ be the solution of the problem (1)-(2), and $x_n(t)$ be the "approximating solutions" found according to the method of Galerkin. Then for $t \in [-1, +1]$ the following estimates hold:

$$\left| d^s/dt^s \left[x^*(t) - x_n(t) \right] \right| \leq C E_n^{(s)}(x^*)\, n^{k-s-3/2}, \quad 0 \leq s \leq k-3,$$

$$\left| d^s/dt^s \left[x^*(t) - x_n(t) \right] \right| \leq C E_n(s)\, (x^*) \sqrt{n}\, \ln n, \quad s=k-2,\ k-1,\ k,$$

where $E_n^{(s)}(x^*) = \inf_{Q_n} \sup_{-1 \leq t \leq 1} \left| d^s/dt^s \left[x^*(t) - (1-t^2)^k Q_n(t) \right] \right|$

and inf is taken according to all polynomials $Q_n(t)$ of degree not greater than n.

For an estimate of the quantity $E_n^{(s)}(x^*)$ it is possible to apply the results of I. Yu. Kharrik (dissertation, Leningrad State University, 1953, "On the Approximation of a Function Vanishing on the Boundary of a Region by Functions of General Form") obtained for a significantly more general problem.

Then the following theorem is obtained:

If under the conditions of the former theorem the solution $x^*(t)$ of the problem (1)-(2) is r-times differentiable and continuous and satisfies the Lipshitz condition of order α, then the following estimates are valid:

$$\left| d^s/dt^s \left[x^*(t) - x_n(t)\right] \right| \leq \begin{cases} \dfrac{C}{n^{r-k+\alpha+3/2}}, & 0 \leq s \leq k-3, \\ \dfrac{C \ln n}{n^{r-s+\alpha-1/2}}, & s=k-2,\ k-1,\ k. \end{cases}$$

28. Linear Processes of the Approximation of Functions

"Linear Processes of the Approximation of Functions, Satisfying the Lipschitz Condition, by Algebraic Polynomials," by I. M. Ganzburg and A. F. Timan; Moscow, Izvestiya Akademii Nauk SSSR Seriya Matematicheskaya, Vol 22, No 6, Nov-Dec 58, pp 771-810

The approximating properties of linear processes of the approximation of functions, satisfying the Lipshitz condition, by algebraic polynomials are investigated.

29. Limit Theorems for Markov Chains

"Limit Theorems for Markov Chains With a Finite Number of States," by L. D. Meshalkin; Moscow, Teoriya Veroyatnostey i yeye Primeneniya, Vol 3, No 4, 1958, pp 361-385

An abstract of the above article follows:

Consider the scheme of trial sequences

$$\begin{array}{l} \gamma_{11} \\ \gamma_{21},\ \gamma_{22} \\ \cdots \\ \gamma_{n1},\ \gamma_{n2},\ \cdots,\ \gamma_{nn} \\ \cdots\cdots\cdots\cdots \end{array}$$

The sequence ξ_{nk} $(k = \overline{1,n})$ is a uniform Markov chain with a finite number of states $E_1 \ldots E_s$ and a given matrix of transition probabilities

$$P = P(n) = \| p_{uv}(n) \|_{u,v=1}^{s}$$

Let $\alpha = \alpha(n)$ denote the number of passages up in the n-th sequence of trials of the system through E_1 on condition that the system is in state E_1 at the initial (or zeroth time). We consider the limit distribution for a sequence of random variables

$$\beta(\alpha - n\theta), \quad \beta = \beta(n); \ \theta = \theta(n).$$

Theorems 1-5 give characteristic functions for some possible limit distributions.

The main results of this paper is theorem 6:

If the limit distribution for $\beta\,(a - n\theta)$ exists, then it does not differ from one of those found in theorems 1-5 by more than a linear transform.

30. Simplest Problem of the Calculus of Variations Discussed

"On the Semiconductivity and Absolute Minimum in the Simplest Problem of the Calculus of Variations," by A. Kh. Khashayev, Ufa; Moscow, Matematicheskiy Sbornik, Vol 45 (87), No 4, 1958, pp 423-432

J. L. Tonelli, in his work which was contained in Fondamenti di calcolo delle variazioni, Bologna, 1921-1923, proved the following theorem concerning a sufficient condition for the existence of an absolute minimum for the simplest problem of the calculus of variations using a long and complicated argument:

If $f(x, y, y')$ is a continuous function with partial derivatives up to and including the second order according to all three arguments, x, y, and y', varying respectively in the intervals $[a, b]$, $(-\infty, +\infty)$, and $(-\infty, +\infty)$, and satisfies the conditions:

$f(x, y, y') \geq \alpha y'^2 - \beta$, where α and β are positive constants, and

$$f''_{y'^2}(x, y, y') \geq 0,$$

then the absolute minimum of the functional

$$I(y) = \int_a^b f(x, y, y')\, dx \text{ exists.}$$

The present work demonstrated that this theorem could be proved without the supplementary condition concerning the existence and continuity of the partial derivatives of the function f (x, y, y').

31. Solution for Degenerate Hypergeometric Function Given

"Asymptotic Expression for a Degenerate Hypergeometric Function," by V. M. Artyunyan, R. M. Muradyan, and A. A. Sokolov, Moscow State University imeni M. V. Lomonosov; Moscow, Doklady Akademii Nauk SSSR, Vol 122, No 5, 11 Oct 58, pp 751-754

The asymptotic behavior of solutions for differential equations of the form

$$u'' + f(x)\, u = 0,$$

where f(x) is a function of one or several parameters, is studied by constructing the so-called "close function." The technique is based on the assumption that differential equations that are approximately the same for all x must have approximately the same solutions. A method for constructing the equation is given and the results are applied to find asymptotic formulas for the degenerate hypergeometric function given by Whittaker

$$\frac{d^2W}{dx^2} + \left[-\frac{1}{4} + \frac{\lambda}{x} \quad \frac{(1/4) - \mu^2}{x^2} \right] W = 0.$$

It is noted that the Hermite and Langer polynomials and Bessel functions are particular cases of this function.

VII. MEDICINE

Bacteriology

32. Culturing Cholera Vibrio in Guinea Pig Intestines

"Culturing of Cholera Vibrio in the Small Intestines of Guinea Pigs," by A. G. Nikonov, V. I. Yevseyeva, P. D. Bibikova, and K. G. Bichul', Rostov-na-Donu Scientific Research Antiplague Institute; Moscow, Zhurnal Mikrobiologii, Epidemiologii i Immunobiologii, Vol 29, No 12, Dec 58, pp 51-53

On the basis of observations that the increase in the virulence of cholera vibrio cultured by the usual methods is unstable and inadequate for vaccine preparation, the authors attempted to pass this pathogen through the small intestines of guinea pigs and to dry it subsequently in the intestinal contents. Results of testing virulence of vaccine strains 11 and 16, prepared by the usual method (culturing in the peritoneal cavity of guinea pigs), are compared in tabular form. Results of the authors' experiments are given in detail in the text and presented in a table. Conclusions based on these results are as follows:

"1. Culturing cholera vibrio in isolated loops of small intestines of guinea pigs increased virulence to a great extent in comparison with passage in the peritoneal cavity. The virulence reached a Dcl of one billion in half the strains passed.

"2. Drying the strains in the contents of isolated sections of small intestine stabilized the virulence attained by passage for a long time."

It is stated that strains 11, 16, and 143 maintained virulence after 5-7 months of preservation in a dried form (Dcl equal to one billion), and that after one year and 5 months virulence was maintained at the same level in strain 16 and was decreased in the other two strains. The same increase in virulence was not observed in all strains -- in strain 140, 325-1-B, the Dcl was never lower than 4 billion.

Epidemiology

33. Brucellosis in the Altay Mountains

"Certain Peculiarities of Brucellosis in the Altay Mountains," by V. M. Lyubushkina, Gornoaltayskaya Oblast Sanitary-Epidemiological Station; Moscow, Zhurnal Mikrobiologii, Epidemiologii i Immunobiologii, Vol 29, No 11, Nov 58, p 116

"While selecting groups for inoculation against brucellosis in 1956 and the beginning of 1957, we were confronted with an interesting fact in Gornoaltayskaya Oblast which obliged us to occupy ourselves more intensively with the problem of the characteristic course of brucellosis under local conditions.

"Our observations encompassed 8 villages (45 animal husbandry farms) threatened with brucellosis abortus, including 8 kolkhozes of Kosh-Agachskiy village, which was also threatened with brucellosis melitensis. A total of 5,059 persons in all were examined, of whom 1,037, or 20.5%, reacted positively to laboratory diagnostic tests. At the same time, 84 persons, or 1.6% were discovered to be clinically ill with brucellosis.

"So, for example, 33.6% of persons examined in Ulaganskiy village reacted positively, whereas clinical manifestations were present in only 1.1%. Results were as follows on individual farms in the aforementioned village: 38.3% of the population reacted positively in the Kirov kolkhoz; 25.7% in 'Pogranichnik' kolkhoz, and 25% in 'Pobeda' kolkhoz in the absence of clinically evident brucellosis. In Mayminskiy village, 30.9% reacted positively in the presence of clinical manifestations in 0.6% of the persons examined. The greatest number of persons who reacted positively to brucellin were in Kosh-Agachskiy village -- 54.4% in the presence of only 1.8% patients.

"In the presence of considerable variation in the percent of positively reacting persons and the percent of persons with clinical manifestations of brucellosis both in individual villages and on separate farms of the same village, the relationship of indexes maintained its characteristics so that the percentage of positively reacting persons considerably exceeded the percentage of persons with clinical manifestations of brucellosis.

"There has been no epidemic outbreak of brucellosis in the oblast for a number of years. In the oblast as a whole (8 villages), the percent of positively reacting persons was 20.5 with clinical manifestations in 1.6% of the persons examined.

"Thus, the results of the investigation indicate a wide distribution of brucellosis in the Altay Mountains and a predominance of brucellosis abortus foci."

34. Complement Fixation Test for Survey of Inapparent B Encephalitis in China

"Use of Complement Fixation Test in Surveys of Inapparent Japanese Encephalitis in Humans and Animals," by Wang Tse (汪 澤) and Chang Sung-shan (張嵩善), Virus Laboratory, Honan Health and Antiepidemic Station, Peiping, Wei-sheng-wu Hsueh-pao (Acta Microbiologica Sinica), Vol 6, No 4, 1958, pp 442-446

This item presents experiments undertaken in 1957 to re-examine the practicability of the complement fixation test in epidemiologic surveys of inapparent Japanese B encephalitis.

