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CENTRAL INTELLIGENCE AGENCY

# SCIENTIFIC INFORMATION REPORT

6 March 1959

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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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# I. ASTRONOMY

## 1. Cold Interstellar Gas

"Cold Interstellar Gas and Light Absorption," by V. I. Krasovskiy, Institute of Physics of the Atmosphere, Academy of Sciences USSR; Moscow, Astronomicheskiy Zhurnal, Vol 35, No 6, Nov/Dec 58, pp 825-828

It is shown that in a cold interstellar gas envelopes of neutral molecules form around the ions. On these envelopes an intense process of recombination of atoms into molecules and the formation of negative ions take place. It is shown that the concentration of negative ions, especially of molecular oxygen, can be high enough for explaining the observed light absorption. Various properties of screened ions are discussed, and the possibility of explaining interstellar polarization of stellar radiation by negative ions is indicated. A footnote by the author expresses the opinion that the phenomenon of ball lightning may be due to the formation of bundles of screened positive and negative ions.

## 2. Fine Structure of Solar Emission

"The Nature of the Fine Structure of Emission of Active Regions on the Sun," by I. S. Shklovskiy, State Astronomical Institute imeni Sternberg; Moscow, Astronomicheskiy Zhurnal, Vol 35, No 6, Nov/Dec 58, pp 838-847

The excitation mechanism of the so-called "emission mustaches" is discussed. It is shown that during the lifetime of mustaches ($\sim$ 200 sec) radiating matter must be "renewed" not less than several hundred times. Separate "knots" of gas of small size, moving in the active region with a velocity of $10^8$cm/sec, interact with the photospheric plasma. This interaction is a result of nonelastic collisions between hydrogen atoms and of phenomena on the front of shock waves which are formed in front of the knots. During this process the excitation of the atoms occurs very strongly. The number of emitted Balmer quanta per every hydrogen atom moving rapidly through the photosphere is about 5. The importance of such a mechanism of desactivation of the excited atoms as the transfer of excitation is emphasized.

The total mass of gas in the knots during the whole lifetime of the active region is about $10^{13}$ grams, which is about $3 \cdot 10^{-4}$ of the mass of the gas of the active region. The energy of the knots ($\sim 10^{28}$ ergs) evidently is derived from the energy of the magnetic field in the active region. The phenomenon of knots is analagous to that of plasmoids.

Similar phenomena (the formation of rapidly moving knots-plasmoids in nonstable magnetic fields) take place in the chromosphere (in flare regions) and prominences (explosive prominences). In this case favorable conditions for accelerating charged particles can arise.

In conclusion it is shown that the so-called "continuous emissions" of active photospheric regions cannot be of synchronic type and therefore thermal emission.

3-4. Solar Radio Emission

"Strong Surge of Radio Emission From the Sun on 3 March 1958," by N. L. Kaydanovskiy, V. N. Ikhsanova, N. S. Soboleva, G. M. Timofeyeva, and G. B. Gel'freykh, Solnechnyye Dannye, 1958, No 3, pp 72-75 (from Referativnyy Zhurnal -- Fizika, No 12, Dec 58, Abstract No 28303)

Observation results of a radio emission surge on a 3.2-cm wave at the Pulkovo Observatory are described. Observations were carried out simultaneously on the polarizing radiometer and on the Great Pulkovo Radio Telescope. The surge could be related to an optical flare of power 3 and radio surges on frequencies of 208.60 and 178 megacycles. The maximum flow exceeds the flow from a quiet Sun by tenfold. The degree of circular polarization equal to 7% remained unchanged during the surge. The angular size of the active zone provoking the surge is about 1.5. The effective temperature was $10^8$ °K. The difference in coordinates between the surge and the optical flare permitted determining the altitude of the surge over the photosphere equal to 0.1 of the solar radius.

"Some Observational Results of Solar Radio Emission on the Large Radio Telescope GAO," by V. N. Ikhsanova, State Astronomical Observatory, Pulkovo, Solnechnyye Dannyye, 1957 (1958), No 6, pp 120-122 (from Referativnyy Zhurnal -- Fizika, No 12, Dec 58, Abstract No 28301)

The first observation of solar radio emission on the radio telescope with strong resolving power (about 1' on 3.2 cm wave) is reported. The active region of radio emission is reliably related to a group of solar spots. In some cases the sizes of active regions are below 1'. By means of comparison of the solar spots' motion together with the motion of radio emission sources, their altitude was established similar for 3.2- and 10-cm waves and equal to 1.07 of solar radius. It was concluded that the radio emission sources are coronal condensations connected to spots.

## II. BIOLOGY

### 5. X-Ray and EDTA Effects on Chromosome Fragmentation and Reconstruction

"The Effect of Roentgen Irradiation and of Ethylenediaminetetraacetic Acid on Chromosome Fragments in Microspores of Tradescantia Paludosa," by N. L. Delone, Institute of Biological Physics of the Academy of Sciences USSR, Moscow; Moscow, Biofizika, Vol 3, No 6, 1958, pp 717-724

The combined effects of X-ray irradiation and treatment with ethylenediaminetetraacetic acid (EDTA) were studied on the chromosomes of the Tradescantia paludosa plant.

Results indicated that certain concentrations of EDTA (0.05-0.001M) cause chromosome reconstruction, and EDTA extends the state in which chromosome fragments are able to recombine.

Comparison of the combined effects of X-ray irradiation and EDTA with the effect of X-ray irradiation alone indicates that the new types of chromosomes arising due to chromosome reconstructions have different spectra of mutations.

### 6. Chinese Cite Achievements in Cultivation of Green Algae

"Unicellular Green Algae -- New Source of Human Food," by Institute of Hydrobiology, Academia Sinica; Peiping, K'o-hsueh T'ung-pao (Scientia), No 21, 1958, p 665

This item reports the achievements of the Institute of Hydrobiology, Academia Sinica, in the accelerated cultivation of unicellular green algae during the great leap forward movement. In the 3 months preceding National Day (1 October), the institute reportedly cultivated unicellular green algae by the outdoor method at an annual rate of 12,000 chin per mou dry weight. This surpasses Japan's world record of 6,000 chin per mou annually. Preliminary analysis of the institute's product showed that the palisade type of unicellular green alga contained 48 percent protein and 13.4 percent fat; the spherical-type [Chlorella?], 48.3 percent protein and 11.3 percent fat.

The article also notes that the institute has developed strains of green algae adapted to temperatures ranging from 15 degrees to 35 and 40 degrees centigrade. Samples of green algae biscuits and candy, trial-manufactured by the Wuhan Food Products Plant, were recently taken to the USSR by Soviet scientists, it is stated.

## III. CHEMISTRY

### Analytical Chemistry

7. Chinese Method for the Colorimetric Analysis of Nickel

"A New Method for Colorimetric Analysis of Nickel," by Cheng K'ang-yuan (鄭 康 原), Institute of Geophysical Prospecting, Ministry of Geology; Peiping, Ti-ch'iu Wu-li K'an-t'an (Geophysical Prospecting), No 5, 1958, p 25

This item reports that a rapid colorimetric method for the determination of traces of nickel has been developed. The "new" method uses alpha furyl dioxime and is simpler than the old method with dimethylglyoxime, since it requires no preliminary separation. It avoids interference from Fe, Co, Cu, and Zn. Its high sensitivity eliminates interference from basic salts and hydroxides that form in alkaline solutions.

A substitute colorimetric method to be used in cases when alpha furyl dioxime is unavailable is also proposed. It calls for the colorimetry of the yellow Ni(II) dimethylglyoxime complex in chloroform.

### Fuels and Propellants

8. The Effect of Ozone on the Rate of Combustion of Hydrocarbons

"The Influence of Ozone on the Rate of Combustion of Hydrocarbons," by V. M. Cherednichenko, I. N. Pospelova, and S. Ya. Pshezhetskiy, Physicochemical Institute imeni L. Ya. Karpov; Moscow, Zhurnal Fizicheskoy Khimii, Vol 32, No 12, Dec 58, pp 2673-2678

The problem concerning the role played by chemical kinetics in combustion cannot be regarded as clarified to a sufficient extent. The correlation between the kinetics of chemical reactions in the flame front and factors which are characteristic for the propagation of flames has not been investigated sufficiently. Furthermore, the problem concerning the relation between the kinetics and mechanism of the preflame reaction and the kinetics of processes taking place in the flame has not been clarified. From this standpoint the effect on the rate of combustion of substances which change the rate of the chemical reaction after being introduced in small quantities is of interest. One of these substances is ozone. When a small quantity of ozone has been added to a mixture of hydrocarbon vapors with oxygen or air, the chemical composition of the mixture has not been

changed noticeably, the temperature of combustion has also not been changed, and such characteristics of the mixture as density, heat capacity, and heat conductivity remain the same. Under the circumstances one may conveniently observe effects of changes in the characteristics of the reaction on processes which take place.

The effect of ozone on the ignition of hydrocarbons was subjected to study in research done by S. A. Kamenetskaya, N. A. Slavinskaya, and S. Ya. Pshezhetskiy. In the work described at present, the effect of additions of ozone in quantities up to 27.3% by volume on the rate of combustion of mixtures of n-butane, n-heptane, iso-octane, and cyclohexane with oxygen and also of n-butane with air was investigated.

It was established that introduction of ozone into the mixture increases the rate of combustion. This effect is greater at low temperatures of combustion. It was established that the accelerating effect of ozone cannot be regarded as being a result of changes in the physical conditions of the process, including temperature changes, but is due to the influence of the ozone on the kinetics of the chemical reaction.

Data concerning the effect produced by ozone on combustion are compared with data on the effect exerted by ozone on ignition. A possible mechanism for the action of ozone in both cases is proposed.

9. Systems Containing Concentrated Hydrogen Peroxide

"Investigation of Systems Containing Concentrated Hydrogen Peroxide; Part 15 -- The Solubility Isotherm at 10° of the Ternary System Ca $(OH)_2$ - $H_2O_2$ - $H_2O$ and Supplementary Characterization of the Solid Phases," by S. Z. Markarov and N. K. Grigor'yeva, Institute of General and Inorganic Chemistry imeni N. S. Kurnakov, Academy of Sciences USSR; Moscow, Izvestiya Akademii Nauk SSSR, Otdeleniye Khimicheskikh Nauk, No 11, Nov 58, pp 1289-1295

On the basis of the solubility isotherms from minus 21° to plus 10° a polythermic diagram of the ternary system Ca $(OH)_2$ - $H_2O_2$ - $H_2O$ with the solid phases $CaO_2.8H_2O$; Ca O. $2H_2$ O; and Ca $O_2.2H_2$ $O_2$ was constructed. The crystals of the hydrates and perhydrates of calcium peroxide and also of anhydrous calcium peroxide were found to belong to a syngony lower than the cubic.

X-ray diffraction analysis of $CaO_2$ and $CaO_2 \cdot 8H_2O$ powders confirmed the data given in the literature in regard to the fact that the crystals of these substances belong to the tetragonal syngony (system). Penetration of 8 molecules of water into the crystal lattice of $CaO_2$ produces only insignificant deformation of the principal lattice. The water molecules apparently enter into the voids between atoms. The X-ray diffraction picture of $CaO_2 \cdot 2H_2O_2$ powder differs considerably from the X-ray diffraction pictures of all other compounds of calcium, which indicates that this compound represents a separate entity.

"Investigation of Systems Containing Concentrated Hydrogen Peroxide; Part 16 -- Solubility Isotherms of the Ternary System $Sr(OH)_2 - H_2O_2 - H_2O$", by S. Z. Makarov and T. I. Arnol'd, Institute of General and Inorganic Chemistry imeni N. S. Kurnakov, Academy of Sciences USSR; Moscow, Izvestiya Akademii Nauk SSSR, Otdeleniye Khimicheskikh Nauk, No 12, Dec 58, pp 1407-1412

The interaction of $Sr(OH)_2$ with $H_2O_2$ of different concentrations has been investigated by the solubility method in the system $Sr(OH)_2 - H_2O_2 - H_2O$ at the temperatures of minus 10°, 0°, plus 20°, plus 30°, and plus 50°. By using the residue method, the existence of the following compounds has been established with certainty: the octohydrate of strontium peroxide $SrO_2 \cdot 8H_2O$ and the diperhydrate of strontium peroxide $SrO_2 \cdot 2H_2O_2$. It was furthermore established that the hitherto unknown monoperhydrate of strontium peroxide $SrO_2 \cdot H_2O_2$ exists and that it is stable at $H_2O_2$ concentrations from 2.9 to 9.0% at plus 50°. Data in the literature concerning the existence of a hemihydrate and a hexahydrate could not be confirmed: the only hydrate that could be found was $SrO_2 \cdot 8H_2O$.

10. Conversion of Natural Gas

Pererabotka Prirodnykh Gazov (Conversion of Natural Gases), Trudy Vsesoyuznogo Nauchno-Issledovatel'skogo Instituta Prirodnykh Gazov (VNIIGaz), No 6 (14), Gostoptekhizdat, Moscow, 1959, 15 standard printed sheets, 3,000 copies, price 12 r (announcement in Tematicheskiy Plan Vypuska Izdaniy Na 1959 God, Gostoptekhizdat, Moscow, No 2, Aug 58, p 14, Item No 71)



"This book will serve the needs of plant engineers and engineers active at planning and design ("project") organizations, as well as of scientific workers of the gas, petrochemical, and chemical industries who are engaged in work on the separation of natural gas, production of intermediate products for chemical synthesis, and manufacture of synthetic products.

"It contains a number of articles dealing with the isolation of hydrocarbons from natural gases and their conversion with the purpose of the manufacture of synthetic products.

"The articles discuss results obtained in work done at VNIIGaz (All-Union Scientific Research Institute of Natural Gas) on the production of hydrogen, acetylene, carbon black, and synthesis gas, the production of formaldehyde by the direct oxidation of methane, propane, and their mixtures, etc. A number of articles deals with the separation of hydrocarbons by adsorption and the purification of hydrogen from admixtures."

11. Review of Work on the Evaporation and Growth of Droplets in a Gaseous Medium

Ispareniya i Rost Kapel' v Gasoobraznoy Srede (Evaporation and Growth of Droplets in Gaseous Media), by N. A. Fuks, Itogi Nauki, No 1; Series published by the All-Union Institute of Scientific-Technical Information, Academy of Sciences USSR, Moscow, 1958, pp 92

According to an editorial note on the back of the title page, the results of theoretical and experimental work and on the evaporation and growth of droplets in gaseous media are discussed and subjected to critical review in this book. Particular attention is paid to establishing whether or not there is agreement between theoretical results and experimental data.