The authors state that Chinese epidemiologists in Shanghai had previously concluded that inapparent infection of B-type encephalitis was difficult to detect by the complement fixation test. However, Hammon and others (1948 and 1947) hold that any fixation of the complement would indicate infection occurring within the past year since B encephalitis antibodies do not remain in the serum longer than a year. From the results of their experiments, summarized below, the authors conclude that the complement fixation test could be used to detect recent inapparent B-encephalitis infection.

Seventy-four healthy patients who had contact with patients suffering with B encephalitis during the 1957 epidemic in Cheng-chou were given the complement fixation test. Thirty-nine were positive in titers of 1:2-1:64, while 3 demonstrated the presence of anticomplement. Twenty-four other healthy persons residing in the same area but with no contact with the patients were likewise tested. Only four were positive. Healthy domestic animals chosen at random from the epidemic area demonstrated by the complement fixation test that they had had recent latent infection in rates as follow: 10/11 cattle, 11/26 hogs, 17/25 sheep, and 5/26 goats.

Since 1952, 32 municipalities in China have conducted surveys of latent B-encephalitis infection in humans by using the neutralization test which calls for the use of large numbers of experimental animals and relatively precise laboratory equipment, according to the authors.

35. Tularemia From Handling Game in East Germany

"Tularemia Infection Originating at a Game Dealer's," by H. Mochmann, Institute of Hygiene, University of Rostock; Berlin, Das Deutsche Gesundheitswesen, No 47, 20 Nov 58, pp 1532-1533

Since 1952 a total of 98 cases of tularemia have been diagnosed serologically in humans in Mecklenburg. Most of the cases were among rural people who had come in contact with diseased wild hares. Since 1945 tularemia has been endemic in Mecklenburg.

In January 1958 two new cases of tularemia were diagnosed. The two patients were an elderly married couple who live in Berlin, and who had skinned, cleaned, and eaten an undressed hare purchased at a game dealer's. The area where the hare had originally been taken could not be ascertained.

The case of the elderly Berlin couple is pointed out as an example of the fact that tularemia should not be considered a disease confined to rural areas, but one which could become epidemic among an urban population.

Immunology and Therapy

36. Allergic Reactions Following Tick Bites After Inoculation Against Tularemia

"Two Cases of Allergic Reaction in Persons Inoculated Against Tularemia Caused by the Bites of Infected Rhipicephalus rossicus Ticks," by V. P. Borodin, A. P. Samsonova, and A. P. Koroleva, Stalingradskaya Oblast Sanitary-Epidemiological Station; Moscow, Zhurnal Mikrobiologii, Epidemiologii i Immunobiologii, Vol 29, No 11, Nov 58, pp 117-118

This article reports two unusual instances of allergic reaction after persons with inoculation immunity to tularemia were bitten by infected ticks. Both individuals worked in a tularemia focus of the marsh-steppe type, collecting ticks. The reactions in both persons, who had been inoculated 4 and 6 years previously with live tularemia vaccine, are described in detail. Conclusions based on the results of observations and tests are as follows:

"1. Local allergic reactions were observed in two persons inoculated with tularemia vaccine and bitten by Rh. rossicus ticks infected with the tularemia pathogen; the reactions were of the positive intensive tularin test type (observed in tularemia patients and persons who have recovered from tularemia) accompanied by a slightly increased temperature.

"2. The isolation of a highly virulent culture of the tularemia pathogen in a marsh-steppe type focus from Rh. rossicus ticks removed from the inoculated persons substantiated their active carrying of the tularemia pathogen and the possibility of infecting nonimmunized persons with the aforementioned disease.

"3. The presence of an allergic reaction in persons inoculated with live tularemia vaccine at the site of a bite by infected Rh. rossicus ticks substantiates their high resistance to tularemia."

Pharmacology and Toxicology

37. Acetylcholine-Cholinesterase Changes in Blood and Plasma Studied

"Mediator System of Acetylcholine-Cholinesterase in Acute Poisoning by Dichloro Ethane," by M. P. Slyusar', Vopr. Gigieny Truda i Profzabolevaniy v Gornorudn., Khim. i Mashinostroit. Prom-sti. (Problems of Labor Hygiene and Occupational Diseases in Mining, Chemistry, and Machine Construction Industry), Kiev, Gosmedizdat, Ukrainian SSR, 1958, 92-100 (from Referativnyy Zhurnal -- Khimiya, Biologicheskaya Khimiya, No 22, 25 Nov 58, Abstract No 28700)

"Acute poisoning was produced within 4 hours in white rats by the administration of dichloro ethane at 10 mg/liter concentration. The animals were sacrificed after a 16- to 18-hour period, and determinations were made of the blood and tissue activity of cholinesterase and of acetylcholine content. It was shown that acute poisoning brought about decreased cholinesterase activity in the blood serum and plasma by 43 and 23%, respectively, during the light narcosis stage and by 37 and 23% during the 'aftereffect' phase. Acetylcholine appeared in the blood. Decreased cholinesterase activity was also evident in the tissues of the brain and spinal cord (16.4 and 16.7%), liver (27.8%), pancreas (20.3%), heart (29%), and pyloric part of the stomach (31.2%).

38. The Effect of Echinopsine on the Permeability of Blood and Lymph Capillaries

"The Effect of Echinopsine on the Permeability of Blood and Lymph Capillaries," by Chzhu Shoypen, Uch. Zap. 2-y Mosk. Med. in-t (Scientific Reports of the Second Moscow Medical Institute), 1957, 6, 99-103 (from Referativnyy Zhurnal -- Khimiya, Biologicheskaya Khimiya, No 22, 25 Nov 58, Abstract No 29981)

"Echinopsine decreased the rate of absorption of Na^{24} Cl from subcutaneous cellular tissue into the blood, and its transfer from the blood stream into tissues. The phenomenon may be connected with decreased membrane permeability or with retardation of blood flow due to the hypotensive effect of echinopsine. Echinopsine did not change the permeability of lymph capillaries with respect to protein-I^{131}."

39. "Nanofin" Effect on S^{35}-Methionine Inclusion into Proteins

"The Effect of Nanofin on the Inclusion of S^{35}-Methionine Into the Proteins of the Brain and Heart of Albino Rats," by I. G. Zhakov, Uch. Zap. 2-i Mosk. Med. in-t, (Scientific Reports of the Second Moscow Medical Institute), 1957, 6, 49-52 (from Referativnyy Zhurnal -- Khimiya, Biologicheskaya Khimiya, No 22, 25 Nov 58, Abstract No 29872)

"After the intrasmuscular introduction into white rats of 5 mg/kg of the ganglion blocking substance 'nanofin,' the rate of inclusion of S^{35}-methionine in the proteins of the brain and of the heart was increased. This was effected chiefly by the rise in the concentration of S^{35} in the tissues of these organs. After the intramuscular administration of 10 mg/kg of 'nanofin,' the inclusion of S^{35}-methionine in the proteins of the brain and heart lagged behind the concentration of S^{35} in the tissue. This is probably connected with decreased protein metabolism in the brain and heart after a large dose of 'nanofin.'"

40. Changes in Iodine-Reducing Compounds During Drug-Induced Sleep

"Concerning the Dynamics of Iodine-Reducing (Sulfhydryl) Compounds in the Blood Under Conditions of Drug-Induced Sleep (Materials Contributing to the Biochemistry of Blood During Sleep Inhibition," by I. S. Roizman, Nauchn. Tr. Vinnitsk. Gos Med. in-ta, (Scientific Works of the Vinnitsa State Medical Institute), 1957, 8, 64-77 (from Referativnyy Zhurnal--Khimiya, Biologicheskaya Khimiya, No 22, 25 Nov 58, Abstract No 29779)

"After various types of drug-induced sleep (ether, chloral hydrate, urethane, amytal, and pentothal) it was observed that the concentration of iodine-reducing compounds was increased in the blood during the period of sleep and was decreased after the period of sleep. Sleep induced by chloroform produced an insignificant decrease in the content of iodine-reducing compounds during sleep and a slight increase after sleep. Data are presented concerning changes in oxidized and reduced forms of iodine-reducing compounds."

41. Morphine-Induced Shock

"Clinicophysiological and Hematological Characteristics of Morphine Shock," by V. K. Ionova; Alma-Ata, Izvestiya Akademii Nauk Kazakhskoy SSR (Seriya Meditsiny i Fiziologii), Vol 1 (9). 1958, pp 55-58

The aim of this research was to study a new form of toxic shock -- morphine-induced -- to establish the peculiarities of this pathological process arising after the intravenous administration of morphine to dogs and to study the clinical symptoms and hematological changes ensuing.

Tests were conducted on 50 dogs which received a 1% solution of morphine at the rate of 0.1-1.0 ml per kg of body weight.

Immediately after the administration of a dose of 0.5-1.0 ml per kg, there was, in most cases, an immediate state of excessive stimulation of the vegetative system, increased blood pressure, and accelerated pulse rate. This state appeared 15 seconds after morphine administration and lasted for 60 seconds. This condition was followed by general inhibition, complete loss of sensitivity to pain, and acute or complete loss of reaction to reflex stimulation. In 40-60 minutes the animals began to react to strong sound stimulation, and in 1-3 hours they were able to move.

Blood pressure in all instances was lowered (down to 15-30 mm Hg) starting 1-3 minutes after morphine administration. Body temperature decreased within 10 minutes and remained low during the second day.

The process of blood coagulation was delayed within a few minutes and this lasted for an hour, but in some instances the blood lost its coagulation capacity. Blood serum complement activity was diminished in all cases. Erythrocyte sedimentation rate was protracted, the erythrocyte count rose by 0.5-2.0 million per mm^3, and hemoglobin rose by 5-10%. The two latter changes became evident within a few minutes and were most pronounced 30 minutes after morphine administration. During this same period the leukocyte count dropped temporarily to 1,000 per mm^3, giving rise to leukopenia of the neutropenic type.

Morphine used in smaller doses (0.1-0.5) did not exert very distinct effects.

The author concludes that the intravenous administration of a 1% solution of morphine at the rate of 0.5-1.0 ml per kg of body weight which causes decreased blood pressure, weakened respiration, accelerated pulse, decreased reflex stimulation, lowered body temperature, delayed blood coagulation, decreased leukocyte count, decreased serum complement titer, delayed rate of erythrocyte sedimentation, increased hemoglobin percent, and increased number of erythrocytes produces a symptom complex similar to the symptom complex of shock.

Physiology

42. Effects of Ultrasound on Gastric Functions

"Effect of Ultrasound on the Secretory and Motor Function of the Stomach (Experimental Investigation)," by M. K. Smirnov (Minsk), Voprosy Kurortologii, Fizioterapii, i Lechebnoy Fizicheskoy Kul'tury, No 6, Nov-Dec 58, pp 512-519

The effect of ultrasound on the function of the stomach is dependent primarily on the intensity of the ultrasound, the functional condition of the gastric glands and muscles, and whether exposure is before, during, or after a meal. Ultrasound even of low intensity (0.6 W/cm^2) stimulates gastric secretion if no food has been introduced into the stomach. Ultrasound of any intensity causes an increase in the amount of gastric juice in the stomach and in the acidity of this gastric juice. This lasts for a period of 3 days irrespective of whether food is eaten or not. Ultrasound shortens the intervals between contractions of the stomach and increases its tonus. A total of 94 experiments were conducted on three dogs.

Public Health, Hygiene, and Sanitation

43. More Sanitary Physicians To Be Trained

"The Status and Outlook for Training and Advanced Training of Sanitary Physicians," by Docent V. V. Yermakov and M. G. Savchenko, Sovetskoye Zdravookhraneniye, No 10, Oct 58, pp 7-10

"The 20th Congress of the Communist Party of the Soviet Union clearly defined the aims of public health protection in the USSR. Continued expansion of health service and further improvement in the level of preventive medical work and general medical service was declared to be necessary."

It is expected that training sufficient numbers of qualified sanitary physicians will solve the problems with which health officials are confronted. The medical universities of the country graduated 8,900 sanitary physicians during the Fifth Five-Year Plan (1951-1955). It is expected that 13,700 more sanitary physicians will be graduated by the end of the Sixth Five-Year Plan. More than 10,000 sanitary physicians will be graduated during the period between 1961 and 1965. "This will satisfy the needs of the Soviet population as far as sanitary-epidemic control is concerned."

"At present the sanitary-epidemic control establishments still need medical personnel specializing in hygiene and sanitation. A great shortage of specialists in epidemiology and communal and industrial hygiene exists. This shortage is particularly great in the Kazakh, Turkmen, Kirghiz, and Tadzhik SSRs. For this reason it is necessary that those in charge of public health in those republics give their utmost attention to training qualified personnel specialized in epidemic control."

"Sanitary physicians are being trained at present in 19 sanitary-hygiene faculties of medical universities of the USSR. This training is conducted in accordance with the plan formulated and approved by the administration of personnel and educational institutions of the Ministry of Health USSR."

"There is a shortage of people with the degree of Doctor of Sciences. People with Doctor of Sciences degrees are needed to occupy the chairs of hygiene in medical universities and institutes for advanced training of physicians. Of 175 heads of chairs of hygiene and sanitation in the medical universities and institutes for advanced study of physicians of the Ministry of Health RSFSR, 89 have a degree of Doctor of Medical Sciences and 78 have a degree of Candidate of Medical Sciences. Of the 89 with Doctor of Medical Sciences degrees, 47 are over 60 years of age and of the 78 with Candidate of Medical Sciences degrees, 46 are over 50 years of age."

44. Tissue Therapy Alleviates Injurious Effects of Radiation Sickness

"The Effect of Tissue Therapy on the Morphological Composition of the Blood of Rabbits Subjected to Total X-ray Irradiation," by D. Baldandorzh, Chair of Pharmacology (head, Prof S. V. Tsyganov) and Chair of Roentgenology and Radiology (head, Prof Ye. D. Dybovyy), Odessa Medical Institute; Kiev, Vrachebnoye Delo, No 10, Oct 58, pp 1073-1076

Since one of the most apparent injuries in radiation sickness is injury to the hemopoietic organs, the present research attempted to verify whether or not tissue therapy would have any favorable effect on the morphological composition of the blood.

Tests were conducted on 75 rabbits divided into three groups: those subjected to single total X-ray irradiation by 620 r followed by daily subcutaneous treatment with an aloe extract (0.5-0.8 ml of aloe extract) for 17-20 days; those irradiated and treated by a single treatment utilizing preserved tissue therapy; and control animals irradiated but not treated.

Results indicate that the viability was greater in the two experimental groups (16 and 17 animals, compared with 10 controls), loss of weight was less and its return to normal was speedier (weight of experimental animals returned to normal by the 45th day at which time that of the controls was 86% of the original), and maximu fall in the number of leukocytes occurred on the 4th day in the experimental animals after which it began to rise, while in the controls it continued to drop until the 6th day. Although the number of thrombocytes decreased in both experimental and control animals, the maximum drop in thrombocyte number in rabbits treated with aloe extract and tissue therapy during the 4th-6th day period was only 51-55% of that in control animals. Use of tissue therapy in irradiated animals aided in the normalization of the erythrocyte sedimentation rate. The return to normal of the number of lymphocytes was accelerated in experimental animals as compared with controls.

The author makes the following conclusions:

1. Tissue therapy contributes to increased animals survival after X-ray irradiation.

2. Tissue therapy prevents leukopenia, which is one of the severe symptoms of radiation sickness.

3. Tissue therapy contributes to the improvement of the morphological composition of the blood and the normalization of erythrocyte sedimentation rate.

4. Tissue therapy wards off thrombocytopenia.

45. Karlsbad Hot Springs Cure Radiation Damage

"Regarding the Favorable Effect of the Karlsbad Hot Springs on Radiation Damage," by A. Kukowka, director, Institute for Health Resorts and Balneology and for Physical Therapy, Bad Elster; Berlin, Das Deutsche Gesundheitswesen, No 49, 4 Dec 58, pp 1606-1608

After years of active work as a roentgenologist and radiologist and in spite of careful attention to what were considered satisfactory protective measures, the author acquired extensive X-ray and radium damage on the fingers of both hands. All attempts to heal, or at least to arrest, the radiation damage failed. Many of the outstanding dermatologists of the world were consulted, and all suggested measures were tried without success. Finally, amputation was suggested, but refused by the patient.

Treatment, both externally and internally, with the waters of the Karlsbad spring, together with special diet, caused the almost complete disappearance of the radiation damage. The improved condition lasted about 8-10 months after the cure; then the treatment was repeated, in order to consolidate the cure.

The therapy was suggested to 12 physicians who suffered varying degrees of extensive radiation damage. Here, too, the Karlsbad water cure was successful. The results varied in accordance with the intensity of the damages and the number of treatments, but in each case there was distinct improvement.

A completely satisfactory explanation of the effect of the Karlsbad hot springs has not yet been given. The author believes it to be based on complex effects on the entire organism.

[For additional information on radiology, see Item No 9.]

Veterinary Medicine

46. Anthrax in Lions at Zoos

"Anthrax Prophylaxis in the Case of the Feeding of Raw Meat in Zoological Gardens," by J. Wilisch and L. Schienbein, Institute for State Veterinary Medicine and Veterinary Hygiene, Karl Marx University, Leipzig; Leipzig, Monatshefte fuer Veterinaermedizin, Vol 13, No 22, 15 Nov 58, pp 676-679

The repeated occurrence of anthrax in lions of a zoo in Central Germany justified an investigation of the possible sources of the infection. In each case, connections could be established between the supply of raw meat and the infection in the lions. Investigations in the supply areas of certain animal carcass disposal plants produced interesting evidence of repeated cases of anthrax in the supply areas of the Mulde and Weisse Elster rivers. Since many tanning factories are also located in these areas, there is support for the opinion that outbreaks of anthrax in the area are not of enzootic origin, but based in most cases on imports (hides, etc). In one case, however, an outbreak of anthrax could be connected directly with an outbreak in the same farm 22 years before.

Eleven regulations are suggested for preventing anthrax in raw meat supplied to zoos for feeding the big cats.

47. Adaptation Mechanism of Foot-and-Mouth Disease Virus to Mouse Brain

"Comparative Histological, Virological, and Hematological Investigations on the Mechanism of Adaptation of Foot-and-Mouth Disease Virus to the Brain of the Mouse," by W. Koetsche, Friedrich Loeffler Institute, Riems; Leipzig, Archiv fuer Experimentelle Veterinaermedizin, Vol 12, No 4, Jul/Aug 58, pp 524-603

Comparative studies of the central nervous system of mice infected with different strains of foot-and-mouth-disease virus during various degrees of passage produced the following results:

Between the original cattle strains and the standard strains adapted to the guinea pig there are, from a histological point of view, no qualitative differences, but only -- in keeping with their stage of adaptation to the mouse brain -- slight quantitative differences which disappear entirely with continued passage. The histological changes are characterized by degenerative damage and inflammatory reactions. Degenerative lesions of the ganglion cells, especially early damage, are considered to

be caused directly by the virus. They can be detected histologically very early, long before the appearance of clinical symptoms. In the course of higher passage, their frequency of occurrence increases steadily. The same applies for an individual infection. During the course of the virus infection, the ganglion cells undergo a number of stages of degeneration, involving both the nucleoplasm and the cytoplasm. The early specific lesions are those which are characterized by activation and swelling processes of the cell nucleus and of the whole cell, wherein the chromatin is effected by congregation processes and the cytoplasm by vacuolar processes. The intermediate and late phases observed during the further course of the virus infection are characterized by a shrinking of the cells, karyopyknosis, and processes which lead to a lysis of the entire cell.

The predilection sites for the degenerative lesions are the cornu Ammonis, Nucleus caudatus, the cortical areas of the Lobus piriformis, Lobus parietalis and Lobus occipitalis, and Nucleus medialis diencephali. In the high passages, degenerative lesions also occur in the remaining sections of the central nervous system, with the exception of the cerebellum.

Ganglion cell degenerations occur especially early and especially pronounced in the areas near the ventricles of the cerebrum, primarily the paraventricular sections of the Nucleus caudatus and the external ridge of ganglion cells of the cornu Ammonis. The vulnerability of the cornu Ammonis is demonstrated in particular also by the preferred occurrence of degenerative ganglion cell lesions after extraneural infection.