The significance of the subject is commented on and the scope of the review outlined in the introduction as follows:

"The evaporation of droplets of a liquid in a gaseous medium and the reverse process of the growth of droplets in a medium containing supersaturated vapor of a liquid play an important role in nature and in human activities. It is sufficient to recall that the cyclic movement of water in nature passes through the stage of the condensation of water vapor on hygroscopic particles (condensation nuclei) contained in the atmosphere with the result that cloud droplets are formed. A considerable proportion of these nuclei is formed as a result of the evaporation of sea-water spray; furthermore, raindrops evaporate after they have formed and often do not reach the ground for this reason. In technology there is evaporation of fuel droplets in internal-combustion engines, in the spray drying of viscous solutions, and during the cooling of hot gases with sprayed water. Fogs are formed by condensation when gaseous products of combustion are cooled after these products have been ejected from chimneys and plane engines and in the process of the condensation of atmospheric moisture on droplets of sulfuric acid at sulfuric-acid plants or on droplets of phosphoric acid when screening smokes are produced by burning phosphorus. The majority of particles in clouds produced after the explosion of a nuclear bomb are formed by condensation. Condensation of vapors in gas ions has been applied for a long time as an important method of investigation in nuclear physics.

"One may mention in connection with this that the processes of absorption of gases on solid and liquid aerosol particles are in many cases similar to the process of condensation of vapors on droplets: the relationships underlying both are described by the same equations.

"Although the number of papers being published on the subject of evaporation and growth of droplets is rather large, no review of the present status of work in this field has appeared either in the USSR or outside the USSR hitherto. The purpose of the survey which has been compiled in this instance is to satisfy to some extent the need for such a review. The review which follows will be limited to the subject of the evaporation of droplets of pure liquids; in other words, the evaporation of droplets of solutions will not be discussed. The thermodynamic aspects of the process i.e., the problem in regard to the vapor tension of the droplets will also not be considered. The reason for this is that the validity of Kelvin's formula cannot be doubted as far as droplets of the dimensions which must be considered in practical work are concerned. Thus, the review deals only with the kinetics of evaporation and of the growth of droplets of pure liquid.

"The phenomenon being considered is very complex under actual conditions, because a great number of droplets evaporate; the process is of a nonstationary type and takes place in a medium having a temperature and vapor concentration which are not constant; the droplets move with relation to the medium in a manner which is not uniform and are deformed to a greater or lesser extent, while circulation originates within them; the heat exchange between the droplets and the medium proceeds by three different mechanisms (heat conductivity, convection, and radiation). For the reason stated, the theory of the phenomenon is very complex, and a number of simplifications have to be made. One must begin with a highly idealized model of the process and then introduce into the equations which have been derived corrections that take into account the effect of different factors which have been excluded from the treatment. One proceeds analogously in the experimental study of the problem: measurements are carried out under conditions which make it possible to exclude the effect of some of the complicating factors.

"Proceeding along this line, we devoted the major part of the review to the quasi-stationary regime of the evaporation of droplets (and of heat transfer to droplets) in which the velocity of the process at any given moment is equal to the velocity of a stationary process proceeding under the limiting conditions existing at this moment. As shown in Chapter III, nonstationary processes of evaporation and heat transfer may in many cases be regarded as quasi-stationary with a very close degree of approximation.

"Chapter I discusses the simplest case of the evaporation of droplets which are motionless with reference to the medium, i.e., when the effect of the hydrodynamic factor is not considered. Although this case is never realized under actual conditions, the motion of sufficiently small droplets has no effect on the rate of evaporation, so that everything that has been said in Chapter I applies to droplets of this size. Chapter II deals with the quasi-stationary evaporation of droplets in a gas stream, i.e., the evaporation of droplets which are displaced with reference to the medium. Chapter III considers a number of cases of nonstationary evaporation of droplets.

"One must note that the experimental investigation of evaporation of droplets lags to some extent behind the theoretical treatment of the subject; specifically, experimental measurements in the nonstationary region have not been conducted at all. On the other hand, many formulas for the nonstationary process have been derived with the aid of various simplifications and cannot be regarded as reliable without being checked experimentally. For these reasons, we have attempted to cover completely in our review all published experimental work on the evaporation of droplets, while, as far as theoretical work is concerned, only those investigations are discussed the results of which can be compared with experimental data." (pp 5-7)

The book's table of contents follows. A bibliography consisting of 88 references, of which 23 are USSR, follows the text of the book.



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12. Rocket Propellants

"Rocket Propellants" (unsigned article); Bucharest, Revista de Chimie, No 12, Dec 58, pp 690-693

This is a theoretical article based chiefly on data published in Western periodicals. The article states that it is believed that the USSR used liquid fuels in launching its sputniks. The USSR is also studying photonic propulsion of rockets.

## Industrial Chemistry

### 13. Current Tasks of USSR Chemical Research

"The Principal Tasks of Chemical Science" (unsigned article); Moscow, Izvestiya Akademii Nauk SSSR, Otdeleniye Khimicheskikh Nauk, No 11, Nov 58, pp 1285-1288

The expansion of chemical production in 1959-1965 that has been foreseen will result in an increase in the output of chemical products by a factor of no less than 2-3 and an increase in the production of synthetic fibers and plastics by a factor of 4.5-8. To accomplish the tasks which must be accomplished in connection with this, it will be necessary to expand research on polymers to a considerable extent. Although chemistry is at a generally high level in the USSR, there is a considerable lag in some fields, particularly as far as work on recovered and synthetic fibers and on plastics is concerned. The reason for this is dispersion of effort and insufficient coordination between scientific research and industrial development. There is an urgent necessity of expanding theoretical work and research in the field of polymers and initial materials used for the production of polymers, so that the USSR will occupy the foremost place in the world in this particular field within a few years.

As has been brought out by Academician A. N. Nesmeyanov, president of the Academy of Sciences USSR, research on polymers involves more than purely chemical work: a considerable amount of physical research is involved. One of the most important problems in connection with the production of fibers of high quality and anisotropic films is that of the orientation of molecules. In view of the fact that solutions are an intermediate stage in the production of polymers, research on solutions will play a considerable role. Data must be obtained on the distribution of molecules according to molecular weight, shape, and dimensions. Problems must also be solved pertaining to the theory of processes involved in the working and molding of polymers so that mechanochemical phenomena can be utilized for safeguarding the quality of polymers and improving it in processes involved in manufacturing.

With the purpose of considerably expanding the volume of scientific research work in this field and reducing the time during which this work is accomplished, an expansion of the network of scientific institutions is planned for 1958-1960. At the same time, some higher educational institutions will be expanded and new educational institutions created which will prepare specialists for work in the industry of polymers. A number of institutes of the Academy of Sciences USSR will be expanded. New institutes will be opened. At the Institute of Organoelemental Compounds, Academy of Sciences USSR, a new division will be organized which will be engaged principally in work on the utilization of organoelemental monomers (of the organosilicon, organophosphorus, and other types) and inorganic

monomers for the synthesis of polymers. At the same institute, work will be done on the theoretical aspects of the chemistry of high polymers, and syntheses of new types of fiber-forming polymers will be developed.

New divisions being created at the Institute of High-Polymer Compounds will do research on the synthesis of new polymers, copolymers, and block polymers and also study problems pertaining to the investigation of physico-chemical properties of polymers, the kinetics of catalytic polymerization, and the deterioration and stabilization of polymers. Laboratories being created at the Institute of Chemical Physics will furnish facilities for advancing work on the kinetics of polymerization and the kinetics of oxidation processes for the conversion of hydrocarbons, as well as expediting the development of a theoretical basis for the production of block and graft polymers. Work will also be done there on the physics and physical chemistry of laminated [reinforced] polymers.

At the Institute of Physical Chemistry problems will be tackled that have a bearing on the scientific aspects of the application of polymers in building, agriculture (to give the desired structure to soils), and other fields. New laboratories are being opened for this purpose. Furthermore, this institute will have to expand work on the catalytic synthesis of monomers, the macrokinetics of catalytic processes, the utilization of radiation as an aid to polymerization, [radiation] vulcanization, and other problems which fit into its range of activity. Syntheses of monomers with the utilization of catalytic processes and of radiation will be investigated at the Institute of Organic Chemistry. Problems pertaining to the conversion of petroleum, natural gases, and by-product gases into intermediate products for the production of polymers will be investigated at the new Institute of Petrochemical Synthesis which will be opened in Moscow on the basis of the Petroleum Institute of the Academy of Sciences USSR. At the periphery the following organizations will be opened: Institute of Organic Chemistry of the Academy of Sciences USSR at Kazan', which will function as a scientific center of petrochemistry for the petroleum-bearing regions of the Second Baku, and the Institutes of Organic Chemistry at Novosibirsk and Irkutsk (within the Novosibirsk Department of the Academy of Sciences USSR), which will function as scientific centers and centers of theoretical work for the eastern regions of the country as far as problems of petrochemical synthesis and of the chemistry of polymers are concerned. The Institute of Catalysis being created at Novosibirsk will work in close contact with these institutes.

Of great importance for the development of chemical science will be expansion of research on naturally occurring compounds, particularly as far as the chemistry of proteins is concerned. In connection with this, the Institute of Naturally Occurring Compounds is being created within the Academy of Sciences USSR. The principal activities of this institute will be in research on the structure of proteins, polysaccharides, and cellulose. Work done at the institute will also be concerned with the synthesis of biologically active substances. A Council on the Chemistry of Naturally Occurring Compounds is being created at the Department of Chemical Sciences, Academy of Sciences USSR, in order to coordinate work in this field.

14. Current Developments in the Field of Organosilicon Compounds

"The Chemistry and Practical Applications of Organosilicon Compounds (An All-Union Conference at Leningrad)," by M. G. Voronkov, Candidate of Chemical Sciences, and V. D. Losev; Moscow, Vestnik Akademii Nauk SSSR, Vol 28, No 12, Dec 58, pp 97-100



"Organosilicon compounds, above all polyorganosiloxanes, which have many advantageous characteristics from the standpoint of technical applications, are being applied extensively in various branches of the national economy. The requirements put by present-day technology induced rapid development in the field of the chemistry of organosilicon compounds. Extensive work in this field is being done in the USSR.

"The Second All-Union Conference on the Chemistry and Practical Applications of Organosilicon Compounds was held at Leningrad, 25-27 September 1958. The conference was organized by the Department of Chemical Sciences, The Institute of Silicate Chemistry of the Academy of Sciences USSR, the All-Union Chemical Society imeni D. I. Mendeleyev, the State Committee on Chemistry at the Council of Ministers USSR, and the Leningrad Sovnarkhoz. More than 650 persons from different cities of the USSR and also from foreign countries participated in the conference. Not only scientists but also persons active in the industry presented reports and participated in the discussions.

"A collection of the reports given at the conference (more than 100) was published before the conference was held. The collection of articles containing these reports included a system of nomenclature of organosilicon compounds proposed by the Commission on the Nomenclature of Chemical Compounds at the Department of Chemical Sciences, Academy of Sciences USSR.

"The conference was opened by a plenary session at which two reports were given, one by K. A. Andrianov and one by V. Bazant.

"Andrianov discussed the characteristic traits and prospects of the development of the chemistry of organosilicon compounds in the USSR. He emphasized that the principal method for obtaining new high-molecular organosilicon compounds is the synthesis of polymers which contain, in addition to silicon, atoms of titanium, aluminum, and other elements. Such polymers can be used for the production of fibers, elastomers, lubricants, and plastics which exhibit a high resistance to heat. Another important line of work is the development of polymers with partly organic and partly inorganic molecular chains consisting of both hydrocarbon and siloxane groups. Polymers containing functional groups in organic radicals forming side chains should also by synthesized. One may expect that by using these methods many polymers capable of forming fibers will be developed. Of interest also is the development of organosilicon polymers with organic chains. One must find active catalysts which assure the transformation of unsaturated silicon hydrocarbons into polymers with high molecular weights. The development of new heat-resistant organosilicon polymers which are suitable for use at temperatures in the range of 200-500° is imposed by the requirements of present-day technology and should form the principal object of work done in the near future.

"V. Bazant reviewed work done on organosilicon compounds at the Institute of Chemistry of the Czechoslovak Academy of Sciences.

"The conference was subdivided into four principal sections: those of monomers, polymers, practical applications, and analysis and physicochemical methods of investigation.

"At meetings of the section of monomers, in addition to a great number of reports on direct synthesis, methods for the production of halogenated organosilanes were discussed. Compounds of this class are initial materials for the production of organosilicon polymers.

"Of great practical interest was the information given on the phenylation of trichlorosilane. Data have been reported which demonstrate that it is possible to apply a new technological process for the production of phenyltrichlorosilane which resembles the process of direct synthesis by the fluidized solids method (N. N. Tishina, K. A. Andrianov, S. A. Golubtsov, and others). New information was given on the synthesis of trichlorosilane by the interaction of hydrogen chloride with silicon in a procedure applying the fluidized solids method. In this procedure powdered silicon is acted on by a stream of hydrogen chloride. The method in question makes it possible to increase the output by a factor of 10 and to control more efficiently the composition of the reaction products by regulating the temperature (I. V. Trofimova, K. A. Andrianov, and S. A. Golubtsov). P. Rosciszewski reported on work done by Polish scientists on the direct synthesis of methyl-, ethyl, and phenylchlorosilanes.

"Very promising from the standpoint of the development of the chemistry of organosilicon compounds are reactions based on the use of compounds which contain Si-H bonds. Methods were discussed for the synthesis of aromatic organosilicon monomers by the interaction of hydrosilanes with aromatic hydrocarbons in the presence of catalysts, so that Si-C bonds are formed after elimination of hydrogen, and also reactions of hydrosilanes with aryl halides at elevated temperatures leading to the formation of Si-C bonds as a result of the elimination of hydrogen chloride (M. Ye. Dolgaya, Ye. A. Chernyshov, and Li Kuang-liang).

"Interest was aroused by the results of investigations of novel methods for the synthesis of triorganosiloxy derivatives of elements of the IIIrd, IVth, and Vth groups of the periodic system. Syntheses of this type are accomplished by reacting triorganosilanols with alkyl derivatives and halides of titanium and vanadium, with orthoboric and phosphoric acids, and with the oxides of boron, phosphorus, vanadium, and antimony (N. F. Orlov, B. N. Dolgov, and M. G. Voronkov).

"Reports were also given dealing with the behavior under the conditions of direct synthesis of different dichloroalkanes and dichloroalkenes containing chlorine atoms bound to one carbon atom or several carbon atoms (G. I. Nikishin, A. D. Petrov, and S. I. Sadykh-zade), the catalytic addition of hydrosilanes to unsaturated compounds (V. A. Ponomarenko, A. D. Petrov, and others), a comparison between the properties of organic compounds of silicon, germanium, and tin (V. F. Mironov, V. A. Ponomarenko, A. D. Petrov, and others), and new methods for the synthesis of organosilicon vinyl ethers (S. I. Sadykh-zade, A. D. Petrov, B. N. Dolgov, and N. P. Kharitonov). A. N. Nesmeyanov, R. Kh. Freydlina, and their collaborators reported on the thermal and catalytic telomerization of hydrosilanes with olefins. In their report, new possibilities of applying reactions of this type were shown.

"Yu. K. Yur'yev proposed a catalytic method for the synthesis of silacyclopentane from furanidine and silane. In his paper he reported the results of an investigation of some transformations of the compound that had been synthesized.