The inflammatory changes are expressed as reactive processes in the form of diffuse leukocyte proliferation within the nerval parenchyma, through vessel wall reactions and pial infiltrates.

In the early passages and early stages of infection, the multiplication of leukocytes can be observed in the central nervous system only within the ventrical and vascular system. During a series of passages, their number increases at first only very slowly, and they are confined initially almost exclusively to the ventrical and vascular system. In certain stages of infection, especially with the onset of regular clinical symptoms within 24 hours, they increase significantly. With continued passages, they reveal more and more the tendency to emigrate into the neural parenchyma. Their presence can be verified as cellular infiltration in the neural parenchyma at the predilection sites of the degenerative changes, and in the periventricular tissue, in the corpus callosum and corpus striatum, and in lesser numbers at many points in the rest of the central nervous system. Toward the end of the infection they show a tendency toward regressive symptoms, especially karyolysis. Near the end of the infection of a high passage, no leukocytes, or only their remnants, can be found in the predilection sites, in spite of widespread degenerative lesions. This speaks against the assumption that the leukocytes

serve only to remove the detritus. In their case, a virotropism is assumed. The number and the localization of the leukocytes found in the central nervous system may be considered an indication of the distribution and the infectious capacity of the foot-and-mouth-disease virus which has come to rest in the central nervous system. In the lower passages, the retention and multiplication of the virus are limited, according to histological examination, primarily to the blood vessels and ventricles and the skeleton musculature. The changes in the latter are expressed as inflammatory reactions and degenerative lesions (Zenker degeneration) and represent the cause of the myositic syndrome. The absolute leukopenia in the case of hematological examination and its almost complete absence within the vascular system (with the exception of the early passages and phases) in the histological findings are considered proof of the origination of the tissue leukocytes in the blood. Their emigration into the nerval parenchyma may be looked on as a tissue wall lesion caused by the virus of foot-and-mouth disease and is supported by the lesions of the neural parenchyma which are caused by the virus and which result from the disturbance to circulation in the terminal area of the blood stream.

Inflammatory changes in the inside walls of the blood vessels, particularly in the small veins of the cerebrum, are in the form of vascular and perivascular infiltrates. In all early passages, the vascular forms appear almost exclusively and are increasingly replaced by the perivascular infiltrates as the passages become correspondingly higher. The vascular infiltrates of the low passages reveal lymphocytes as the primary inflammation cells. Later, the leukocytes which had been located at the walls move away and form mixed lympholeukocytic infiltrates, whereby the leukocytes show, from the very beginning, a tendency to emigrate into the perivascular and perineural tissue. Leukocytic perivascualr infiltrates are formed for the most part in the higher passages. Around some of the vessels lying within the telencephalon and in the vicinity of the ventricle there are edematized tissue zones. They are considered a morphological expression of increased tissue permeability in the region of the terminal vessels. The pia mater, especially the cerebral diencephalic pia mater, exhibits, in several sections, an inflammatory reaction of varying degree. The basal sections of the cerebrum and the diencephalon are especially affected, but reactions, although slight, are also found in the remaining portions of the central nervous system. The cells are predominantly lymphocytes. The endothelial cell nuclei of the capillaries of the cerebrum and diencephalon, and, to a lesser degree, the capillaries of the other parts of the central nervous system, regularly show a slight to moderate activation in the form of an edema which, in the case of increasingly higher passages, is still present only in the early stages of infection.

Through histological and hematological examinations of the changes occurring in the individual phases, it was established that the course of an individual infection corresponds to that of a total series of passages.

The injection, as such, does not lead to specific lesions and reactions, but it is surmised that the injection trauma creates predisposing conditions for the primary retention and multiplication of the virus.

The investigations were carried out on mice about 4-5 weeks old, and on animals about 3-4 weeks old, in the case of the "special" standard-A series. A series of passages was begun with material of the "special" standard-A series with 5- to 7-week-old mice. On the basis of histological examinations, it could be shown that a series of passages longer than that used for the mice 3-4 weeks old has to be conducted before the lesions and changes have reached the threshold value characterized by clinical manifestation. The transition from slight changes, comparable in quality to the other series, to pronounced changes is visible within the span of a few passages (between the 68th and 80th mouse passage). From this it can be concluded that the age of the mice is of considerable importance for the rapidity of the retention process. It is assumed, however, that the age factor is not decisive for the ultimate fixation, since the maximum histological changes occur at practically the same time for both the 3- to 4-week-old mice and the 5- to 7-week-old mice. There is no doubt, however, that, in the low passages, the active metabolism of a younger mouse could offer especially favorable possibilities for the synthesis of the virus.

There are parallel connections between the intensity of the histological changes and the virus content. The earliest proof of virus, as shown by experimental investigations of all phases of the infection, can be produced after a latent stage between the first and third hour post infectionem, 3 hours post infectionem from the blood of the infected animals, 8 hours post infectionem from the bled brain. The cerebrum, diencephalon, and the blood have the highest virus content. In the other sections of the central nervous system, the virus content diminishes in a cranial -- caudal direction. In the low passages the virus undergoes an autosterilization in the brain 48 hours post infectionem. The early detection of the virus in the blood indicates the existence of viremia, through which, in the primary infection, a spread of the virus at its main multiplication sites takes place.

After a determination of the blood status of healthy mice from the first day of life to an age of 10 weeks, extensive hematological investigations showed, for the course of the foot-and-mouth diseases infection of all mouse-brain-adapted strains of the foot-and-mouth disease virus, significant and readily characterized changes in the blood picture. In

the case of clinically infected animals there is an absolute -- confirmed histologically also -- leukopenia with leukocyte counts at times under 3,000 mm^3. The leukopenia, according to histological examinations, is caused by the emigration of the leukocytes into the neural parenchyma.

In the differential blood picture a considerable increase of the neutrophilic granulocytes over the lymphocytes takes place, which, corresponding to the stage of adaptation, can lead to an almost complete inversion of these two values. This is the case with the standard-A strains in very high passages, but all other investigated strains show, in the course of their passages, a tendency toward the formation of such a blood status.

Before, or together with, the onset of clinical symptoms, there is an overlapping of the neutrophil and lymphocyte curves. The blood picture, and especially the dynamic differential blood picture, may be considered a sensitive indicator of the existing degree of adaptation of the virus of foot-and-mouth disease to the central nervous system of the mouse. Comprehensive interpretation of the histological, virological, and hematological data is considered one possibility of providing information on the adaptation of the virus of foot-and-mouth disease to the mouse brain. Above and beyond that, the view is expressed that it is possible, with the aid of the dynamics of the blood picture, to investigate the course of adaptation even in the case of other types of virus.

The work was suggested and guided by Professor Roehrer, president of the institute; others who took part in the research were Miss I. Jacob, Miss A. Ruehtz, and Mrs E. Oltmanns, all technical assistants, and Mr. W. Lange and Mr. E. Buechner, associates.

48. Immunizing Properties of Type O Foot and Mouth Virus

"On the Immunizing Properties of Type O Foot and Mouth Virus Adapted to the Chicken Egg," by Ursula Schmidt, Friedrich Loeffler Institute, Riems; Leipzig, Archiv fuer Experimentelle Veterinaermedizin, Vol 12, No 4, Jul/Aug 58, pp 643-656

Strain U1308 of type O_2 foot and mouth virus, after 19 reciprocal passages between unweaned mouse and incubated chicken egg, was adapted to the egg and carried through 69 additional passages up to the time of the report. Before being used for inoculation, the virus was first purified with an ultracentrifuge and later by chemical means. From the 56th egg passage on, the transfer was successful without this previous treatment.

A detailed description is given of the varying behavior of the infection titer, during the course of passages, toward cattle, pigs, guinea pigs, and unweaned mice. During the passages, virus suspensions from parts of infected incubated eggs were used to produce vaccines which produced complete immunity in the case of pigs, but which protect cattle only very rarely against test infections. There appears to be some connection between the infectiousness of the egg-adapted virus and its ability to produce immunity for the animals in question.

49. Era of Medical Physics Opens New Fields and Requirements

"Physics and Medicine," by G. Frank, Corresponding Member of the Academy of Medical Sciences USSR; Moscow, Meditsinskiy Rabotnik, No 95, 28 Nov 58, p 2

Reference is made to an article by N. S. Khrushchev appearing on the same date and in the same paper emphasizing the importance of natural sciences, especially physics. The author makes the following statements.

Physics now commands a revolutionary significance owing to advances in nuclear physics and the extensive use of artificial radioactive substances in biology and medicine. Through the use of isotopes we can talk about the molecular anatomy of living things and a new type of in vivo biochemistry has been born. Through the use of the highly magnifying electron microscope, and techniques of ultrafine tissue sections (down to 0.01 micron in thickness) we can talk about molecular organization of cell structure, and structural details previously unsuspected are disclosed in many extremely important parts of living things. The introduction of roentgenostructural analysis, modern procedures of electronics in research on the electrical structure of living tissue, electrical parameters, etc., demand that new techniques, new methods, and new terminology be introduced in many fields of medicine and biology. With the birth of molecular morphology of living things, new fields have been opened in the study of pathology due to molecular changes during the course of infectious diseases, malignancy, chemical immunity, atherosclerosis, etc. The use of electron paramagnetic resonance promises to reveal unsuspected phenomena in the mechanism of enzyme processes in organisms, and the chemical effects of ionizing radiation, etc. which are connected with the so-called free radicals.

The author goes on to say that it is time to reform educational programs and introduce the study of physics into medical vuzes (higher educational institutions). This may be done by designing each chapter of physics intended for use in medical vuzes around interesting examples in the field of medicine. This is a gradual way of introducing a course of medical physics. The author concludes that it has become necessary to unify the efforts of physicists working in medical vuzes with those working in scientific research institutes.

50. New Institute of Medical Radiology To Be Opened Near Moscow

"Institute of Medical Radiology" (unsigned article); Moscow, Izvestiya, 21 Dec 58

A new Scientific Research Institute of Medical Radiology (Nauchno-Issledovatel'skiy Institut Meditsinskoy Radiologii), Academy of Medical Sciences USSR, is being planned. Construction will begin in 1959; the institute will be located on a site near Moscow.