"A number of reports dealt with the synthesis and the results of the investigation of the reactivity of organosilicon monomers containing different functional groups or double bonds in the hydrocarbon radicals. Specifically, the chloromethylation of organosilicon compounds was investigated for the first time (N. S. Nametkin, A. V. Topchiyev, and others).

"It was found in an investigation reported that organosiloxanes readily enter into heterolytic scission reactions under the effect of nucleophilic and electrophilic reagents (M. G. Voronkov and others).

"In reports presented in the section of organosilicon polymers new data were reported on the combined hydrolysis of equimolecular mixtures of diethyldichlorosilane with phenyltrichlorosilane. This is the principal reaction for synthesizing polyorganosiloxane resins (A. G. Kuznetsova, K. A. Andrianov, and D. Ya. Zhinkin). The results of a physicochemical investigation of the mechanism of the hydrolysis and condensation of mixtures of methyl chlorosilanes were also reported (B. Lengyel, T. Szekely, and A. Szuppon of Hungary). Results were reported of an investigation dealing with the catalytic polymerization of products of the hydrolysis of di- and tri-functional compounds with the purpose of obtaining soluble polymers with an increased viscosity (S. N. Dzhenchel'skaya, K. A. Andrianov, and Yu. K. Petrashko) and of research on the polymerization of octamethylcyclotetrasiloxane under the effect of alkalis (M. Kucera, Czechoslovakia).

"The synthesis and properties of polysiloxane elastomers were discussed in a separate session. Specifically, a report was given on the synthesis of the chlorine-containing siloxane rubber SKT-Kh 5, which adheres better to metals and exhibits a better stability at low temperatures and a higher heat resistance than the dimethylsiloxane rubber SKT (K. A. Rzhendzinskaya and I. K. Stavitskiy). A method has been developed for the vulcanization of liquid and rubber-like polydimethylsiloxanes at room temperature which is based on the interaction between the end hydroxyl groups of the polymer in the presence of esters of orthotitanic acid and of a complex catalyst (a solution of an organotin compound in tetraethoxysilane). Compositions for hermetic sealing have been proposed which are based on liquid polydimethylsiloxanes which harden at ordinary temperatures; within a few hours they change from the viscous-liquid state to that of a rubber-like material which exhibits superior dielectric properties (N. B. Baranovskaya, A. A. Berlin, and others). A heat-resistant rubber-like polymer could be obtained by utilizing the capacity of polydimethylsiloxane and teflon to undergo decomposition under the effect of mechanical and thermal treatment. The material in question has a high tensile strength (100-180 kg per square centimeter as compared with 30-40 kg per square centimeter for the polydimethylsiloxane rubbers 5 R-129, MR-2, etc.). It retains these characteristics from minus 75° to plus 350° (A. I. Glukhova, K. A. Andrianov, and others).

"The complex catalyst triethylaluminum-titanium tetrachloride was applied for the first time in the polymerization of unsaturated silicohydrocarbons, with a result that polymers derived from dialkyldiallylsilanes could be obtained at relatively low temperatures and ordinary pressure (A. V. Topchiyev, N. S. Nametkin, and collaborators).

"An important achievement in the chemistry of organosilicon high-polymer compounds is the synthesis of polymers with organic principal chains. In connection with this, interest was aroused by the description of a method for the synthesis of polyorganometalsiloxanes the molecular chains of which consist of alternating Si, O, and metal atoms and of polyorganosiloxymetaloxanes with chains consisting, to give an example, of alternating O and Al atoms surrounded by $R_3$ Si O groups (A. A. Zhdanov and K. A. Andrianov). It was reported that polyamides synthesized from dicarboxylic acids containing silicon have a higher recoverable elasticity than analagous polymers [not containing silicon] (V. V. Korshak, G. M. Frunze, E. V. Kukharskaya, and D. N. Sndreyev).

"The organosilicon polymers that are applied industrially have a low tensile strength because of the small magnitude of the forces acting between molecules. One of the methods of eliminating this shortcoming is introduction of polar groups into the organic radical at the Si atom. As a result of this, the polarity of individual links of the polymer chain is changed and the forces of interaction between the molecules are increased (L. M. Volkova, K. A. Andrianov, and collaborators).

"Combining of organosilicon polymers with other high-molecular organic substances makes it possible to improve the technical characteristics of materials. Thus, I. Ya. Guretskiy, A. P. Kreshkov, and P. A. Andreyev investigated the chemical aspects of the interaction of a number of organosilicon compounds with cellulose nitrates under different conditions. The products that were obtained proved to be good film-forming materials.

"In the section of practical applications, the greatest deal of attention was paid to electrical insulators and materials for protective water-repellant coatings. New insulating materials were proposed which protect articles coated with them at temperatures of 300-350°.

"Because of their high stability to abrupt temperature changes in the range from minus 70° to plus 350°, high resistance to moisture, and good dielectric properties, these materials can replace to advantage coatings made from enamel or glass enamel. They exhibit a high resistance to the chemical action of oxidants and corrosive substances, and to the action of solvents (N. P. Kharitonov and B. N. Dolgov).

"Hydrophobic material of the glass-fiber reinforced textolite type was obtained by using polyester binding materials containing organosilicon compounds which have unsaturated groups (methacrylic, allyl, or vinyl) at the Si atoms and also groups capable of undergoing hydrolysis as a result of the action of moisture present at the surface of the glass fibers (V. A. Kiselev, Z. A. Zinov'yev, and others). By combining organosilicon polymers with phenolformaldehydes, epoxy resins, and nitrile rubbers, heat-resistant and mechanically strong materials for the production of foam plastics were obtained (M. Ya. Borodin, Z. I. Kazakova, and others). A number of papers gave information on the application of organosilicon compositions as waterproofing impregnating agents for cotton fabrics, leather and its substitutes, paper, building materials, and glass and on the use of organosilicon compounds for increasing the resistance of concrete to freezing.

"In the section of analysis and physicochemical methods of investigation, reports were given on progress in the field of the analysis of organosilicon compounds (A. P. Kreshkov) and of methods for the control of the production of organosilicon monomers and polymers (S. V. Syavtsillo, A. P. Kreshkov, A. P. Terent'yev, and others). Results were discussed of the determination by an X-ray diffraction method of the activity of silicon-copper alloys used for the direct synthesis of methylchlorosilanes (I. Cermak, D. Snobl, and M. Dvorak, Czechoslovakia).

"Molecular spectroscopy is at present of considerable importance in research on organosilicon compounds and in the analysis of such compounds. Correlations between spectra of organosilicon compounds and the nature of chemical bonds in them and between the physical characteristics and vibrational spectra of organosilicon compounds and their structure were discussed at the conference. The characteristics and analytical applications of infrared, Raman, and ultraviolet spectra of methylphenylsiloxanes were also discussed. A new additive statistical method for the calculation of physicochemical characteristics, particularly thermodynamic values, was considered. Only two reports were given on problems of chemical analysis, which testifies to the insufficient extent of work on this subject in the USSR.

"At the concluding plenary session, D. P. Novikov reviewed the status of and plans for the development of the production of organosilicon compounds in the USSR.

"The resolution passed by the conference noted both achievement and shortcomings in the field of the chemistry of organosilicon monomers and polymers. It proposed a number of measures which will expedite progress in the field of science and technology under consideration. A commission was elected for work on the nomenclature of organosilicon compounds.

"No reports on the theory of technological processes and the calculation and design of chemical equipment were presented at the conference."

15. Possibilities of the Development of a Plastics and Synthetic Fiber Industry Based on Products Derived From Wood

"Prospects of the Development of a Chemical Industry and of Scientific Chemical Research in the Latvian SSR," by A. I. Kalnins; Riga, Izvestiya Akademii Nauk Latviyskoy SSR, No 10, (135), Nov 58, pp 5-10

Various modifications of the process of hydrolyzing plant material with concentrated acids are already being introduced into industrial application. The so-called "Riga method" of hydrolysis developed in work done under the direction of P. N. Odintsov, Corresponding Member of the Academy of Sciences Latvian SSR, is preferable to the method of hydrolysis with dilute sulfuric acid which is being applied at present. Pure glucose produced from wood wastes by the "Riga method" is approximately 40% cheaper than that produced from maize grain (corn) by the method applied at present. Consequently, glucose will become in the near future one of the cheapest organic substances available as a raw material for the production of plastics, synthetic fibers, insecticides, detergents, etc. Experimental plants have already been built at which glucose is hydrolyzed in the presence of ammonia to produce 2-methylpiperazine, a chemical from which one can produce a synthetic fiber that exhibits characteristics between those of nylon and dacron. By using 60% of glucose and 40% of fats, one can also produce detergents of a very high quality. The world consumption of soap is in excess of 6 million tons per year; in the opinion of a number of specialists, half of this quantity can be replaced by detergents derived from glucose ("New Ways of Utilizing Sugar," by H. B. Hass, La Sucrerie Belge, Vol 75, No 5, 1956, pp 185-191).

Work carried out by Prof I. P. Losev, president of the All-Union Chemical Society imeni Mendeleyev, and S. N. Ushakov, Corresponding Member of the Academy of Sciences USSR, established that alkali lignin is a good crude material for the production of plastics. Use of lignin for this purpose makes it possible to save up to 70% of phenol and up to 80% of formaldehyde in a number of cases.

Particularly promising is production from lignin of a polyester fiber of the dacron type without the use of phenol. The pyrocatechol necessary for the production of this fiber is obtained by the melting of hydrolysis lignin or some other type of active lignin with caustic in the medium of an inert heat carrier. The other necessary reagent, viz., epichlorohydrin, is produced from glycerin, which can be manufactured most cheaply by applying a biological method of production

from sugar hydrolysates with the use of a new process developed at the Institute of Forest Industry Problems (Institut Lesokhozyaystvennykh Problem), Academy of Sciences Latvian SSR. Glycerin is converted into epichlorohydrin by subjecting it to the action of gaseous hydrogen chloride in glacial acetic acid. Dichlorohydrin is formed, which is converted into epichlorohydrin by treatment with a concentrated solution of sodium hydroxide. Polycondensation of the two initial materials takes place in an alkaline medium when the mixture is heated in vacuum. Fibers of a very high strength are produced by spinning from the molten polymer. These fibers are highly resistant to the effects of moisture and can be dyed with facility.

According to tentative calculations, fiber derived from glucose or lignin obtained from wood waste will cost no more than 9,000 rubles per ton, while the cost of pure wool is 90,000 rubles per ton. Furthermore, one must take into consideration that the synthetic fiber will have a tensile strength ten times higher than that of wool.

Work on the subjects mentioned above will be conducted at the Institute of Forest Industry Problems and of the Chemistry of Wood (specifically at the Division of the Chemistry of Lignin and of Wood Polysaccharides to be organized in 1959 at this institute, which has been in existence since October 1958 as a subdivision of the Department of Chemical and Geological Sciences organized at that time within the Academy of Sciences Latvian SSR).

Work on monomers for the synthesis of plastics and synthetic fibers derived from furfural will be conducted at the Institute of Organic Synthesis, Department of Chemical and Geological Sciences, Academy of Sciences Latvian SSR.

An experimental installation will be built for the vapor-phase oxidation of formaldehyde to glyoxal, a chemical needed for the production of high-strength viscose fiber.

## Nuclear Fuels and Reactor Construction Materials

16. Developments in the Utilization and Treatment of Uranium Ores Containing Other Elements in Addition to Uranium

"Complete Utilization of Uranium Ores," by B. V. Nevskiy; Moscow, Atomnaya Energiya, Vol 6, No 1, Jan 59, pp 5-13

The subject is reviewed on the basis of non-USSR publications and papers presented at the First International Conference on Peaceful Uses of Nuclear Energy, Geneva, 1955. It is brought out that during recent years uranium deposits consisting of rich ores have been almost entirely

depleted. At the same time, the demand for uranium grows. For this reason, poor uranium ores are being used. Of great importance for a profitable utilization of ores of this type is the use of other components contained in them in addition to uranium. Gold-uranium and uranium-vanadium ores are mined on a large scale and utilized in this manner. Progress is being made in developing the technology of the extraction of uranium and other elements accompanying it from phosphorites containing uranium, coals and combustible shales, uranium-thorium ores, uranium-copper, uranium pyrite, zirconium-uranium, niobium-tantalum-uranium, and uranium-molybdenum ores. The increased emphasis on the many-sided and complete utilization of uranium ores will make it possible to produce and convert on an industrial basis some new types of mineral crude materials.

## 17. Changes in the Valency State of Plutonium Under the Action of Radiation

"The Effect of Radiation on the Valency State of Plutonium in Perchloric Acid Solutions," by N. I. Popov; Moscow, Atomnaya Energiya, Vol 6, No 1, Jan 59, pp 71-73

A previous paper reported the results of an investigation of the effect produced by X-ray irradiation of the valency state of plutonium in nitric acid solutions (cf. N. I. Popov and others, Atomnaya Energiya, Vol 4, No 2, 1958, p 154). The oxidation of tetravalent plutonium in nitric acid solutions was explained by the action of hydroxyl radicals. However, in view of the fact that the nitric acid anion is also affected by radiation, the action on the plutonium of short-lived unstable nitrogen oxides derived from the anion could have affected the valency state of plutonium. To avoid the extraneous effect of products formed from the anion, the perchloric acid anion, which is not sensitive to radiation, was used in this case. The results of the experiments described lead to the conclusion that changes in the valency state of plutonium in aqueous solutions subjected to the action of radiation are due to the effects of the H and OH radicals unless acceptors which react with these radicals are present. This conclusion is in agreement with results obtained in previous work.

18. Isolation of Radiochemically Pure $Np^{239}$

"Preparation of Radiochemically Pure $Np^{239}$ With the Use of the Recoil of Fission Products," by Yu. A. Zolotov and I. P. Alimarin; Moscow, Atomnaya Energiya, Vol 6, No 1, Jan 59, pp 70-71

Radiochemically pure $Np^{239}$ was prepared using the fact that, when the particles of the parent substance have dimensions which are smaller than the length of the free path of fission products, one can free the substance from the activity of fission products by utilizing the recoil effect. Uranium dioxide containing 0.4% of $U^{235}$ was irradiated in a nuclear reactor. Calcium carbonate was used as a carrier. The $Np^{239}$ was separated from uranium, $UX_1$, and $UX_2$ by applying the extraction method. After the oxidized (hexavalent) neptunium and the uranium had been extracted with ether, the neptunium was separated from the ether extract by reducing it with hydrazine. As a result of being reduced, the neptunium was transferred into the pentavalent state and became insoluble in ether. The method described makes it possible to separate $Np^{239}$ in 1-2 hours. Calcium carbonate or other carriers which can stand for a prolonged time the high temperature of the reactor core may be used. Because of the high temperature, it is not advisable to irradiate uranium oxides in aqueous suspensions stabilized with gelatin.

19. The Status of the Industrial Production of Heavy Water

"The Industrial Production of Heavy Water," by K. I. Sakodynskiy; Moscow, Atomnaya Energiya, Vol 6, No 1, Jan 59 pp 14-20

The importance of heavy water in nuclear technology increases. It can be used both as a moderator and a heat-transfer agent in nuclear reactors. As brought out in recent statements made by I. V. Kurchatov, deuterium is a promising fuel for thermonuclear reactions.

The requirements of different countries for heavy water are reviewed on the basis of information given in non-USSR publications (no data on the USSR are included). Installations for the production of heavy water are described and information is given on the output and productivity of installations that are in operation at present or have been built, but are closed now. Plans for the development of the industrial production of heavy water in different countries are discussed.

20. A Method for the Determination of Critical Heat Loads for Water Flowing in Tubes

"Critical Heat Loads for Water Flowing in Tubes," by I. T. Alad'yev, L. D. Dodonov, and V. S. Udalov; Moscow, Atomnaya Energiya, Vol 6, No 1, Jan 59, pp 74-78

On the basis of work done in 1956-1957 at the Laboratory of Heat Transfer, Power Institute of the Academy of Sciences USSR, a method is proposed for the determination of critical heat loads during the flow of water below the temperature of saturation in tubes with a diameter of 8 millimeters or higher or in tubes of the same clearance but with a cross section other than circular, within the pressure range of 20-200 atmospheres. The results obtained are compared with those reported in previous publications by the authors and in papers published by US workers.

21. Interactions of the Chlorides of Hafnium, Niobium, and Tantalum With Phosphorus Oxychloride

"On the Interaction of the Chlorides of Hafnium, Niobium, and Tantalum With Phosphorus Oxychloride," by B. A. Voytovich and I. A. Sheka, Institute of General and Inorganic Chemistry, Academy of Sciences Ukrainian SSR, Kiev, Dopovidi Akademii Nauk Ukrains'koi RSR, No 8, Aug 58, pp 849-852

The transformation in the systems $HfCl_4$ - $POCl_3$, $NbCl_5$ - $POCl_3$, and $TaCl_5$ - $POCl_3$ were investigated and also, with the use of the cryoscopic method, the interactions of hafnium, niobium, and tantalum chlorides with phosphorus oxychloride in nitrobenzene and in benzene. On the basis of the data obtained, the incorrectness of some data published in the literature concerning the composition of hafnium and zirconium chloride compounds with phosphorus oxychloride is established.

22. A Method for the Determination of Rare-Earth Elements in Marine Deposits

"A Method for the Determination of Rare-Earth Elements in Marine Deposits," by E. A. Ostroumov, A. A. Astanina, and T. G. Shokhor, Institute of Oceanology and All-Union Institute of Mineral Raw Materials; Moscow, Trudy Instituta Okeanologii, Vol 19, No 56, pp 297-303

It has been established that it is possible to separate quantitatively small amounts of rare-earth elements in the form of their oxalates in the presence of interfering elements (iron and aluminum) by applying a method developed by I. D. Borneman-Starynkevich and using a calcium salt as a coprecipitant. It was furthermore established that when the total quantity of rare-earth oxides in the material being investigated is of the order of 0.0005 gram, these elements can be determined precisely by a gravimetric method. Quantities of rare-earth elements that cannot be determined gravimetrically with the use of an ordinary analytical balance can be determined by the X-ray spectrometry method. The procedure developed was checked on a bauxite sample to which a known quantity of rare earths had been added and on samples of bottom deposits from the Black Sea.

23. Decomposition of the Formiates of Rare-Earth Elements of the Cerium Group

"Thermographic Investigation of the Decomposition of Formiates of Rare-Earth Elements of the Cerium Group," by M. N. Ambrozhiy and Yu. A. Osipova, Saratov State University imeni N. G. Chernyshevskiy; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 3, No 12, Dec 58, pp 2716-2720

The behavior of the formiates of lanthanum, cerium, praseodymium, neodymium, and samarium was investigated thermographically. It was established that the thermal decomposition of the formiates of lanthanum and cerium takes place in two stages with the formation of intermediate products of an indeterminate composition. Clarification of the nature of these products is referred to as a subject for a special investigation. The thermal decomposition of the formiates of praseodymium, neodymium, and samarium leads to the direct formation of solid metal oxides and of gaseous carbon monoxide.

24. Papers on Nuclear Materials Presented at the Fourth Ukrainian SSR Conference on Chemical Production Control in the Metallurgical Industry

"Fourth Ukrainian SSR Conference on Chemical Production Control in the Metallurgical and Metalworking Industry," by M. Ye. Vdovenko; Kiev, Ukrainskiy Khimicheskiy Zhurnal, Vol 24, No 5, Sep-Oct 58, pp 695-697

The Fourth Ukrainian SSR Conference on Chemical Production Control in the Metallurgical and Metalworking Industry was held at Dnepropetrovsk, 5-8 June 1958. The conference was organized by the Dnepropetrovsk Sovnarkhoz, the Ukrainian SSR Direction (Pravleniye) of the Technical Society of Ferrous Metallurgy, the Section of Analytical Chemistry and Production Control of the Direction of the Ukrainian Scientific-Technical Society of Ferrous Metallurgy, and the All-Union Chemical Society imeni Mendeleyev.

Great interest was evinced in a paper by N. S. Mustafin and Ye. A. Kashkovskaya (Saratov State University) on the application of the new colorimetric reagent alberon, which is very sensitive to aluminum and beryllium. By using alberon, one can detect 0.025 microgram of aluminum or beryllium in one milliliter of solution. Alberon forms instensely colored water-soluble compounds with a number of ions, while it is almost colorless itself. It interacts with these ions in a wide range of hydrogen ion concentrations. In the work reported in the paper, the possibilities of determining aluminum in the presence of beryllium were investigated. Furthermore, a method for the rapid determination of aluminum in steels and bronzes was developed.

L. S. Serdyuk and G. P. Fedorova (Dnepropetrovsk State University) investigated the color reactions of lanthanum, yttrium, and cerium with aluminon and Alizarin S. It was established that water-soluble colored complex compounds of yttrium, lanthanum, and cerium are formed in the presence of an aqueous ammonia solution of aluminon even when sulfosalicylic acid is absent.

The effects of boric acid and ethylenediamine on procedures for the separate determination of elements in mixtures of (1) lanthanum and yttrium and (2) yttrium and cerium in the form of alizarin salts of these elements were investigated.

A. I. Ponomarev and A. Ya. Sheskol'skaya (Institute of Metallurgy imeni Baykov, Moscow) reported on the separation of niobium from titanium by binding titanium in the form of an ascorbic acid complex. The authors of the report proposed the use of tartaric or oxalic acid as a complex-forming agent to separate niobium from tungsten.

25. Chromatographic Method for the Determination of Traces of Magnesium in Zirconium

"Determination of Magnesium in Zirconium With the Application of Ion-Exchange Chromatography," by S. V. Yelinson and M. S. Limonik; Moscow, Zavodskaya Laboratoriya, Vol 24, No 12, Dec 58, pp 1434-1436

A procedure for the determination of traces of magnesium contained in ziconium is described. Before the determination the magnesium is separated chromatographically with the aid of the ion-exchange resin SBS, which contains sulfonic acid groups.

26. Scientists Extract 13 Rare-Earth Elements From Chinese Soil

"Institute of Chemistry Extracts 13 Rare-Earth Elements" (unsigned article); Peiping, K'o-hsueh Hsin-wen (Scientific News), No 14, 1958, p 345

This item reports that 20 young scientists of the Analytical Division of the Institute of Chemistry, Academia Sinica, recently extracted from Chinese native ores the oxides of 13 heretofore difficult-to-extract rare-earth elements.

Oxides of the following 11 were obtained in a state of spectrochemical purity corresponding to international standards, the article says: lanthanum, cerium, praseodymium, neodymium, samarium, gadolinium, dysprosium, ytterbium, yttrium, holmium, and erbium. All surpassed British and American products in purity. The erbium oxide was purer than that put out by the British manufacturer, "Johnson-Smith." Two rare-earth elements were extracted in 90-plus percent purity: thulium and latetium.

The article gives the following general information on rare-earth elements:

The rare-earth elements are difficult to separate because of their similar physical and chemical properties. Their application in scientific research and industry is rapidly expanding. For example, neodymium is being used in high temperature alloys for jet planes; thulium, for X-ray machines and mine logging equipment; and gadolinium, extensively in nuclear research.

China is among the countries which have the world's largest deposits of rare-earth elements. In the Pao-t'ou Mine (Inner Mongolia) alone, there are many times 10 million tons.

27. USSR Work on Lithium-Organic Syntheses and Lithium-Organic Compounds

"Lithium-Organic Synthesis of Hydrocarbons and Hydrocarbon Derivatives Containing Oxygen," by A. D. Petrov, Ye. B. Sokolova, and Kao Ch'ing-lan; Moscow, Uspekhi Khimii, Vol 27, No 12, Dec 58, pp 1471-1503

Progress in the field of lithium-organic synthesis during the past 10-15 years is reviewed. The review begins with an introduction discussing syntheses based on dehydrobenzene (cyclohexadienine), which was prepared by G. Wittig in 1942 from o-Li-fluorobenzene. Part 1 deals with methods for the preparation of lithium-organic compounds on the basis of work done by H. Gilman (US), G. Vavon (France), E. A. Braude (Great Britain), K. A. Kocheshkov (USSR), B. M. Mikhaylov (USSR), and others. Part 2 discusses the reactions of lithium-organic compounds with alkyl- and aryl halides. This type of reaction is referred to as being for all practical purposes the best for the synthesis of polycyclic hydrocarbons. Research on the synthesis of such hydrocarbons by A. D. Petrov, B. M. Mikhaylov, and their co-workers is reviewed in some detail. Part 3 discusses reactions of lithium-organic compounds with aldehydes, ketones, and esters, i.e., syntheses of alcohols and glycols. It is pointed out by the authors of the review that because of the high reactivity of lithium-organic compounds reactions of this type always proceed in a normal manner. It is added that by using this general method one can synthesize not only saturated, but also unsaturated alcohols and glycols, because lithium forms reactive derivatives even with alpha-alkenyl halides. Work by A. D. Petrov and members of his group on the interaction of esters of monocarboxylic acids (ethyl formiate, methyl butyrate, methyl isobutyrate, ethyl enanthate, and methyl undecylenate) and dicarboxylic acids (dimethyl esters of adipic and azelainic acids, etc.) with tert-butyl lithium is described. The reactions investigated led to tertiary alcohols, which were obtained with good yields, and ketones as intermediate products of the reaction.

Part 4 reviews reactions of the addition of organolithium compounds to double bonds of conjugated dienes and olefins. The industrial importance of reactions of this type (e.g., as applied in the industrial method of polymerization of butadiene to rubber in the presence of butyl lithium) is pointed out. K. Ziegler's (Germany) work in this field is discussed. A. A. Korotkov's (USSR investigations on the polymerization of dienic hydrocarbons (butadiene and isoprene) under the action of butyl lithium and the copolymerization of styrene with alpha-methylstyrene under the action of ethyl lithium (as compared with the same copolymerization in the presence of titanium terachloride and triethylaluminum) are mentioned.

A bibliography consisting of 130 references (21 of them USSR) is appended to the article, which was written with the intention of supplementing K. A. Kocheshkov and T. V. Talalayeva's review on the same subject published in 1949 (Sinteticheskiye Metody v Oblasti Metalloorganicheskikh Soyedineniy Litiya, Natiya, Kaliya, Rubidiya, i Tseziya [Synthetic Methods in the Field of Organometallic Compounds of Lithium, Sodium, Potassium, Rubidium, and Cesium], Academy of Sciences USSR, Moscow, 1949, pp 20-158).

28. Organophosphorus Research

"Investigation in the Field of Thiosulfonic Acids. III. Alkyl Esters of Phenylmethane Thiosulfonic Acid and Their Antibacterial Properties," by B. G. Boldyrev and Yu. I. Kofman, Zh. Obshch. Khimii, 1958, 28, No 3, 768-769, Moscow, (from Referativnyy Zhurnal--Khimiya, No 22, 25 Nov 58, Abstract No 74022 by Yu. Vol'kenshtein)



"The purpose of the present work is to investigate the effect which structural changes in esters of thiosulfonic acids (ET) have on the antibacterial activity; for this purpose a number of compounds of the formula $C_6H_5CH_2SO_2SR$ (I) were synthesized. A study of the antibacterial properties of (I) showed that their activity in relation to gram-positive, gram-negative, and acid-resistant bacteria is lower than that of esters of alkane thiosulfonic acids. The activity of (I) with respect to various fungi is markedly higher; hence, the activity of (ET) depends not only on the nature of the radicals bound to the sulfide sulfur, but also on the composition of the original thiosulfonic acids. The ester syntheses were realized by a method described in Reports I and II (cf. RZhKhim, 1957, Abstracts No 41042 and 77025). The values obtained for (I) were [listed in this order: R. yield in %, melting point in °C (from 40% alcohol)]: $C_2H_5$, 29.3, 70-71; $C_3H_7$, 44.4, 44; iso-$C_3H_7$, 21, 61-62; $CH_2=CHCH_2$, 33.8, 27; $C_4H_9$, 37, 34-35; iso-$C_4H_9$, 22, 44-45; $C_6H_5CH_2SO_2SK$, melting point 220-221° (from alcohol or $C_4H_9OH$).

"On the Problem of the Interactions of Chlorine-Substituted Tertiary Alcohols With Phosphorus Trichloride," by V. S. Abramov and V. K. Khairullin, Tr. Kazansk. Khim-Tekhnol. In-ta (Works of the Kazan' Chemicotechnological Institute), 1957, No 23, 65-76 (from Referativnyy Zhurnal--Khimiya, No 22, 25 Nov 58, Abstract No 74106 by V. Gilyarov)



$ROPCl_2$ (I) and $(RO)_2PCl$ (II) are formed by the reaction of $PCl_3$ with chlorine-substituted tertiary alcohols, but $(RO)_3P$ is not formed because of steric hindrance. Compounds of the formula $(RO)_2POH$ (III) are obtained by saponifying (II). By interacting (I) with R'OH (R' ≠ R), RO(R'O)PCl (IIa) are synthesized and, after saponification, (RO)(R'O)POH (IIIa) are obtained. Below are given the values for R (for the compounds (IIa) and (IIIa), also R'), yield in %, boiling point in °C/mm or the melting point in °C, for liquid substances the $n^{20}D$, $d_4^{20}$: $(CH_3)_2C(CCl_3)$, (I), 71, 118/16, 1.5236, 1.5280; (II), 78.5, 171/5, 1.5265, 1.5192; (III), —, 45-46; $\overline{CH_2(CH_2)_3C}(CCl_3)$, (I), 58.5, 127/5, 1.5425, 1.5215; (II), 52, 193-194/3 (melting pt. 57-58°), 1.5450, 1.4966; (III), -, -, 1.5235, 1.4770; $\overline{CH_2(CH_2)_4C}(CCl_3)$, (I), 72, 129-130/1 (melting pt. 55-56°), 1.5528, 15091; (III), -, 138-139; $(CH_3)_2C(CCl_3)$, $\overline{CH_2(CH_2)_3C}(CCl_3)$, (IIa), 77, 178-179/4, 1.5365, 1.5152 (melting pt. 39-40.5°); (IIIa), -, -, 1.5130, 1.4900; $(CH_3)_2C(CCl_3)$, $\overline{CH_2(CH_2)_4C}(CCl_3)$, (IIa) 58.5, 181-182/2, 1.5421, 1.5047; (IIIa), -, 67-69.