The institute will be a scientific center where atomic energy will be used for medical purposes. The basic aim of the institute will be to work out new methods of recognizing and treating various diseases with the aid of ionizing radiation. It will also study new sources of radiation of high energy and their use in medicine. Considerable attention will be given to the study of the biological action of ionizing radiation on animal organisms and measures for protection against it.

The institute will have an Experimental Sector which will consist of 20 laboratories, among which will be the Laboratory of Biophysics, Medical Physics, Microbiology, Genetics, and Radiobiology; the sector will be concerned with the study of the influence of cosmic radiation on humans, as it will affect them during space flight.

The institute will also have a Clinical Department of 400 beds, which will have the latest equipment, especially in the surgical clinic.

The new institute will be the scientific methodological center for all establishments utilizing radioactive substances in medicine, and it will train all personnel who will be working in this field.

51. Prof V. A. Potemkina, Soviet Helminthologist, Celebrates 60th Birthday

"Jubilee of V. A. Potemkina" (unsigned article); Moscow, Veterinariya, No 12, Dec 58, p 83

Prof Valentina Alekseyevna Potemkina, Doctor of Veterinary Sciences, celebrated her 60th birthday and 33d year of scientific and pedagogical work in December 1958.

Potemkina graduated in 1929 from the Veterinary Faculty of the Moscow Zootechnical Institute, and in 1931 went to work for the All-Union Institute of Helminthology imeni Skryabin as a laboratory assistant. She has remained at this institute up to the present and is now a professor.

She has published over 50 works on the diagnosis and therapy of helminthosis of domestic animals. She is currently a member of the Scientific Council of the above institute and a member of the All-Union Scientific Research Institute of Veterinary Sanitation and Ectoparasitology. She has been awarded the Order of Labor Red Banner, the medal "Outstanding in Agriculture," and other medals.

52. Higher Veterinary Education in China

"Higher Veterinary Education in the People's Republic of China," by Prof V. S. Mersov; Moscow, Veterinariya, No 12, Dec 58, pp 71-73

In 1952 a major reorganization in the higher school system of China gave the agricultural vuzes and faculties independent status as institutions. At present there are 24 agricultural and three zooveterinary vuzes, which are directly subordinate to the Ministry of Agriculture.

There are 11 institutes that train students in the veterinary sciences; three of these institutes offer a 5-year course and the rest a 4-year course, but all institutes are scheduled to have a 5-year course in the future.

The training of agricultural cadres is conducted in 15 specialities: agronomy, mechanization of agricultural production, veterinary medicine and zootechnology, plant protection, soil sciences, agricultural chemistry, and others.

The number of students studying in zooveterinary and agricultural institutes has increased considerably since 1953, when 15,419 students were being trained. In 1956 the number rose to 34,484 students. At present over 3,000 students are being trained in veterinary sciences alone.

VIII. PHYSICS

Nuclear Physics

53. Superfluid State of Matter

"The Possibility of Superfluid State of Nuclear Matter When p - p and n - n Interactions Are Taken Into Account," by V. G. Solov'yev, Joint Institute for Nuclear Research; Moscow, Doklady Akademii Nauk SSSR, Vol 123, No 3, 21 Nov 58, pp 437-439

An attempt is made to find conditions which would satisfy the potential of n- n interaction in order to create a state of superfluidity of nuclear matter. The p - p interactions only are analyzed under the assumption that the n - n interactions are of the same nature and equal in magnitude. For this purpose a model hamiltonian is analyzed according to N. N. Bogolyubov's method (ibid., 119, 52, 1958). It was found that the state of superfluidity of nuclear matter can be reached if the p - p interactions are predominant and are of very weak magnitude.

54. Hungarian Nuclear Physics Commented on by Dubna Director

"Concerning Scientific Cooperation of Social Countries and Concerning the Results of Hungarian Atomic Physics Research -- Statements of Prof D. I. Blokhintsev, Director of the Dubna Joint Institute for Nuclear Research" (unsigned article); Budapest, Nepszabadsag, 11 Dec 58

The Joint Institute for Nuclear Research in Dubna is the joint research laboratory of the 12 socialist countries, including Hungary. They are dealing primarily with that branch of research which promises the most: an examination of the properties and effects of high energy, accelerated particles. However, this purely scientific institute also serves far-reaching practical goals because its work is closely connected with the realization of the peaceful use of atomic energy. The world's largest [most powerful] particle accelerator is here; there is no similarly versatile piece of equipment anywhere else in the world. There are now 11 young Hungarian researchers in Dubna.

Professor Blokhintsev said that it is necessary that there be coordination of the research being done in his institute and in the several national research institutes such as the Central Physics Research Institute (Kozponti Fizikai Kutato Intezet) in Hungary. Professor Blokhintsev's visit served this purpose. He visited the atomic physics research institutes in Hungary and his statements concerning Hungarian research are summarized below.

Lenard Pal, deputy director of the Central Physics Research Institute, has done research on neutron physics which promises to be useful in the area of reactor construction, providing better economy of the neutrons which liberate the energy in reactors.

The instruments of the Frvin Fenyves group of the Central Physics Research Institute automate a very tedious job: the tracing of particle tracks in photoemulsion plates /apparently the instrument locates transformed points in single plates/.

Academician Lajos Janossy, director of the Central Physics Research Institute, has done research on the nature of light which makes use of extraordinarily precise measurements; from a metrological viewpoint his work means the ultimate exploitation of the technological possibilities. Professor Janossy is working on a resolution of the apparent wave-particle duality.

Professor Blokhintsev also visited Debrecen, where he found the most interesting work of the Debrecen nuclear research institute, headed by Prof Sandor Szalay, to be the work on migration of atoms of heavy elements in the soil; this might be called biogeochemistry.

As an example of the benefits of international cooperation, Professor Blokhintsev noted that Janossy had needed some information on the effect of certain high energy, accelerated particles. Hungary did not have the equipment for these tests.. but they were done in Dubna and in 2 weeks Janossy got the results

Molecular Physics

55. Theory of the Hydride Molecule

"On the Theory of the Hydride Molecule According to the Model of the United Atom," by R. Gaspar and I. Tamassy-Lentei, Institute for Theoretical Physics of Kossuth-Lajos University, Debrecen; Leipzig, Annalen der Physik, Vol 2, No 3/4, 1958, pp 208-216

The various properties of the molecule are computed by the variation method, with the aid of the model of the united atom used for the decription of the term systems in molecular spectroscopy. In this model, the atomic nuclei are kept in the geometric arrangement of the molecule and the eigenfunction of the molecule is obtained from the single center, single-electron eigenfunctions by the Slater process. Good results for hydride molecules can be expected with this approximation. The calculations are carried out for the molecules HF and H_2O and for the molecular ion $(HO)^-$. The computed values for total energy, nuclear spacing, and dissociation energy of these molecules are in good agreement with the experimental values. One great advantage of this method is that the analytical part of the calculations is no more tedious than in the case of atomic problems.

Theoretical Physics

56. Field Equations of General Theory of Relativity

"On Time-Dependent Solutions of the Field Equations of the General Theory of Relativity," by A. Papapetrou, Research Institute for Mathematics, German Academy of Sciences in Berlin; Leipzig, Annalen der Physik, Vol 2, No 3/4, 1958, pp 87-96

The earlier discussed treatment of gravitational and electromagnetic fields which are periodic with respect to time is generalized for the case of an arbitrary dependence on time. It is shown that the boundary condition in the infinite can be satisfied only if both the electromagnetic and the gravitational field are independent of time for $t \longrightarrow -\infty$ and $t \longrightarrow +\infty$.

The role of the de Donder condition, used in the computation, is discussed; and it is shown that the results obtained here are independent of the de Donder coordinate condition.

57. Bose Statistics

"An Approximate Solution of the Quantum Problem of Many Bodies in the Case of Bose Statistics," by B. T. Geylikman. Moscow State Pedagogical Institute imeni Lenin; Moscow, Doklady Akademii Nauk SSSR, Vol 123, No 3, 21 Nov 58, pp 430-432

It was demonstrated by N. N. Bogolyubov (Izv. AN SSSR, ser. fiz 11, 77, 1947) that the growing density and interaction energy of a Bose gas leads to a decrease of the amount of particles in the condensate N_o. A case in which N_o is low is analyzed, and the necessary equations are derived, although not solved.

58. Thermodynamics of Superconductivity

"Thermodynamics of Superconductivity," by V. A. Moskalenko, Moscow State University imeni Lomonosov; Moscow Doklady Akademii Nauk SSSR, Vol 123, No 3, 21 Nov 58, pp 433-436

A demonstration is presented that the variational principle as applied to the analysis of the phase transition of superconductors confirms previous results obtained by N. N. Bogolyubov, D. N. Zubarenko, and Yu. A. Tserkovnikov (DAN, 117, 135, 1957) and by J. Bardeen, L. N. Cooper, and J. R. Schrieffner (Phys. Rev. 106, 162, 1957; 108, 1175, 1957) based on a Hamiltonian model. It is shown that the application of the variational principle gives more general results than the above-mentioned works, if the variational principle is based directly on H. Froelich's (Phys, Rev. 79, 845, 1950) thermodynamics of superconductivity (D. N. Zubarev and Yu. A. Tserkovnikov, DAN, 122, No 6, 1958).

Electronics

59. Luminous Trail of Breakdown Streamers Photographed

"Two Manifestations of the Breakdown Streamer of a Positive Point Corona in Atmospheric Air," by G. List, Institute for Radiation Source, German Academy of Sciences in Berlin; Berlin, Experimentelle Technik der Physik, Vol 6, No 5, 1958, pp 223-228

Two characteristic manifestations of the breakdown streamer of a positive point corona are described, which were observed in the space (1-30 cm in length) between a pointed and a flat electrode. The photographs

include what is considered to be the first description of the unstable luminous trail in the case of large electrode spacings. It was found that the path of the complete sparking-over does not always follow the luminous trail of the corona discharge. Measurements were made on a corona discharge between a positive point and a grounded plate, and the breakdown voltage U_D is plotted against the electrode spacing d. For small spacings, up to d = 8 cm, the curve is described by the equation $U_D = 11.7d - 0.7\ d^2$, while for $d > 18$ cm it is a straight line corresponding to the equation $U_D = 11.50 + 4.43$ d. For average spacings (d = 8... 18 cm), the curve goes over from the quadratic form to the straight line.