To obtain (I): 1 mole of $C_5H_5N$ at < 0° is added to a mixture of 1 mole of $PCl_3$ and 1 mole of alcohol in ether; the mixture is stirred for 1-2 hours at 20° and 30 minutes at 36°. The viscous and fuming liquids (I) are soluble in organic solvents. To obtain (II): 1 mole of alcohol is added to a chilled mixture of 1 mole of (I) and 1 mole of $C_5H_5N$ in ether; the mixture is boiled for 30 minutes. To 102.2 grams of (II) (R = $(CH_3)_2C(CL_3)$) 4.42 grams of water are added; on shaking a violent reaction is observed. (III) (where R = $(CH_3)_2C(CCl_3)$) are recrystallized from ether. Other (III) compounds are obtained analogously; the yields are nearly quantitatives. In the reaction of (II) with alcohol, the yields of (IIIa) are equal to 50-70%. To obtain $CH_2(CH_2)_3C(CCl_3)OH$ (IV), 75 grams of KOH are gradually added, for 4 hours with stirring, to a mixture of 810 grams of $CHCl_3$ with 500 grams of cyclopentanone at -18°; the mixture is stirred another 4 hours at -20° and then poured over one kilogram of ice and acidified; (IV) are extracted by ether; yield 18.5%, boiling point 97-98°/13 mm, $n^{20}D$ 1.5085, $d_4^{20}$ 1.3854 and melting point of 19-20°.

29. Some New Arylsulfamides Prepared

"On the Reactions of Arylsulfonamides With Propylene Oxide," by A. Ye. Kretov and Ye. A. Abrazhanova, Dnepropetrovsk Chemico-technological Institute; Leningrad, Zhurnal Obshchey Khimii, Vol 28, No 10, Oct 58, pp 2779-2782

The reactions between three arylsulfonamides, the benzene-, para-chlorobenzene-, and para-toluene-sulfonamides, and propylene oxide were investigated. The reaction proceeds in two stages. Depending on the conditions of the reaction one can obtain either mono- or di-substituted arylsulfonamides.

$$ArSo_2NH_2 + RCH\text{-}CHR \rightarrow ArSO_2NHCHR\text{-}CHROH \quad (1)$$

$$ArSO_2NH_2 + ZRCH\text{-}CHR \rightarrow ArSO_2N(CHR\text{-}CHROH)_2 \quad (2)$$

The following compounds were prepared for the first time and characterized: N-beta-hydroxyisopropylbenzenesulfonamide, N-beta-hydroxy-isopropyl-para-toluenesulfonamide, N-beta-hydroxy-isopropyl-para-chlorobenzenesulfonamide, N-beta, beta'-dihydroxy-diisopropyl-para-toluenesulfonamide, N-beta, beta'-dihydroxy-diisopropyl-para-chloro-benzenesulfonamide, N-beta-chlorodisopropyl-benzenesulfonamide, N-beta, beta'-dichlorodiisopropyl-para-toluenesulfonamide, N-beta, beta'-dichlorodiisopropyl-para-chlorobenzenesulfonamide and N-beta-acetyliso-propyl-benzenesulfonamide.

30. Antituberculosis Compounds Tested

"The Synthesis of the Hydrazides and Hydrazones of Several Hetero-cyclic and Aromatic Acids," by Ye. S. Nikitskaya, Ye. Ye. Mikhlina, L. N. Yakhontov, and V. Ya. Furshtatova, All-Union Scientific Research Chemicopharmaceutical Institute imeni S. Ordzhonikidze; Leningrad, Zhurnal Obshchey Khimii, Vol 28, No 10, Oct 58, pp 2786-2790

The hydrazides and hydrazones of the following acids were synthesized and tested for the purpose of studying their antituberculosis activity: pyridyl-4-acetic, beta-(pyridyl-4)-propionic, beta-(piperidyl-4)-propionic, beta-(pyridyl-4)-acrylic, 6-methylpicolinic, alpha-quinuclidinecarboxylic, and para-nitro-benzoic.

Tests in vitro showed that these compounds are considerably less active than the corresponding derivatives of isonicotinic acid which have exhibited significant anti-tuberculosis activity in vitro as well as in vivo.

31. New Cocaine Synthesis Method

"Synthesis of the Alkaloid Cocaine," by G. I. Bazilevskaya, M. S. Bainova, D. V. Gura, K. M. Dyumaev, and N. A. Preobrazhenskiy, Chair of the Technology of Medicinal and Aromatic Substances, Moscow Intitute of Fine Chemical Technology; Ivanovo, Izvestiya Vysshykh Uchebnykh Zavedeniy -- Khimiya i Khimicheskaya Technologiya, No 2, May 58, pp 75-81

A new method for synthesizing the alkaloid cocaine has been developed at the Moscow Institute of Fine Chemical Technology. The over-all results of this work have been as follows:



"1. The development of a method for the synthesis of the hydrochloride of racemic cocaine.

"2. Investigation of the condensation of succinic dialdehyde with methylamine and the dipotassium salt of the monomethyl ester of acetone dicarboxylic acid to the methyl ester of tropane-3-one-2-carboxylic acid.

"3. Development of a method for the quantitative determination of the content of methyl ester of tropane-3-one-2-carboxylic acid in the reaction mixture on the basis of the amount of reineckate insoluble in water that is formed.

"4. The realization of stereo-specific reduction of the methyl ester of tropane-3-one-2-carboxylic acid to the methyl ester of racemic ecgonine.

Pharmacological tests of synthesized samples were conducted at the Minsk Medical Institute by Prof K. S. Shadurskiy and Aspirant N. A. Iskarev. The tests revealed that in some cases it is best to use racemic cocaine because it is not inferior in physiological activity to levo-(natural) cocaine and furthermore exhibits a lower toxicity than the latter.

32. Some New Toxic Fluorine Compounds

"Synthesis of Some Physiologically Active Substances," by T. V. Smirnova, N. M. Dukel'skaya, and Yu. A. Kondrat'yev, Moscow Chemicotechnological Institute imeni D. I. Mendeleyev and Biology-Soil Faculty of the Moscow State University imeni M. V. Lomonosov; Ivanovo, Izvestiya Vysshikh Uchebnykh Zavedeniy -- Khimiya i Khimicheskaya Tekhnologiya, No 2, May 58, pp 82-86

The purpose of this work was to synthesize and study physiologically active compounds containing fluorine which could be used as raticidal agents. Six new halogen-containing derivative phenyl ethers were synthesized and characterized. They were the para-chlorophenyl-beta-fluoroethyl ether, para-fluorophenyl-beta-fluoroethyl ether, the phenyl-beta-fluoroethyl ether, the para-bromophenyl-beta-fluoroethyl ether, and the para-fluorophenyl-beta-bromoethyl ether.

That the compounds have physiological activity was confirmed by tests on white rats. Toxic properties were exhibited by the following ethers: para-chlorophenyl-beta-fluoroethyl, phenyl-beta-fluoroethyl, para-fluorophenyl-beta-fluoroethyl, and para-bromophenyl-beta-fluoroethyl, and by para, para'-di (beta-fluoroethoxyphenyl)-dimethylmethane.

It was found that para, para'-di (beta-fluoroethoxyphenyl)-dimethylmethane possesses raticidal properties. The lethal doasage for white rats was equal to 120-140 mg/kg, and for Mirotinae) 0.25 mg/100 g of body weight. Because of the high sensitivity of Microtinae to this compound, its use as a field extermination agent was proposed.

33. Review of Soviet Organophosphorus Insecticides

"Organophosphorus Insecticides and Acaricides," by Prof N. N. Mel'nikov, Doctor of Chemical Sciences, Scientific Institute of Fertilizers and Insectofungicides; Moscow, Zashchita Rasteniy ot Vrediteley i Bolezney, No 5, Sep-Oct 58, pp 13-15

In this article Prof N. N. Mel'nikov of NIUIF [Nauchnyy Institut po Udobreniyam i Insektofungitsidam, Scientific Institute of Fertilizers and Insectofungicides] reviews the Soviet use and planned usage of certain organophosphorus insecticides in agriculture.

In the Soviet Union at present the following organophosphorus contact insecticides have been studied and have come into use: Thiophos (also known as NIUIF-100) - 0,0-diethyl-0,4-nitro-phenylthiophosphate; Metaphos (vofatoks)

- O,O-dimethyl-O,4-nitrophenylthiophosphate; Carbophos (malathion) - 1,2-dicarboethoxyethyl-O,O-dimethyldithiophosphate; Chlorophos - 1-hydroxy-2,2,2-trichloroethyldimethylphosphonate; and Dithiophos - tetraethyldithio-pyrophosphate.

Among the toxic chemicals possessing systemic activity to be introduced extensively into production are mercaptophos - O,O-diethyl-2-ethylmercapto-ethyl-thiophosphate; Methylmercaptophos - O,O-dimethyl-2-ethylmercaptoethyl-thiophosphate; Octamethyl - octamethyltetraamide of pyrophosphoric acid; and Preparation M-81 - dimethyl-2-ethylmercaptoethyldithiophosphate.

The first group of enumerated preparations can be used against pests affecting very different agricultural crops by spraying an equeous emulsion or suspension or by dusting. To prepare an equeous emulsion, OP-7 or OP-10 is used as an emulsifier. The toxicity of these preparations persists for not more than 3 days. Arranged in an increasing order of toxicity to man and animals, they are Carbophos, metaphos, methylethylthiophos [sic], thiophos, and dithiophos.

All the above-mentioned insecticides, in one way or another, are of interest for use in agriculture. At the same time, in deciding on the question of the development of their production in the approaching Seven-Year Plan, it is necessary to consider many factors: effective action on pests, availability of raw materials, simplicity of production, the quantities which have to be used and the cost of the preparation, and the toxicity to man and animals.

Calculations have shown that the cheapest chemicals are metaphos and methylethylthiophos, while the costliest is carbophos. Hence, the principal representative of this group produced in the coming years will be metaphos, while methylethylthiophos will be produced in lesser quantities. The production of dithiophos can be organized at the production facilities for methylethylthiophos or mercaptophos and therefore will not require additional capital expenditure. In spite of its greater cost, it is expedient to organize the mass production of carbophos when its low toxicity to man and animals is considered. It will find very extensive application in combating sucking pests in collectives and in individual orchards and gardens of workers and farmers.

The chemical industry is planning, in the near future, to organize the production of metaphos, methylethylthiophos, and other organophosphorus contact insecticides in such quantities as will meet the demands of agriculture. It is contemplated that the production of carbophos will be organized in two stages; at first at a small plant which will begin operation in 1959-60, and then a further expansion to mass production so that a supply sufficient for the needs of the country will be ensured.

Among the contact poisons a special place is held by chlorophos, chiefly because of its activity in combating the cattle skin gadfly and flies. It is possible that it will find use even against some plant pests, in particular those damaging cotton and fruit crops. The production of chlorophos in the near future, will be on a scale corresponding to the interests of agriculture.

Among the, group of toxic systemic-action chemicals at present, the following have been sufficiently studied and recommended for use in plant protection: mercaptophos, octamethyl, methylmercaptophos, and M-81. The first two are being supplied to agriculture at the moment, but only in small quantities. To attain adequate supplies, the full-scale production of mercaptophos is contemplated in 1959, and of octamethyl in 1961-62.

It should be noted that these two substances are extremely toxic, owing to which public health officials and plant protection workers have urged their replacement by other insecticides which are safer to man and domestic animals. With this end in view, mercaptophos is scheduled to be replaced gradually by methylmercaptophos, which will serve the same purpose and is much cheaper to produce. Its production can be organized using the same equipment used for the production of mercaptophos and consequently does not require any great additional capital expenditure. Because of its lower toxicity to man and animals, methylmercaptophos will undoubtedly find wide application in the protection of some fruit crops.

A second possible substitute for mercaptophos is the substance M-81, which, as far as its toxicity to man and warm-blooded animals is concerned, is close to methylmercaptophos, although it is somewhat more expensive than the latter. In view of the many-sided character of Soviet agriculture, the organization of the production of this chemical is being planned at rates which will be specified. In any case, the construction of a special plant department is required. To some degree, the production of M-81 can be coupled with the production of carbophos since the initial intermediate for both compounds is dimethyldithiophosphoric acid.

Together with ensuring the agricultural facilities with organophosphorus insecticides already known, scientific research is continuing the search for new effective toxic chemicals, both contact- and systemic-action types. A basic aim of the research is the discovery of substances which are not only effective in combating plant pests but, also safer from the standpoint of both production and application. Up to the present time, a number of new interesting insecticides have been found which deserve further careful study. Among them should be mentioned substances with the following general formulas:

$(RO)_2 P(=O)-CH_2COSR'$ and $ArO(RO)P(=S)-NR'_2$.

Another contact-action insecticide being studied and synthesized in the laboratories of A. Ye. and B. A. Arbuzov is dimethyldiethyldithiopyrophosphate, which is considerably less toxic to animals than tetraethyldithiopyrophosphate (dithiophos).

## Radiation Chemistry

### 34. Work on the Radiation Chemistry of Polymers at the Physicochemical Institute imeni L. Ya. Karpov

"Materials Change Their Properties," by A. Paparnaya; Moscow, Promyshlenno-Ekonomicheskaya Gazeta, No 5, (460), 11 Jan 59

At one of the laboratories of the Physicochemical Institute imeni L. Ya. Karpov a new type of polyethylene for use as an electrical insulating material has been developed by irradiating ordinary polyethylene with cobalt-60. Ordinary polyethylene cannot be used as an electric insulating material at the temperature of 100°, because it softens and begins to flow at 80-90°. On the other hand, the new type of polyethylene, which has been cross-linked by irradiation, can be used at 150-180° for any length of time without undergoing deterioration. The use of the newly developed polyethylene insulation reduces the dimensions of motors and transformers. Insulation of this type is needed for new high-capacity electric power stations and for long power transmission lines. This type of polyethylene will also be useful in machine building and the construction of instruments. Other uses for polyethylene treated by irradiation will be as a material for chemical laboratory wear that will be resistant to strong acids and alkalis and as a material for equipment to be used in the petrochemical industry.

The use of polyethylene pipelines appear to be very promising. Production of pipes from polyethylene is simple. This material is corrosion-proof: pipes made of polyethylene will be suitable for petroleum, acids, gasoline, and alkalis. If the pipes are made of irradiated polyethylene, it will be possible to pump hot liquids through them.

In a laboratory headed by V. L. Karpov, wood has been impregnated with solutions of styrene, acrylonitrile, or some other monomer. After the wood treated in this manner has been subjected to irradiation, the monomer polymerizes and becomes strongly bound to the molecules of the wood. The new material combines the properties of wood with those of the polymer. The compression strength of ordinary wood, which amounts to 395 kg per sq cm, becomes 3 1/2 times greater after the wood has been modified in the manner described. The new material preserves its dimensions when exposed to moisture and to the effects of the atmosphere. After being kept for 20 days in water, a slab of ordinary wood weighing one kg increased

in weight to 3 kg and 800 grams. A slab of wood weighing one kg, which had been treated with a monomer and then subjected to irradiation, showed an increase in weight amounting to only 295 grams after the wood had been kept under water for the same length of time.

Although capron cord is of great advantage in the manufacture of tires because of its strength and durability, it does not adhere well to rubber: during the use of the tire, the bond between the rubber and the capron cord loosens. According to Yu. M. Malinskiy, senior scientific associate at one of the laboratories of the Institute imeni Karpov, the problem of producing by means of irradiation a layer on the surface of the capron cord which would adhere well both to the capron and to the rubber is being studied.

Work will also be done on waterproofing very thin fabrics by exposing them to irradiation. By subjecting capron to the action of radiation emitted by radioactive substances, this material can be made heat-resistant: fabrics made of irradiated capron will not be damaged by ironing with a hot iron. Another possibility of radiation-chemical processing is improvement of the dyeing properties of synthetic fibers such as nitron, lavsan, enant, and khlorin, which at present cannot be dyed readily.

35. Chemical Dosimeter Type in Czechoslovak Laboratory

"A Simple Chemical Dosimeter," by Jiri Teply, Institute of Nuclear Physics of the Czechoslovak Academy of Sciences, and Jaroslav Bednar, "Antonin Zapotocky" Military Technical Academy, in Brno; Prague, Jaderna Energie, No 9, Sep 58, pp 262-265

The article describes the main chemical characteristics of a saturated solution of chloroform in water in relation to its behavior toward radiation and discusses the applicability of this chloroform solution in chemical dosimetry in the laboratory.

[For additional information on radiation chemistry, see Item No 17.]

## Radiochemistry

36. Czechoslovak Isotope Production

"We Have Our Own Isotopes" (unsigned article); Prague, Obrana Lidu, 20 Dec 58, p 1

Although the first Czechoslovak reactor at the Institute of Nuclear Physics (Ustav jaderne fysiky) in Rez is not yet working at full capacity, because some auxiliary equipment has not been installed, the institute has

already conducted more than 100 irradiations and has begun production of isotopes for use at the institute itself and other institutions. The radioactive iodine being produced at the institute is used to make preparations which are used at the Endicrinological Institute (Endokrinologicky ustav) in Prague for treating thyroid gland diseases. Methods of preparing radioactive sulfur, phosphorus, arsenic, and gold have been worked out. All these methods will be used to a greater extent next year when radioisotopes will be produced in greater quantities. The institute has also prepared suspensions of chromium phosphate with radioactive phosphorus for clinical use.

[For additional information on radiochemistry, see Item No 18.]

## IV. ELECTRONICS

### Communications

37. Horn-Parabolic Antenna

"Horn-Parabolic Antenna for Radio-Relay Communication Lines With 'Vesna' Equipment," by A. A. Metrikin and V. K. Paramonov; Moscow, Vestnik Svyazi, No 11, Nov 58, pp 4-6

The horn-parabolic antenna, which is a combination of a part of a paraboloid of revolution and a pyramidal horn the apex of which coincides with the focus of the paraboloid, satisfies most of the requirements imposed by the radio-relay systems. Such an antenna, intended for use on radio-relay lines having the "Vesna" equipment, consists of three distinct parts all connected by bolts: parabolic reflector with the side walls and protective cover, pyramidal horn proper, and horn matching junction. The parabolic reflector and the side walls of the horn portion of the antenna are assembled from welded aluminum sheets 2 mm thick, and mounted on a steel-angle welded frame. The frame of the parabolic reflector is assembled with angle spars, bent to a specified profile. The parabolic mirror is formed from an aluminum sheet over a concrete hump-mold. The accuracy of mirror fabrication is ± 2 mm. The antenna is provided with a rotating device which permits smooth rotation within a range of $\pm 7^{\circ}$ in the horizontal plane and a range of $\pm 5^{\circ}$ in the vertical plane. The antenna aperture is covered with a hermetically sealed cover of a dielectric material which practically reflects no electromagnetic energy.

An excess pressure of dry air inside the antenna is obtained with the aid of an AD-4 dehydrator, which supplies 20 liters of dry air per min. The traveling-wave ratio in the feed waveguide of the antenna was found to be about 0.97 in the frequency range of 3,450-4,150 Mc.

The over-all dimensions of the antenna are as follows: height 620 cm, width 390 cm, depth 320 cm, aperture area 7.5 $m^2$, antenna volume 11 $m^3$, weight 990 kg, and weight with rotating device 1,370 kg.

38. New Soviet TV Receivers

"TV Receivers 'Rubin-102' and 'Almaz-102'" (unsigned article); Moscow, Vestnik Svyazi, No 11, Nov 58, inside cover

A Moscow TV equipment plant has designed the new-model TV receivers "Rubin-102" and "Almaz-102." The TV receiver "Rubin-102" is designed for reception on 12 TV channels and FM-UHF radiobroadcasts. This TV set has

19 vacuum tubes, its sensitivity is better than 100 microvolts, its power consumption is about 150 w, and the screen size is 270 x 360 mm. The set has two 1-GD-9 loudspeakers. The "Almaz-102" set has four loudspeakers and a 340 x 450 mm screen.

## Components

### 39. Frequency Dividers

"Frequency Divider With Direct Locking," by T. S. Fedosova and K. A. Samoylo; Moscow, Radiotekhnika i Elektronika, No 1, Jan 59, pp 43-53

The article analyzes the theory of operation of a direct locking frequency divider which differs from a conventional self-excited oscillator by the presence of synchronizing emf. The phase-pulse method which negleced the effect of harmonics was used to study the circuit.

The purpose of this research was to prove the accuracy of theoretically calculated formulas. The dependence of oscillation amplitude and frequency-division band on the following values were determined experimentally: division factor and the number of sync pulses, width of the reference pulse, duration of the sync pulse, phase shift in the feedback circuit, and voltage amplitude in feedback coupling and amplitude of sinusoidal sync voltage. Satisfactory agreement between the experimental data and the theoretical showed that the theory of frequency divider operation, derived without taking into account the effect of harmonics, is fully satisfactory for engineering purposes.

### 40. High-Sensitivity Bolometer

"Bolometer for Registration of Pulsating Light Flux," by Ya. A. Imas, State Optical Institute; Moscow, Pribory i Tekhnika Eksperimenta, No 6, Nov-Dec 58, pp 100-101

The bolometer described differs from existing instruments in that it permits direct registration of light flux with a high degree of resolution. The standard semiconductor bolometer of $1.5 \times 10^3$ v/w sensitivity is used as a luminous-flux pickup. The device incorporates in its electronic circuit two 6N2P triodes, one 6N1P double triode, and an electromagnetic oscillograph MPO-2.

The characteristics of the instrument are as follows: maximum sensitivity for the whole scale is 0.2 cal/cm$^2$ sec, spectrum sensitivity is uniform in the range of 0.4-3 microns, time constant after correction is $2 \cdot 10^{-3}$ sec, and the error in reproduction of calibration signal is $\pm 5\%$.

41. New Soviet Transistor Radio

"Newest Soviet Transistor Radio" (unsigned article); Paris, L'Humanite, 30 Jan 59

The article was accompanied by a photograph of the "newest Soviet transistor radio" described as a "pocket sputnik." It is said to pick up and rebroadcast the "bips" of the artificial satellites.

## Computers and Automation

42. Method of Selecting Logical Operations Permitting Their Accomplishment on Digital Computers

"Method of Selecting Logical Operations and Mechanisms for Effecting Their Accomplishment on Digital Computers," by G. G. Lyubchenko; Kiev, Ukrainskiy Matematicheskiy Zhurnal, Vol 10, No 4, Oct/Nov/Dec 58, pp 375-388

A method of selecting and appraising a set of logical operations is described which can be constructively applied in a universal or specialized computing machine. The author shows that it is expedient to apply only 11 logical operations from which only 2,037 sets may be composed which are practicable in a universal machine. The application of a logical constant frequently leads to simplification of the mechanism and to shortening of the time required by the machine for calculation. The appraisal and selection of the sets of operations are carried out in accordance with the constructive complexity of the machine aggregates which effect the selection, with the rate of calculating the Buhl functions, with the energy expended by the aggregates, and with various combinations of these three factors. On selecting a set of operations, the appraisal should be carried out in three stages (an initial, rough, and final estimate) which, as is shown, makes it possible to estimate all the 2,037 sets by examining a relatively small number of sets.

43. Calculus of Assertion Formulas of Bivalent Logic

"Methods for Determining the Identical Truth or Falsity of the Calculus of Assertion Formulas of Bivalent Logic," by G. G. Lyubchenko, Calculation Center of the Academy of Sciences Ukrainian SSR; Kiev, Dopovidi Akademiy Nauk Ukrayns'koy RSR, No 11, Nov 58, 1153-1156

The article gives five sets of rules enabling one to determine identically true or false formulas of the calculus of assertion formulas expressed solely by means of logical operations of one of the 16 combinations of these operations. The rules are designed for transformation

into algorithms which can be worked out on computers. These rules differ by a number of properties from those of the known method of determining identical truth or falsity of formulas. The rules are effective for the given purpose because of these properties.

44. Likely Locations for New Computer Installations Listed

"List of Higher Educational Institutions at Which Intervuz Computer Installations Should Be Established" (unsigned article); Byulleten' Ministerstva Vysshevo Obrazovaniya SSSR, No 9, Sep 58, p 9

A list of higher educational institutions (VUZes) is given at which intervuz computer installations should be established. The list follows.

Moscow

Power Engineering Institute

Moscow Higher Technical School imeni Bauman

Aviation Institute

Moscow Chemicotechnological Institute imeni D. I. Mendeleyev

Leningrad

Polytechnic Institute imeni M. I. Kalinin

Electro-technical Institute imeni V. I. Ul'yanova (Lenin)

Opticomechanical Institute

Leningrad Chemicotechnological Institute imeni Lensovet

Minsk

Belorussian Polytechnic Institute

Baku

Azerbaydzhan Polytechnic Institute

Yerevan

Polytechnic Institute

Odessa

Polytechnic Institute

Sverdlovsk

Ural Polytechnic Institute

Tashkent

Central Asia Polytechnic Institute

Tbilisi

Georgian Polytechnic Institute

Tomsk

Polytechnic Institute

## Instruments and Equipment

### 45. Series Ionic Converter

"Performance Analysis of a Series Ionic Converter," by A. Ye. Slukhotskiy, A. S. Vasil'yev, and V. M. Martsinovich; Moscow, Radiotekhnika i Elektronika, No 1, Jan 59, pp 63-69

Sonic and ultrasonic (hydrogen gate) frequency generators feeding power to various types of oscillators can be built on the principle of the series converter. The following frequencies can be generated by a series converter when utilizing different gating devices: with mercury gate up to 3,000 cycles, with inert-gas gate from 6,000 to 7,000 cycles, and with hydrogen gates up to 30,000 cycles. In the latter case an appreciable output can be realized only for pulsed operation.

The article analyzes the performance of a series ionic converter that can be utilized as a source of higher-frequency current. Conditions are determined at which the load voltage acquires nearly sinusoidal form and the operation becomes stable. The latter characteristic of a series ionic converter is not present in the more commonly used parallel ionic converters.

The calculated characteristics for a series ionic converter were in close agreement with the experimental data (discrepancy not greater than 10%).

46. Methods of Accelerometer Calibration

"Methods and Instruments for Calibration and Testing Accelerometers," by S. S. Shchedrovitsiy; Moscow, Izmeritel'naya Tekhnika, No 6, Nov/Dec 58, pp 87-93

Wide use of accelerometers in quality control of machine building (machine tools, pumps, motors etc.) and as flight data-units of aircraft, has necessitated the development of new methods for accurate calibration and testing of accelerometers.

P. N. Agaletskiy has developed a differential method for checking and calibrating the accelerometers. According to this method, the instrument is first set at a distance $r_1$ from the axis of rotation and is tested for the angular velocity $w_1$. Then the instrument is reset at a distance $r_2$ and an angular velocity $w_2$ is selected so that the output signal is equal to one obtained for the first setting. The acceleration is then calculated by the formula

$$a = \frac{r_1 - r_2}{w_2^2 - w_1^2} w_1^2 w_2^2$$

For the purpose of dynamic testing of accelerometers, the vibration stand VS 300-P was designed at the All-Union Scientific Research Institute of Metrology imeni D. I. Mendeleyev. This stand was designed for operation in a vibration range of 100-10,000 cycles and for a maximum amplitude of 0.5 mm. The platform can be set at any angle with the horizontal plane. The stand has two electrodynamic vibrators, a sound generator for frequencies up to 10,000 cycles, and a TU-600 power amplifier. Maximum permissible load on the platform is 5 kg. Such electrodynamic vibration stands for calibration of accelerometers are in use at the Central Scientific Research Institute of Technology and Machine Building (TsNIITMASH).

A piezoelectric vibration stand for operation at frequencies higher than 10,000 cycles was developed at TsNIITMASH. The dynamic component of such a stand is made up of a set (about 40) of piezoceramic (generally barium titanate) rings energized with a sinusoidal voltage. An effective acceleration of 120 g can be obtained at a vibration frequency of 20,000 cycles.

A calibration stand of the falling-hammer type is used to reproduce acceleration impulses of very high value, up to 100,000 g.

47. Coincidence Analyzer

"Time Analyzer," by V. V. Okorokov; Moscow, Pribory i Tekhnika Eksperimenta, No 6, Nov/Dec 58, pp 63-67

The article describes a 112-channel coincidence (time) analyzer with a minimum width channel of one microsec, which permits registering several pulses during a single cycle. The coincidence circuit of the analyzer is built in the form of a matrix, so that the time-delay is applied to both the trigger pulse and the investigated pulse. The circuit will conduct only when tow registered pulses appear in the same channel and when the mechanical counter is in operation. Such a registration of pulses in various channels is carried out independently, one of the other.

The circuit incorporates the following components: master quartz oscillator which generates a series of one-microsec trigger pulses, a frequency divider which transforms the one-microsec pulses into 8-microsec pulses, first blocking oscillator which is connected to a 14-cell "slow" commutator switch, the phasing circuit to which the examined pulse is fed, and the second blocking oscillator connected to "fast" commutator switch. The "slow" commutating switch has 14 cells and the "fast" commutator switch has 8 cells, thus forming a total of 112 channels (14 x 8 112) in the matrix. The coincidence of pulses in one of the cells of the "fast" switch with that of a pulse in the "slow" switch is registered by a mechanical counter. The analyzer utilizes 6P9, 6Zh4, 6N15A, and 6N15P tubes.

The analyzer performed satisfactorily during the several months of the test run.

48. Czechoslovak Laboratory Instruments

"We Are Exporting Laboratory Instruments" (unsigned article); Prague, Obrana Lidu, 23 Dec 58, p 2

The article states that the Laboratory Instruments National Enterprise (Narodni podnik Laboratorni pristroje) in Czechoslovakia is making the following instruments: the "Minor" photocolorimeter, which is smaller and cheaper to manufacture than previous types, but which works as well; a smoke meter (kouromer) for measuring the intensity of combution engines and for measuring soot in exhaust fumes; a perfected dosimeter, which looks like a wrist watch and accurately measures the radioactivity in the air; a nuclear particle counter, the "Dostra," for which Czechoslovakia has a world patent; and a microphotometer, which uses electronic tubes.