60. Flamelike Plasma Discharge

"Electron Temperature and Electron Noise in the High-Frequency Torch Discharge," by L. Mollwo, Heinrich Hertz Institute of the German Academy of Sciences in Berlin, Berlin-Adlershof; Leipzig, Annalen der Physik, Vol, 2, No 3/4, 1958, pp 96-129

The noise temperature of the electron "torch" in air and nitrogen at atmospheric pressure is found to be about 14,000°K at a test wavelength of 20 centimeters. Output and resistance are also measured for the volume involved. The discussion shows that the electron temperature is about 13,500°K, and that of the shot noise, 380°K. The gas temperature is about 4,000°K. The discharge column is in a state corresponding to that of a DC glow-discharge column at atmospheric pressure. It is shown that the possibility of a stabilization of such a state is much more favorable for a high-frequency discharge than for a DC current discharge.

Mechanics

61. Nonlinear Oscillations of Bounded Liquid Studied

"On the Theory of the Nonlinear Oscillations of a Bounded Volume of Liquid," by N. N. Moyseyev, Moscow; Moscow, Prikladnaya Matematika i Mekhanika, Vol 22, No 5, Sep/Oct 58, pp 612-621

The introductory remarks of the author follow:

"The present work concerns the calculation of the nonlinear oscillations of a bounded volume of liquid. It has, however, a number of shortcomings, with the result that for a long time the author felt that its publication would not be expedient.

"It should be mentioned that the results were obtained in a formal manner, convergence of the process has not been proved, and the calculations involved in carrying out the process are very tedious.

"The possibility of extending the results to the case of a body containing a liquid with a free boundary was not certain, since a theorem concerning the amplitude of the main oscillations of such a body is lacking.

"Since the amplitude in nonlinear oscillations quickly reaches its limiting value and the waves are destroyed, it would seem that only a linear theory would be of practical value or a theory which takes into account the dissipation of energy on destruction of the waves.

"The process does not have any firm foundation at present. Nevertheless, the following circumstances, it seems to us, now warrant publication of the theory.

"1. The application of high-speed computers now make it possible to carry out the required calculations without any particular difficulty, particularly since effective methods have been developed in recent years for calculating the solutions of the corresponding boundary-value problems.

"2. The problem of the amplitude of the main oscillations of a body with liquid has been cleared up completely. The extension of this theory to the case of the oscillation of a body containing a liquid with a free boundary does not present any great difficulty.

"3. Investigation of resonance phenomena is, in principle, impossible to carry out within the limits of linear theory, but the problem is now beginning to interest practical persons."

62. Equations for the Nonlinear Reflection of Shockwaves Given

"On the Nonlinear Reflection of Weak Shock Waves," by O. S. Ryzhov and S. A. Khristianovich, Moscow; Moscow, Prikladnaya Matematika i Mekhanika, Vol 22, No 5, Sep/Oct 58, pp 586-599

Physical conditions are given which permit considerable simplifications to be made in the equations of gas dynamics describing nonstationary flows with small but sharp changes in the parameters of the medium. The mathematical simplifications are based on the fact that pressure changes in the flow occur in a small region adjacent to the shock-wave front. Such flows are termed "short waves." Exact particular solutions are obtained for the nonlinear differential equations evolved. These solutions are then applied to obtain an approximate solution for the problem of the nonlinear reflection of a shock wave from an absolutely rigid wall.

63. Applicability of Linearization Method in Theory of Shells Examined

"Certain General Problems on the Stability of Shells," by I. I. Vorovich; Moscow, Doklady Akademii Nauk SSSR, Vol 122, No 1, Sep 58, pp 37-40

The fundamental equations of the nonlinear theory of shells are analyzed to determine whether the linearization method, in which the moment of stability loss is determined by the first eigen number of some nonlinear boundary-value problem, is applicable as a method of solution in the case of shells.

64. New Formulas for Friction and Heat Transfer in Turbulent Motion

"Hypothesis of Localization in the Turbulent Motion of a Liquid With Viscosity," by L. G. Loytsyanskiy, Leningrad; Moscow, Prikladnaya Matematika i Mekhanika, Vol 22, No 5, Sep/Oct 58, pp 600-611

The hypotheses of the localization of the mechanism of turbulent mixing and the localization of the Reynold analogy between transfer of motion and heat content are expanded to the entire region of turbulent motion, where interaction of molecular and molar processes occurs. This it is claimed, makes it possible to unite all existing semiempirical theories of turbulent motion and heat- and mass-exchange.

New formulas for friction and heat-transfer in turbulent motion are obtained. These formulas are used to construct analytic expressions for the velocity and excess-temperature profiles throughout an entire cross section of the flow, covering laminar, intermediate, and purely turbulent regions. These expressions are continuous, with continuous first derivatives.

65. Stability of Motion of Heavy Point of Variable Mass

"On the Stability of Programed Motion of a Heavy Point of Variable Mass," by A. S. Galiullin, Kazan; Trudy Kazanskogo Aviatsionnogo Instituta, No 37, 1957, pp 85-90 (from Referativnyy Zhurnal -- Mekhanika, No 7, Jul 58, Abstract No 7356 by M. I. Yefimov)

Several types of sufficient conditions for stability of programed motion of a heavy point of variable mass are established under the assumption that the reactive force of the environment on the point at

a tangent and normal to the trajectory has the form

$$F_{\tau} = K_1(t)\nu, \qquad F_n = K_2(t)\nu$$

where ν is the modulus of the velocity of the point, and K_1, K_2 are the coefficients of influence of the environment on the point.

Example of stable motions along a vertical straight line are given.

66. Synthesis of Compensating Networks in Dependent Control Systems

"Synthesis of Compensating Networks in Dependent Regulation Systems in the Case of Slowly Changing Influences," by Ye. I. Baranchuk, Tr. Leningr. voyen.-mekhan. in-t, 1957, No 6, pp 335-348 (from Referativnyy Zhurnal -- Mekhanika, No 11, Nov 58, Abstract No 12120 by Ye. N. Miroslavlev)

A dependent regulation system whose links are linear systems, in which case the connections between them are fixed, is examined. The possibility of synthesis of such a system according to given qualitative indicators with the aid of characteristics and equations based on an analysis of forced motions of the system is proved. An example of the synthesis in the case of slowly changing influences is presented.

67. Heating of Body Moving Through Viscous Fluid Considered

"On the Heating and Melting of a Solid Body Through Friction," by S. S. Grigoryan, Moscow; Moscow, Prikladnaya Matematika i Mekhanika, Vol 22, No 5, Sep/Oct 58, pp 577-585

The heating and melting of a solid through friction are analyzed and solved for two simple cases. First, the problem of the friction of one solid on another is considered, and then the problem of the flow of a viscous incompressible fluid over a solid object. Methods of dimensional analysis are used in the treatment (L. I. Sedov, Metody Podobiya i Razmernosti v Mekhanike [Similarity and Dimensional Methods in Mechanics], Gostekhteoretizdat, Moscow, 1957).

68. Parameters of High-Altitude Stage Rocket

"Selection of Parameters of a High-Altitude Stage Rocket," by A. K. Platonov; Moscow, Tr. Mosk. aviats. in-ta, 1956, No 64, pp 15-40 (from Referativnyy Zhurnal -- Mekhanika, No 7, Jul 58, Abstract No 7533 by A. S. Budnik)

This work sets forth an approximate graphoanalytic method for determining design parameters of single and two-stage high-altitude rockets. For the case of vertical flight without considering the atmosphere the ballistic problem in dimensionless parameters is solved and a method of constructing a grid of functions of dimensionless parameters of motion from similarity criteria of rockets (relative mass and thrust-weight ratio) is given. Using this graph the author solves the ballistic problem (for the preliminary design stage of rockets) by determining the required relative final mass for a known altitude of ascent, the thrust-weight ratio, and the specific thrust of the motor. For flight in the atmosphere a scheme of an analogous solution of the ballistic problem with an approximate consideration of drag and the influence of back pressure of the atmosphere on the performance of the motor is used.

Equation of the weight balance of the rocket is constructed with the aid of statistical data on specific weight characteristics of the construction elements excluding the motor elements for which an approximate theoretical weight analysis is performed.

With the aid of this method for solving the ballistic problem and the weight balance equation, a method for determining the basic design parameters of the rocket is set up. In this case optimum parameters are partially selected. The minimum total propellant consumption is selected as the criteria of optimality. From this condition the selection of optimum pressures in the engine chamber and the nozzle are made for single-stage rockets. The determination of the optimum coefficient of oxidizer surplus is made only for maximum thermodynamic specific thrust.

For two-stage rockets the question concerning the selection of optimum staging is examined. A method of graphic searching for the optimum combination of values of relative final masses of the stages under conditions of minimum loss of fuel is derived. The problem is solved for the case of specific thrust of motors identical for both stages and different (for each stage) weight coefficients.

69. Equations of Motion for Gas With Shock Wave Solved

"On Exact Solutions of the Equations of One-Dimensional Gas Dynamics With Shock and Detonation Waves," by I. S. Shikin, Moscow State University imeni M. V. Lomonosov; Moscow Doklady Akademii Nauk SSSR, Vol 122, No 1, Sep 58, pp 33-36

A general method is given for solving exactly the equations for the one-dimensional nonstationary motion of an ideal non-heat-conducting gas in which the velocity at any given time is a linear function of the distance from the center, axis, or plane of symmetry and in which a shock or detonation wave is propagated with a certain velocity with respect to the undisturbed gas with constant pressure and a certain initial density.

Spectroscopy and Optics

70. Energy Levels of Rare Earth Ions

"Solution of a Problem on Splitting the Energy Levels of Rare Earth Ions in the Crystal Lattice Field," by N. V. Afanas'-yeva; Leningrad, Optika i Spektroskopiya, Vol 5, No 6, Dec 58, pp 629-633

The effect of crystalline fields of various symmetry on the state of ions of rare earths is analyzed. A method is suggested for finding operator equivalents for various potential functions. The relative location of ion energy levels is found in the field of cubic symmetry. The parameters of crystal lattices for double nitrates and ethyl sulfates of rare earths were determined.

71. Spectra of Polyatomic Molecules

"Intensities in the Spectra of Polyatomic Molecules," by B. S. Neporent and N. G. Bakhshiyev; Leningrad, Optika i Spektroskopiya, Vol 5, No 6, Dec 58, pp 634-645

The effect of the solvent on the magnitude of the absorption integral, on the duration of the excited state, and on their correlation is analyzed for polyatomic molecules. It is shown that the concepts of integral intensities of electron transitions may without doubt be referred only to complex polyatomic molecules, while for the case of simple polyatomic molecules the conditions and limitations are determined under which

these concepts retain their meaning. It is shown that for the case of complex and for some simple polyatomic molecules the solvent may be considered as an external dielectric medium. Several models of the system "absorbing molecule - solvent" are discussed, and the inadmissibility of some models accepted by several writers in which the solvent is formally considered an isotropic medium "penetrating the molecule" is demonstrated. The necessity of introducing corrections considering the internal field in the solution is shown: the correction suggested by T. P. Kravets (Izv. Imp. Mosk. Inzhenernogo Uchilishcha, Ser. II, No 6, 1912) according to Lorentz or the correction with consideration of the reactive field. The values of the absorption integral were studied experimentally, as well as the duration of the excited state in vapors and in several solutions for phthalimide and five of its derivatives. It was established that the agreement of the experimental data with the correlations derived from theory is reached in taking into account the reactive field according to H. Onsager (J. Amer. Chem. Soc. 58, 1986, 1936) or, with somewhat worse approximation, by means of the Lorentz correction.

72. Absorption Bands in Solutions

"Internal Field and Intensities of Absorption Bands in Solutions," by N. G. Bakhshiyev; Leningrad, Optika i Spektroskopiya, Vol 5, No 6, Dec 58, pp 646-654

The relation of the internal field to the intensity of absorption bands in solutions is analyzed in a general form. A simplified expression for the correction of the solvent effect was obtained according to the theory of H. Onsager (J. Amer. Chem. Soc., 58, 1986, 1936) and of C. Boettcher (Theory of Electric Polarization, Amsterdam, 1952). The results are applied to electron absorption spectra of a number of aromatic compounds.

73. Spectra by Low-Voltage Pulse Discharge

"Excitation of Spectra in the Vacuum Region by a Low-Voltage Pulse Discharge," by F. Z. Pedos and N. S. Sventitskiy, Leningrad, Optika i Spektroskopiya, Vol 5, No 6, Dec 58, pp 706-707

The possibility of obtaining a low-voltage pulse discharge in vacuum, previously described by the authors (ibid. Vol 4, p 407, 1958), is of particular importance for the excitation of spectra in the far ultraviolet. The equipment was augmented by an automatic pulse repeater and a voltage regulator. It was used for photographing the spectra of Fe, Cu, C, Mg, Al, Ti, W, and other elements.

74. Polarization of Scattered Light

"Ellipticity of Polarization of Scattered Light," by G. V. Rozenberg and I. M. Mikhaylin; Leningrad Optika i Spektroskopiya, Vol 5, No 6, Dec 58, pp 671-681

A visual device is constructed for the measuring of all polarization characteristics of a light beam, i.e., the polarization degree, the degree of ellipticity, and the position of the plane of the predominating polarization. The degree of ellipticity of the polarization of light, scattered by atmospheric air, either pure or smoky, under conditions of irradiation by a linearly polarized beam, is measured as a function of the scattering angle. It was established that under proper conditions the degree of ellipticity of polarization of the scattered light is considerable.

75. Interferometer

"Interferometer With a Concave Diffraction Grating," by F. M. Gerasimov and S. S. Naumov; Leningrad Optika i Spektroskopiya, Vol 5, No 6, Dec 58, pp 682-685

Interference of two beams diffracted from a grating is analyzed and an interferometer with a concave grating, built on this principle, is described. The interferometer is used for testing reflecting surfaces and for checking the quality of plane diffraction gratings (G. W. Stroke, J. Opt. Soc. Amer., 45, 30, 1955).

76. Optical System for Image Formation

"Image Formation by an Aberrationless Optical System of Objects in a Field Brighter or Darker Than the Objects Themselves, by L. P. Moroz; Leningrad, Optika i Spektroskopiya, Vol 5, No 6, Dec 58, pp 692-698

An equation is derived, connecting the width of a separate object in the shape of a narrow band in cases when this band is situated in a field brighter or darker than the band, the band's contrast with the field, the contrast between a point on its axis and the surrounding field in an image formed by an aberrationless optical system with a round aperture, the aperture of this system, and the wavelength of radiation. This equation permits the solution of the problem of finding the necessary values, and, in particular, the threshold values of each of the enumerated quantities, when all remaining quantities are specified

with relation to the values of the threshold of contrast response of the instrument's receiver. The equation is of different type depending on whether the object is brighter or darker than the field at a specified contrast with the field. A connection between the two cases is established. The method used for the derivation of these equations may be applied also for objects of different shape, for optical systems having other properties, and in the case of image receivers having scattering properties.

Miscellaneous

77. New Isotope Laboratory in Hungary

Budapest, Nepszabadsag, 14 Dec 58

A new Isotope Laboratory will begin operations soon in the Lorand Eotvos Science University. This will be the first isotope laboratory in which analytic experiments exclusively will be performed.

78. Soviet Physicist Comments on Hungarian Theoretical Physics

"Professor Blokhintsev visits the Theoretical Physics Institute" (unsigned article); Budapest, Nepszabadsag, 13 Dec 58

D. I. Blokhintsev, director of the Joint Institute of Nuclear Research Dubna, visited the Theoretical Physics Institute (Elmeleti Fizikai Intezet) of the Lorand Eotvos Science University and discussed the research being done there. The members of the institute reported on their scientific work and plans. Blokhintsev, who has achieved outstanding results in the area of theoretical physics, listened to the reports with interest. Academician Karoly Novobatzky, director of the institute, reported on his examinations connected with fundamental problems of theoretical physics. Docent Gyorgy Marx reported on achievements in the theory of elementary particles.

Blokhintsev stressed the importance of theoretical research, and reported on the experiences of Soviet research institutes. He also noted that the contacts between the joint institute of Nuclear Research in Dubna and the Hungarian research institutes, which have proved profitable in the past, must be even closer in the future.

Scientific Workers	1943 Total No	1943 No of Uzbeks	1947 Total No	1947 No of Uzbeks	1952 Total No	1952 No of Uzbeks	1957 Total No	1957 No of Uzbeks
Doctors of Sciences	28	2	46	7	51	17	71	32
Candidates of Sciences	57	27	145	53	256	74	403	162
Total	210	51	441	110	605	157	1,064	455

The more recent developments in Uzbekistan are: establishment of the Institute of Nuclear Physics in 1956 and establishment of the Institute of Regional Medicine in 1957. The latter is expected to develop into a scientific center for the study of problems of experimental and theoretical medicine.

During the school year 1956-1957, there were in operation in Uzbekistan, 32 universities, 100 technical schools and special schools of subprofessional level. The total student population in these schools during the 1956-1957 school year was 130,000.

The chapter headings in the book are as follows:

I. Building of Communism and Growth of Science in the USSR

II. Science in Uzbekistan: the Offspring of October (Revolution)

III. Scientists of Uzbekistan and Development of Theoretical Questions of Modern Science

IV. Social Sciences and Their Role in Cultural Structure of the Republic

V. Scientific Basis: a Perspective of Comprehensive Development of Economic Regions of the Republic

VI. Scientists of Uzbekistan: (Scientists) in Cotton Growing

VII. Geological Surveys and Mineral Resources of Uzbekistan

VIII. Chemical Scientists and the Economy of the Republic

IX. Technical Sciences in the Service of Socialist Construction

IX. MISCELLANEOUS

79. Scientific Progress in Uzbekistan Attributed to Soviet System

40 Let Sovetskoy Nauki V Uzbekistane (Forty Years of Soviet Science in Uzbekistan), by Kh. M. Abdulayev, president of Academy of Sciences Uzbek SSR, Publishing House of Academy of Sciences Uzbek SSR; Tashkent, 1958, 216 pages

"The history of Uzbekistan is one of degradation and despair, a history of rapid subjugation by foreign armies and of catastrophic events which reduced the country to a status of a colony and brought feudalism and ruin to the most prosperous cities in Central Asia. Scholarship suffered and the record of these years is not easy to reconstruct. Science and technology in present-day Uzbekistan is an offspring of the Soviet revolution of 25 October 1917. Since on the eve of the October Revolution the republic was technologically and economically one of the most retarded sections of Tsarist Russia, progress made by scientists of Uzbekistan during the past 40 years cannot be considered less than phenomenal."

Abdulayev's book is an expanded and supplemented edition of the text of a report read at a meeting of the Academy of Sciences Uzbek SSR celebrating the 40th anniversary of the revolution. The book presents a brief sketch of the formation and development of Soviet science in Uzbekistan and, in a condensed form, tells of the most important achievements of Uzbek scientists in various fields of natural history and social sciences. The aim of this book is twofold:

1. To present concrete data, characterizing the principal landmarks of development of Soviet science in Uzbekistan.

2. To point out the growth of science in Uzbekistan, which was achieved under the leadership of the Communist Party and the Soviet government, creating a cultural revolution in the country and subsequently realizing Lenin's policy concerning nationalities.

The rapid tempo of development of science in the Uzbek SSR is clearly expressed in the increase in native scientific personnel, primarily that of the scientific personnel of the republic Academy of Sciences. This can be seen from the figures given in the table below.

X. Investigation of Soil Improvement in Uzbekistan

XI. Investigation of Flora and Fauna of Uzbekistan

XII. Science and Rise in Sericulture and Animal Husbandry

XIII. Medical Science in Uzbekistan

XIV. The Immediate Problems of the Soviet Science in Uzbekistan

80. New Scientific Organization Founded in China

"Scientific and Technical Association of the People's Republic of China Founded" (unsigned article); Peiping, K'o-hsueh T'ung-pao (Scientia), No 19, 1958, p 603

This item reports the establishment of a new scientific organization, the Scientific and Technical Association of the People's Republic of China (中华人民共和國科学技术协会), by the amalgamation of the All-China Federation of Scientific Societies and the All-China Association for the Popularization of Science and Technology. The motion to combine the two societies under the new name was unanimously passed during their joint national congress which convened in Peiping 18-25 September 1958. A motion was also passed to consider the current congress as the new organization's first. A presidium and secretariat of the association's first national committee were elected.