The article states that instruments made at the Laboratory Instruments National Enterprise are exported to South America, China, Japan, Portugal, Egypt, Mexico, Pacific Islands, and other places.

## Radar

### 49. Radar Signal Detection in Presence of Interference

"Signal Detection With the Background of Normal Noise and Random Reflections," by V. D. Zubakov; Moscow, Radiotekhnika i Elektronika, No 1, Jan 59, pp 28-38

The article discusses the theory of optimum radar signal detection in the presence of normal noise and random reflections from surrounding objects. A special case was examined for detection of coherent-sequence signals under the conditions of known Doppler frequency and unknown initial high-frequency phase. The investigation of a case when the Doppler frequency is not known presents considerable difficulties, but the problem can be reduced to simpler terms if the signal is transmitted in two coherent blocks.

## V. ENGINEERING

### 50. Resonance Transformer

"Resonance Transformer," by A. A. Kosovskiy; Moscow, Elektrichestvo, No 12, Dec 58, pp 22-26

The author developed a resonance transformer (authorship certificate No 103446 METP SSSR) for testing the insulation of large electrical equipment (hydrogenerators, cables, etc.) with high voltage. The inductance of the resonance transformer and the capacitance of the tested electrical equipment are matched to form a resonant circuit. The transformer is of core type with an adjustable upper yoke, which can be raised to any desired height by four jacks. Each core has two air gaps, the upper of which can be regulated. The transformer is designed to supply 16 kv to the tested electrical equipment having capacitance of approximately one microfarad and loss-angle tangent up to .25.

[For additional information on engineering [subjects, see Items Ha 26, 93, and 94.]

## VI. MATHEMATICS

### Approximation Theory

51. The Error Introduced by Solving a System of Differential Equations in Partial Derivatives by the Finite Difference Method

"Estimate of the Error of Solving a System of Differential Equations in Partial Derivatives by the Finite Difference Method," by V. S. Skvortsov; Moscow, Uspekhi Matematicheskikh Nauk, Vol 13, No 6 (84), Nov/Dec 58, pp 155-160

An estimate of the error introduced by solving the first boundary value problem for an elliptical system of linear differential equations in partial derivatives of the second order having constant coefficients, and homogeneous according to the order of differentiation, by the finite difference method for the case of two and three dimensions is given.

52. Linear Positive Polynomial Operators in the Approximation of Functions of Class $Z_2$

"Concerning One Asymptotic Property of Positive Methods of Summing Fourier Series and the Best Approximation of Functions of the Class $Z_2$ by Linear Positive Polynomial Operators," by P. P. Korovkin; Moscow, Uspekhi Matematicheskikh Nauk, Vol 13, No 6 (84), Nov/Dec 58, pp 99-103

Let

$$u_n(t) = 1/2 + \sum_{h=1}^{n} \rho_k^{(n)} \cos kt \geq 0$$

be an even, positive trigonometric polynomial of order n. We set

$$L_n(f,x) = 1/\pi \int_{-\pi}^{\pi} f(x+t)\, u_n(t)\, dt. \qquad (1)$$

It is clear that $L_n(f,x)$ is a positive linear operator, the value of which for each integrable function $f(x)$ is a trigonometric polynomial of an order not greater than n. It is known (see P. P. Korovkin, "Concerning the Convergence of Linear Positive Operators in the Space of Continuous Functions", DAN Vol 90, 1953) that the sequence $L_n(f,x)$ converges uniformly to $f(x)$, $f(x) \in c_{2\pi}$, if

$$\lim_{n\to\infty} \rho_1^{(n)} = 1. \qquad (2)$$

In the present work the case is investigated when the order of $L_n(f,x)$, the approximation to $f(x)$, depends only on the value of the second generalized derivative of $f(x)$ at the point x, i.e., when

$$\lim_{n\to\infty} \frac{L_n(f,x) - f(x)}{L_n(\psi,x) - \psi(x)} = \frac{D_2 f(x)}{D_2 \psi(x)}, \qquad (3)$$

where

$$D_2 f(x) = \lim_{t\to 0} \frac{f(x+t) - 2f(x) + f(x-t)}{t^2}.$$

53. Approximation of Class Z Functions by Certain Polynomial Operators

"The Order of Approximation of Class Z Functions by Certain Polynomial Operators," by I. M. Petrov; Moscow, Uspekhi Matematicheskikh Nauk, Vol 13, No 6 (84), Nov/Dec 58, pp 127-131

A function periodic with period $2\pi$ is said to belong to the class Z if the inequality

$$f(x+h) - 2f(x) + f(x-h) \leq 2h$$

is satisfied for all x and h.

Let

$$D_{2n-2}(f,x) = \frac{3}{2\ n(2n^2+1)} \int f(t) \left[n + 2\sum_{k=1}^{n-1} (n-k)\cos k(t-x)\right]^2 dt$$

be the operator of Jackson.

We then set

$$b_n = \sup_{f(x)\ Z^{2n}} f(x) - D_{2n-2}(f,x).$$

Two theorems are then proved, namely:

Theorem I -- The equality

$$\lim_{n-} b_n \qquad \frac{12 \ln 2}{\pi} \text{ is valid.}$$

Theorem II -- The equality

$$\lim_{n-} b'_n = \int_0^{\pi} \frac{\sin x}{x}\, dx - \frac{4}{\pi} \text{ holds.}$$

54. Methods of Cesaro and Abel Used in the Summation of Double Series

"Summation of Double Series by the Methods of Cesaro and Abel in a Restricted Sense," by I. I. Ogiyevetskiy; Moscow, Uspekhi Matematicheskikh Nauk, Vol 13, No 6 (84), Nov/Dec 58, pp 119-125

A notion of summability of a double series in a restricted sense, based on the utilization of a bounded limited transition, was required when it arose in the theory of double Fourier series, where its application makes it possible to obtain results of a more general character, than the use of ordinary summability based on the limited transition of Pringsheim (see C. N. Moore, "On the Summability of the Double Fourier Series of Discontinuous Functions," Math. Ann. Vol 74, 1913, 555-572; J. Marcinkiewicz, A. Zygmund, "On the Summability of Double Fourier Series," Fund. Math., Vol 32, 1939, 122-132).

Use of the bounded limited transition was also proved effective in other investigations to some degree or the other in connection with the theory of functions of two variables, for example, in the approximation of functions of two variables by trigonometric polynomials and by Berstein polynomials, in the interpolation of functions of two variables by a trigonometric polynomial (see Kipriyanov, "Convergence and Summation of Trigonometric Interpolation Polynomials for Functions of Two Variables," DAN, Vol 97, No 6, 1954), and in the summability of double Sturm-Liouville series, etc.

In connection with this there is interest in the investigation of bounded limited transition in application to the summing of double numerical series -- the summing of double numerical series in the restricted sense.

In the present work the summation of double numerical series in the restricted sense by the methods of Abel and Cesaro is considered.

55. Convergence of a Power Series Representing the Solution of a Differential Equation

"Concerning the Region of Convergence of a Power Series Representing the Solution of a Differential Equation," by P. T. Reznikovskiy; Moscow, Uspekhi Matematicheskikh Nauk, Vol 13, No 6 (84), Nov/Dec 58, pp 145-150

In studying the motion of planets, perturbations of the elements of the orbits are generally represented in the form of infinite series. Estimates of the regions of convergence of power series satisfying differential equations are known ([1], [2], [3]). All these estimates are based on application of a majorizing differential equation, the right side of which is a Cauchy majorant.

A. M. Lyapunov [4] used a finite (not differential) majorizing equation with a Cauchy majorant for investigation of the convergence of series ordered according to the degrees of the initial data. Nevertheless, the calculations, traced by the author, frequently lead to results of no practical significance.

In the present work the author considers the conditions of convergence of a series, satisfying a differential equation and ordered according to the degrees of a small parameter.

For this case a terminating majorizing equation is introduced (containing a small parameter) with an arbitrary majorant.

1. A. M. Lyapunov, "Concerning the Conditions of Motion in a Particular Case of the Three Body Problem," Soobshch Matem. ob-va 2-ya Seriya, Vol 2, No 1, 2 (1889).

2. H. Poincare, Les Methodes Nouvelles de la Mecanique Celeste, Vol I, Paris, 1892.

3. V. V. Golubev, Lektsii po Analiticheskoy Teorii Differentsial'nykh Uravneniy, (Lectures on the Analytical Theory of Differential Equations), Moscow-Leningrad, Gostekhizdat, 1952.

4. A. M. Lyapunov, Obshchaya Zadacha ob Ustoychivosti Dvizheniya (General Problem Concerning the Stability of Motion), Moscow-Leningrad, Gostekhizdat, 1952.

## Information Theory

### 56. Ergodic Transfer and Stationary Transfer Capabilities Related

"Remark concerning the Transfer Capability of a Stationary Channel with a Finite Memory," by I. P. Tsaregradskiy; Moscow, Uspekhi Matematicheskikh Nauk, Vol 13, No 6 (84), Nov/Dec 58, pp 49-61

A. Ya. Khinchin gave a mathematically rigorous proof for the case of discrete information of the functioning of systems of communication within the premises of a stationary system (A. Ya. Khinchin, "Concerning the Basic Theorems of the Theory of Information," UMN Vol 11, No 1, 1956, 17-75). Nevertheless, there remains uncertainty concerning questions of the possibility of substantiating the inverse assertions of these theorems.

The purpose of the present work is to establish the exact relation between the ergodic transfer capability $C_e$, introduced in the article cited, and the stationary transfer capability $C_s$, and to prove the validity of the inverse assertions of the theorems of Shannon.

## Linear Difference Equations

### 57. System of Two Linear Difference Equations

"Concerning a System of Two Linear Difference Equations With Constant Coefficients," by A. G. Naftalevich, Vil'nyus; Moscow, Matematicheskiy Sbornik Novaya Seriya, Vol 46 (88), No 4, Dec 58, pp 420-432

A system of two linear difference equations is considered, namely,

$$\sum_{k=1}^{n} a_k f(z+k\alpha) = g(z), \qquad (1)$$

$$\sum_{j=1}^{m} b_j f(z+j\beta) = h(z), \quad I(\alpha/\beta) \neq 0.$$

where $a_k$, $b_j$, $\alpha$, $\beta$ are complex numbers, $g(z)$ and $h(z)$ are functions given meromorphic in the complex plane and $f(z)$ is the sought-for meromorphic function.

If the letters A and B designate the operators $Af(z) = f(z+\alpha)$, $Bf(z) = f(z+\beta)$, then the system (1) has the form

$$\left(\sum_{k=1}^{n} a_k A^k\right) f(z) = g(z),$$

$$\left(\sum_{j=1}^{m} b_j B^j\right) f(z) = h(z).$$

Let

$$\sum_{k=1}^{n} a_k t^k = a_n \prod_{j=1}^{s} (t - \lambda_j)^{k_j},$$

$$\sum_{j=1}^{m} b_j t^j = b_m \prod_{i=1}^{r} (t - \mu_i)^{h_i}.$$

It follows that system (1) may be described (assuming $a_n = b_m = 1$) as follows:

$$\prod_{j=1}^{s} (A - \lambda_j E)^{k_j} f(z) = g(z),$$

$$\prod_{i=1}^{r} (B - \mu_i E)^{h_i} f(z) = h(z),$$

$$E f(z) = f(z).$$

It is proved that any solution of the homogeneous system (1) (that is, systems in which $g(z)$ and $h(z)$ are identically equal to zero) may be represented in the form of a sum of the solutions of an elementary system of the form

$$(A-\lambda_j E)^{k_j} f(z) = 0, \quad (B - \mu_i E)^{h_i} f(z) = 0$$

$$(j = 1, 2, \ldots, s, \; i = 1, 2, \ldots, r), \quad (E_{i,j});$$

and conversely, it is proved that any function, given in the form of a sum of the solutions of the system $(E_{i,j})$, is a solution of the system (1). The solution of system $(E_{i,j})$ is expressed in final form by means of elliptical functions and sigma and zeta functions of Bernstein. It is noted that the system $(E_{i,j})$ for the case $h_i = k_j = 1$ has been solved by Ermit (see P. Appell, E. Lacour, Principes de la theorie des fonctions elliptiques et applications, Paris, 1922).

As far as the inhomogeneous system (1) is concerned, it is proved that it is joint if and only if

$$\left(\sum_{k=1}^{n} a_k A^k\right) h(z) = \left(\sum_{j=1}^{m} b_j B^j\right) g(z).$$

Several applications of the theory of asymptotic periods of integral and meromorphic functions were also introduced (see A. O. Gel'fond, Ischisleniye Konechnykh Raznostey [Numerical Finite Differences], Moscow-Leningrad, Gostekhizdat, 1952).

## VII MEDICINE

### Antibiotics

58. Antibiotics 23-21 and 1779 in the Therapy of Malignant Growths

"Effect of Two Antibiotics (23-21 and 1779) on Experimental Tumors," by Hsu Ping, Lu Ming-chang, Wu Te-cheng, Ch'u Tsun-ch'ing, V. Kurilovich, Institute of Drug Sciences, China, Shanghai; Moscow, Antibiotiki, 6, Nov/Dec 58, pp 5-8

White mice were used in the experiments which were conducted to determine the effectiveness of antibiotics 23-21 and 1779 when used in the therapy of experimentally induced malignant tumors. Both antibiotics are obtained from strains isolated from the soil in South China, and on the basis of their chemical and biological properties may be grouped with actinomycins. They are obtained in the form of red crystals and have bacteriostatic effect on gram positive microbes. The experiments were carried out in vitro and in vivo. Growths were produced in the mice by the intraperitoneal administration, of Ehrlich's adenocarcinoma in ascitic fluid containing 3-10 million cancer cells. Different doses of 23-21 and 1779 were applied and in all cases were found to have the ability to inhibit the growth of the cancer in the animals. Tests were also conducted to determine the toxicity of the antibiotics. It was established that the $LD_{50}$ for 23-21 is 452 gamma/kg, and of 1779 -- 745 gamma/kg. A table, two graphs, and a bibliography are provided in the article.

59. Effect of Chlorotetracycline and Oxytetracycline on Virus Toxicity

"On the Effect of Chlorotetracycline and Oxytetracycline on the Toxic Properties of Viruses of the Ornithosis-Psitaccosis Group in Vitro," by B. F. Semenov and V. A. Lashkevich, Institute for the Study of Poliomyelitis, Academy of Medical Sciences USSR; Moscow, Antibiotiki, 6, Nov/Dec 58, pp 73-77

An account of the research work done to determine the effect of chlorotetracycline and oxytetracycline on the toxic properties of the ornithosis virus, strain B; psitaccosis virus, strains "Ara" and "Lori; and the primary atypical pneumonia virus, strain 15. The toxicity of the viruses was established by the intravenous administration of virus suspensions prepared on meat-peptone bouillon. Dilutions of the antibiotics were then administered to the animals. Both antibiotics -- chlorotetracycline and oxytetracycline -- displayed a capacity for inactivating the toxicity

of the ornithosis-psitaccosis group of viruses. The viruses displayed an equal sensitivity to the antibiotics. The tests also revealed that high concentrations of the antibiotics, at least 1,000 units, are required to inactivate the viruses. Chlorotetracycline and oxytetracycline failed to prevent intoxication of the mice when administered prior to the viral infection of the animals.