According to the article, the Scientific and Technical Association will assume the party-assigned responsibility of utilizing every level of its organization in the promotion of a mass movement for an extensive technological revolution in China. It will endeavor to fulfill in 1962 the Twelve-Year Plan for Scientific and Technical Development [originally scheduled for completion in 1967] and to bring China up to the world's advanced level in science and technology in 3 years.

[SIR Note: Elsewhere in this journal a list of members of the association's 150-man First National Committee is presented, with the following persons identified as officers:

Chairman: Li Ssu-kuang

Vice chairmen: Liang Hsi, Hou Te-pang, Chu K'o-chen, Wu Yu-hsun, Ting Hsi-lin (丁西林), Mao I-sheng, Wan I (万毅), Fan Ch'ang-chiang (范長江), Ting Ying (丁颖), and Huang Chia-ssu (黄家驷).

Members of Presidium: Wang Fa-wu (王 发 武), Liu Ch'eng-chao, Tu Kuo-hsiang, Su Feng (苏 峰), Su Pu-ch'ing, Chao Shou-i (赵 守 一), and Mi Chia-fan (密 加 凡).

Members of Secretariat: Yen Chi-tz'u, Ch'en Chi-tsu (陈 继 祖), Chou P'ei-yuan, T'u Ch'ang-wang, Hsia K'ang-nung (夏 康 农), and Nieh Ch'un-jung (聂 春 荣).

The full text of the "Resolution to Establish the Scientific and Technical Association of the People's Republich of China," on page 583 of this issue, embodies the constitution and by-laws of the association. The association's resolutions, "To Struggle for the Fullfillment of the Twelve-Year Plan for Science and Technology Five Years Ahead of Schedule" and "To Sponsor a Scientific and Technical Gift Presentation Movement on the Tenth Anniversary of the People's Republic of China and Prepare for the Calling of a National Congress of Activists of Scientific and Technical Discoveries and Inventions," are published on pages 585.]

81. Hungarians Appoint New Scientific Qualifications Committee

"Resolution No 1035/1958 (IX. 2) of the Hungarian Revolutionary Worker-Peasant Government, Concerning Replacement of Chairman, Secretary, and Members of the Scientific Qualifications Committee," by Antal Apro, First Deputy Premier of Hungarian Revolutionary Worker-Peasant Government; Budapest, Akademiai Kozlony, Vol III,
 No 15-16, 15 Sep 58

"1. The [present] chairman, secretary, and members of the Scientific Qualifications Committee are hereby relieved of their respective offices.

"2. The following persons are appointed to these offices as noted:

"Academician Elemer Vadasz, chairman

"Corresponding Member [of the Hungarian Academy of Sciences] Gabor Tolnai, secretary.

"Academician Antal Babits, Corresponding Member Otto Benedikt, Corresponding Member Agoston Budo, Doctor of Technical Sciences Gyorgy Csanadi, Academician Tibor Erdey-Gruz, Academician Pal Kiss Gegesi [or Kiss Pal Gegesi], Corresponding Member Arpad Gerecs, Candidate of Economics Arpad Haasz, Academician Gyorgy Hajos, Candidate of Chemical Sciences Gyula Hardy, Academician Lajos Janossy, Candidate of Biological Sciences Gabor Kolozsvari, Corresponding Member Mate Major, Academician

Rezso Manninger, Academician Erik Molnar, Academician Gyula Nemeth, Candidate of Biological Sciences Sandor Rajki, Candidate of Technical Sciences Istvan Salyi Sr., Academician Andras Somos, Doctor of Medical Sciences Jozsef Sos, Academician F. Bruno Straub, Academician Imre Szabo, Doctor of Technical Sciences Lajos Szeniczei, and Academician Erno Winter, members.

"First Deputy Minister of Health Istvan Simonovits, Representative of the Ministry of Health

"Chief Director Istvan Tamassy, Candidate of Biological Sciences, representative of the Ministry of Agriculture."

82. Hungarian Academy of Sciences Institutions Listed

"Directive No 14/1958 MTA (A. K. 17-18) of the President of the Hungarian Academy of Sciences," by Istvan Rusznyak, president); Budapest, Akademiai Kozlony, Vol VII, No 17-18, 15 Oct 58

The following list of Hungarian Academy of Sciences installations is an attachment to a directive concerning "Organizational and Operational Fire Regulations for the Hungarian Academy of Sciences." This directive sets up five different types of positions: an "independent official" (fugget-lenitett eloado), who "operates under the technical direction of the National Fire Command of the Ministry of the Interior"; a "nonindependent official" (nem fugg. eloado), who "is the fire official of the institution and works under the direction of the institution's director or chief"; a "person responsible for fire regulations" (tuzrendeszeti felelos); a "fire regulations committee" (tuzrendeszeti bizottsag) made up of 3-9 persons depending on the fire danger in the institution, its size, the number of workers, and technological dangers (the chief of the committee is the "official" -- see above -- and the members are engineers, technicians, etc.; the function of the committee is primarily advisory); and finally, "volunteer fire fighters." The table below gives the regulations for setting the number of volunteer fire fighters needed. Inasmuch as the following list includes institutions for which no such official is proposed (these are probably housed in areas not under academy control), the list can be presumed to be a complete list of all institutions administratively responsible to the academy.

Number of Volunteer Fire Fighters Per Shift

Danger Group to Which Institution Belongs	No. of Workers 51-200	201-500	501-1,000	Above 1,000
I	11	15	19	21
II	9	13	17	19
III	7	9	13	17

In the following list, the first number is the serial number of the institution; following the name of the institution is the number of positions (if any) of the various types.

1. Academy Office (Akademiai Hivatal) -- one responsible person.

2. Philology Institute (Nyelvtudomanyi Intezet) -- one responsible person.

3. Literary History Institute (Irodalomtorteneti Intezet) -- one responsible person.

4. Folk Music Research Group (Nepzenekutato Csoport) -- one responsible person.

5. Historical Sciences Institute (Tortenettudomanyi Intezet) -- one nonindependent official.

6. Economic Sciences Institute (Kozgazdasagtudomanyi Intezet) -- none.

7. State and Legal Sciences Institute (Allam- es Jogtudomanyi Intezet) -- none.

8. Geographical Sciences Research Group (Foldrajzitudomanyi Kutato Csoport) -- none.

9. Trans-Danubian Scientific Institute (Dunantuli Tudomanyos Intezet) -- none.

10. Philosophic Institute (Filozofiai Intezet) -- none.

11. Central Physics Research Institute Kozponti Fizikai Kutato Intezet) -- one independent official, 8 responsible persons, a fire regulations committee of 5, and 19 volunteer fire fighters [per shift].

12. Nuclear Research Institute (Atommagkutato Intezet) -- one nonindependent official.

13. Mathematics Research Institute (Matematikai Kutato Intezet) -- one responsible person.

14. Astronomical Institute (Csillagvizsgalo Intezet) -- one responsible person.

15. Theoretical Physics Research Group (Elmeleti Fizikai Kutato Csoport) -- one responsible person.

16. Cybernetics Research Group (Kibernetikai Kutato Csoport) -- one responsible person.

17. Solar Physics Research Group (Napfizikai Kutato Csoport) -- none.

18. Agricultural Research Institute (Mezogazdasagi Kutato Intezet) -- one nonindependent official, 19 responsible persons, a fire regulations committee of 3, and 8 volunteer fire fighters [per shift].

19. Soil Study and Agricultural-Chemical Research Institute (Talajtani es Agrokemiai Kutato Intezet) -- one responsible person.

20. Animal Health Research Institute (Allategeszsegugyi Kutato Intezet) -- one responsible person.

21. Soil Biology Research Laboratory (Talajbiologiai Kutato Laboratorium) -- one responsible person.

22. Agricultural Operations Institute (Mezogazdasagi Uzemtani Intezet) -- none.

23. Child Psychology Institute (Gyermeklelektani Intezet) -- one responsible person.

24. Technical Physics Institute (Muszaki Fizikai Intezet) -- one responsible person.

25. Geodesics and Geophysics Research Laboratory (Geodeziai es Geofizikai Kutato Laboratorium) -- one responsible person.

26. Geochemistry Research Laboratory (Geokemiai Kutato Laboratorium) -- one responsible person.

27. Oil Mining Research Laboratory (Olajbanyaszati Kutato Laboratorium -- one responsible person.

28. Central Chemical Research Institute (Kozponti Kemiai Kutato Intezet) -- one nonindependent official.

29. Stereochemistry Research Group (Sztereokemiai Kutato Csoport)-- one responsible person.

30. Genetics Institute (Genetikai Intezet) -- one responsible person.

31. Bilogical Research Institute (Biologiai Kutato Intezet) -- one responsible person.

32. Biochemistry Research Institute (Biokemiai Kutato Intezet) -- one responsible person.

33. Botanical Research Institute (Botanikai Kutato Intezet) -- one responsible person.

34. Academy Library (MTA Konyvtara) -- one responsible person.

35. Farm of the Agricultural Research Institute (Mezogazdasagi Kutato Intezet Gazd.) -- one nonindependent official, 4 responsible persons, a fire regulations committee of 5, and 9 volunteer fire fighters [per shift].

36. Academy Press (Akademia Nyomda) -- one nonindependent official, 2 responsible persons, a fire regulations committee of 7, and 13 volunteer fire fighters.

37. Academy Publishing House (Akademia Kiado) -- one responsible person.

38. Research Tools Making Enterprise (Kutatasi Eszkozoket Kivitelezo Vallalat) -- one nonindependent official, 8 responsible persons, a fire regulations committee of 3, and 13 volunteer fire fighters [per shift].

39. Matrahaza Scholars Vacation Area (Matrahazi Tudosudulo) -- one responsible person, who will be the manager.

40. Balatonvilagos Scholars Vacation Area (Balatonvilagosi Tudosudulo) -- one responsible person, who will be the manager.

41. Balatonszabad Officials Vacation Area (Balatonszabadi Hiv. Udulo) -- one responsible person, who will be the manager.

42. Nagymaros Officials Vacation Area (Nagmarosi Hiv. -- one responsible person, who will be the manager.

43. Balatonalmad Scholars Vacation Area (Balatonalmadi Tudosudulo) -- one responsible person, who will be the manager.

83. Computer Presented as Gift

"Short Communications," Izvestiya Sovetov Deputatov Trudyashchikhsiya SSSR, 20 Dec 58, p 4

The Soviet Union gave a new complete electronic computer of the Ural type to the Indian Statistica Institute in Calcutta.

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