60. Antibiotics in the Therapy of Acute Radiation Sickness

"Application of Bicillin and Oxytetracycline in the Therapy of Acute Forms of Radiation Sickness," by M. Ya. Chaykovskaya, I. S. Kas'yanov, and G. Ye. Vaysberg, Radiological Division (head, Prof A. V. Kozlova) of State Scientific Research Institute of Roentgenoradiology and Chair of Microbiology (head, Prof Z. V. Yermol'yeva, Corresponding Member, Academy of Medical Sciences USSR) of Central Institute for Advanced Training of Physicians; Moscow Antibiotiki, 6, Nov/Dec 58, pp 92-95

Report on research work conducted to determine the effectiveness of bicillin [dibenzyl-ethelene-diamine of penicillin] in combination with oxytetracycline when used in the therapy of acute radiation sickness and concomitant lesions. Bicillin is a slowly soluble preparation which, unlike other antibiotics, is retained in the blood in therapeutic doses for periods of 7-10 days. The experiments were carried out on dogs which were subjected to irradiation in doses of 500 r. It was established that the application of bicillin in doses of 250,000 units every 3 days and oxytetracycline in doses of 300 milligrams daily had a beneficial effect on the course of acute radiation sickness and concomitant affections.

## Aviation Medicine

61. New Preflight Tests for Czechoslovak Pilots

"Experience With a Battery of Vasomotor Tests With Flying Personnel," by Maj Alois Sturma, Military Political Academy (Vojenska politicka akademie) in Prague; Prague, Vojenske Zdravotnicke Listy, Dec 58, pp 572-574

This article describes a battery of vasomotor tests given to pilots to determine the functional condition of the central nervous system before flying. Although experiments with this battery of tests were performed on only 14 pilots, the author believes that the results showed that these tests indicate the flying ability of the pilot better than tests previously used, which consisted of an anamnesis, measurement of blood pressure and pulse, and a cold pressor test.

The new tests, the article states, consist of detailed anamneses, both familial and personal; a character evaluation by the individual himself, by his commanding officer, and by his fellow pilots; and the length of time he sleeps, the length of time necessary to rest, the length of time he rests before night flights, the manner in which he spent the previous day (alcohol, traveling, sexual contact, increased effort, excitement), the quality and length of time since his last meal before flying, appetite, use of black coffee and its effect, the manner in which preflight preparations were made, and his symptoms and difficulties during flight (headaches, earaches, psychic condition, and digestive difficulties).

## Contagious Diseases

### 62. Czechoslovak Research on Virus Infections

"A Micromethod of Complement Fixation in the Diagnosis of Virus Infections," by Rudolf Benda, Ludek Danes, and Jiri Obenberger, from chair of the Epidemiology, "Jan Ev. Purkyne" Military Doctors Research and Graduate Institute (Vojensky lekarsky vyzkumny a doskolovaci ustav Jana Ev. Purkyne); Prague, Vojenske Zdravotnicke Listy, Dec 58, pp 574-579

This article describes the technique of complement fixation by a modified micromethod on Plexit glass plates, using constant dilution of the serum and antigen with several doses of complement. The article reports experiments in which this method was used in the diagnosis of and research on different virus infections, including glandular viruses of the Coxsackie group, tick-borne encephalitis, "LCM," rabies, Q fever, and lymphocytic choriomeningitides.

## Immunology and Therapy

### 63. Tick-Borne Encephalitis Vaccine

"Yolk (Embryonal) Vaccine for Prophylaxis of Spring-Summer (Tick-Borne) Encephalitis," by A. K. Shubladze, Ye. N. Bychkova, and V. A. Anan'yev, Institute of Virology imeni Ivanovskiy; Moscow, Zhurnal Mikrobiologii, Epidemiologii i Immunobiologii, Vol 29, No 10, Oct 58, pp 102-109

The research to which this article is devoted involves a study of a yolk vaccine for protection against spring-summer encephalitis. The experiments were based on a vaccine proposed by Shubladze and Andzhaparidze in 1949, which consisted of a 10% suspension of virus-infected chick embryo with 0.1% formalin; three strains, a laboratory Sof'in strain, strain $YaM_3$,

and strain $90_E$, were used in this vaccine. In addition, the following strains were tested for the new vaccine: $L_3$, $IX_{10}$, $YaS_8$ (all yolk-cultured), and Sof'in (cultured in mouse brains). In 1957, a vaccine consisting of the first three of these strains was compared with the brain-cultured vaccine with respect to immunogenic effectiveness. Results are shown in a table. At present, the authors have undertaken studies of several variants of the yolk vaccine; liquid and dry, with and without supplements, mono- and polyvaccines, vaccines inactivated by cold and high temperatures, deformalinized, and with a decreased amount of formalin. Experimentation with these variants is summarized in six tables.



Conclusions drawn from these results are as follows:

"1. Experimental study of yolk (embryonal) vaccines showed that they are immunogenically adequate.

"2. The immunogenicity of a 5% yolk vaccine is not inferior to that of a vaccine with a 10% content of infected chick embryo tissues.

"3. Complete inactivation of the virus in the yolk vaccine was observed after decreasing the amount of formalin from 0.1 to 0.05%.

"4. The rate at which the virus is inactivated in the vaccine can be shortened from 20 days (for 5 days at room temperature and for the subsequent 15 days at 4°) to 12 days.

"5. Three-day exposure of the vaccine to 0.05% formalin at 37° is sufficient to inactivate the virus.

"6. The harmlessness of the vaccine (complete inactivation) must be checked after its deformalinization.

"7. The immunogenicity of the vaccine is not decreased by deformalinization.

"8. The immunogenicity of liquid yolk vaccine is decreased after 6 months preservation.

"9. Dry yolk vaccines have good immunogenicity.

"10. The experimental data provide a basis for recommending the development of the production of the vaccine from virus cultures on fibroblastic chick embryos."

64. Dry Live Brucellosis Vaccine for Cattle

"The Problem of Vaccinating Adult Cattle Against Brucellosis With Dry Brucellosis Vaccine," by M. M Ivanov, I. G. Levina, P. S. Studentsov, and V. S. Kuznetsov, Tr. Gos. Nauchno-Kontrol'n. In-t po Vetpreparatam, No 6, 1956, pp 110-123 (from Referativnyy Zhurnal -- Biologiya, No 11, 10 Jun 58, Abstract No 50173, by I. Ya. Panchenko)



"Vaccination was performed with live brucellosis vaccine from strain No 19. The vaccine was administered subcutaneously in 5 ml doses to all barren cows and to cows with calves up to 6 months old. The agglutination reaction was the criterion for the immunological reactivity of the animals. If the agglutination titer was lower than 1:200 some 15-20 days after vaccination, vaccination was repeated, and if the required titer was not attained, the animals were vaccinated a third time. Observations showed that the vaccination can terminate a brucellosis enzootic and stop the spread of abortions. The RSK (complement fixation reaction) disappeared after 5-8 months in healthy vaccinated cattle, whereas it was maintained for a long time (more than 2 years) in animals which were in the initial or latent stages of infection before vaccination. These indexes can be used for differentiating healthy cattle from brucellar cattle in vaccinated herds. Immunological reactivity with respect to vaccine from strain No 19 was noted in several healthy animals."

65. Diagnosis of Brucellosis in Cattle

"Comparative Evaluation of Immunobiological Reactions in Diagnosing Brucellosis of Cattle," by P. B. Sadauskas, Byul. Nauchno-Tekhn. Inform. Lit. N.-I. In-t Zhivotnovodstva i Veterinarii, No 2, 1957, pp 37-40 (from Referativnyy Zhurnal -- Biologiya, No 11, 10 Jun 58, Abstract No 50167, author's summary)



"It was demonstrated that, in a herd with fresh, acute brucellosis, combined RA (agglutination reaction), RSK (complement fixation reaction), and Huddleson reactions can be used to detect the greatest number of Brucellar animals. When the course of the infection is chronic, the greatest number of animals can be detected by combining the RSK, opsonophagocytic reaction (OFR), and eye allergen. When infection disappears during normal calving, the RA, the Huddleson reaction, and the RSK disappear in the herd, and at the same time the OFR and the eye test reaction are pronounced."

66. Brucellosis Therapy in Cattle

"Antivirus Therapy of Cattle With Brucellosis," by V. P. Gromov and Kh. B. Frumkina, Tr. Sverdl. S. -Kh. In-ta, No 1, 1957, pp 311-315 (from Referativnyy Zhurnal -- Biologiya, No 11, 10 Jun 58, Abstract No 50171, by A. D. Musin)



"Experimental Therapy with antivirus (AV) was performed on 24 cows with brucellosis. AV was prepared from three strains of Brucella by the usual method; 15 ml of it was administered to the cows the first time, 50 ml after 15 days, and the same amount 30 days after the second injection and 30 days after the third injection. A general reaction of the organism to the introduction was manifested by increased titers and an increase in the opsonic index. The agglutinin titer increased to 1:400-1:6,400 under the effects of AV; it remained at this level for a long time, and decreased to 1:50-1:25 toward the 10th-12th month after therapy. The phagocytic reaction was reinforced and clinical manifestations of brucellosis disappeared in the sick animals after AV therapy. The authors suggest that AV can be used to treat brucellar cattle on threatened farms in conjunction with measures for improving sanitary conditions."

67. Diagnosis of Brucellosis

"The Effectiveness of Seroallergic Methods of Diagnosis Following Recovery of Cattle Hosts From Brucellosis," by A. I. Bychkov, Tr. Mosk, Vet. Akad., Vol 19, No 1, 1957, pp 258-272 (from Referativnyy Zhurnal -- Biologiya, No 11, 10 Jun 58, Abstract No 50165, by A. M.)

On comparative study of seroallergic methods of diagnosis, it was shown that the RA (agglutination reaction) and RSK (complement fixation reaction) did not guarantee the detection of all animals suffering from brucellosis. A considerable number of sick animals were detected by the main allergen of Rostov VOS which was used in addition to the RA and RSK. Corpuscular antigen of VIEV (All-Union Institute of Experimental Veterinary Science) is a particularly specific and active allergic preparation which the authors recommend for checking healthy herds and for the recovery of herds threatened with brucellosis, for the examination of animals brought onto the farm, and for the examination of animals after vaccination for brucellosis."

68. Agglutination Reaction in Ouine Brucellosis

"The Problem of the Specific Sensitivity of the Accelerated Agglutination Reaction in Diagnosing Brucellosis in Sheep," by M. A. Prudentov, Tr. Stavropol'sk. Krayevoy N.-I. Vet. St., No 3, 1956, pp 139-143 (from Referativnyy Zhurnal -- Biologiya, No 11, 10 Jun 58, Abstract No 50180, by I. P. )



"Research showed that the flocculation RA (agglutination reaction) has greater specific sensitivity than does the blood-droplet reaction. The author recommends the flocculation RA with serum for diagnosing brucellosis in sheep which are clinically healthy with respect to brucellosis, and also for checking post-vaccinal reaction in sheep which have been vaccinated against brucellosis."

## Pharmacology and Toxicology

69. Therapy of Burn Shock With Adrenocorticotrophic Hormone

"Effect of Adrenocorticotrophic Hormone on the Course of Burn Shock," by G. A. Zubovskiy; Moscow, Eksperimental'naya Khirurgiya, 6, Nov/Dec 58, p 59



'The effect of adrenocorticotrophic hormone (ACTH) on the course of burn shock was studied in experiments on rabbits. Two series of experiments were carried out. Fourth degree burns on the skin of the abdomen (12 percent of the body surface) were inflicted on 22 animals of the first series, and the character of the developing pathological process was studied. Observations have shown that when traumas of this type were inflicted on rabbits a fatal form of burn shock developed. Two of the 22 animals died as a result of vascular collapse within 7-12 minutes after the trauma was inflicted; 16 animals died within 35 -- 140 minutes, and four within 24-48 hours with manifestations of progressive cardiovascular asthenia and blood clotting. Blood clotting was observed only in the animals that died within 24-48 hours after the trauma was inflicted.

"Sixteen rabbits in the second series received 25 units of ACTH intravenously 10 minutes after burns were inflicted. The reaction of the organism to the administration of ACTH was expressed by an insignificant and brief rise in arterial pressure. Within an hour after the administration of the drug, the development of cardiovascular asthenil symptoms ceased in almost all the animals, and a considerable rise in arterial pressure and in tissue blood circulation was observed. Only six animals of this group died within the first hour; the other ten died within 24 hours.

"Thus, a single injection of ACTH during the erectile phase of burn shock produces an expressed therapeutic effect in the course of several hours. This effect is apparently conditioned by the intensification of the humoral protective mechanism, and has a particularly beneficial effect on the condition of the vascular-motor center."

70. Serotherapy of Gas Infection

"Serotherapy of Experimental Gas Infection Caused by Septic Vibrio Combined With Aerobes," by S. V. Solov'yev; Moscow, Eksperimental'naya Khirurgiya, 6, Nov/Dec 58, p 61



"The object of the work was the study of the effectiveness of the serotherapy of a gas infection produced in white mice by a combination of two cultures: septic vibrio and one of the aerobes -- hemolytic streptococcous, staphylococcus aureus, Bact. proteus vulgaris, and Bacillus coli. The antisepsis serum was administered to the experimental animals in doses of 200 antitoxic units as follows: once 3 hours after the infection; twice 3 and 24 hours after the infection; three times 3, 24, and 48 hours after the infection.

"These doses of the serum had a favorable therapeutic effect when administered to animals infected with a monoculture of septic vibrio. In the basic experiments, the antisepsis serum was administered in similar doses to white mice infected by the combination of sublethal doses of two cultures. As a result of the more intensified virulent action of the anaerobic and aerobic causative agents, the control nontreated animals died, although in all, they received less than a single lethal dose.

"In the serotherapy of a gas infection caused by septic vibrio in combination with hemolytic streptococcus, Bact. Proteus vulgaris, or Staphylococcus aureus, the antisepsis serum was found to have little effect. A favorable therapeutic effect was obtained, however, when the animals were infected with septic vibrio in combination with colibacillus. The therapeutic effect was noticeably increased when the serum doses were increased.

"It was thus found that the course of a gas infection and the therapeutic effect of the antigangrene serum frequently depend on the character of the wound microflora."

71. New Czechoslovak Medicines

"Local and Foreign News" (unsigned article); Prague, Obrana Lidu, 21 Dec 58, p 2

The "Galena" National Enterprise in Komarov, near Opava, is preparing the production of new medicines. The enterprise will make "Cholagol" drops from curcuma rootstock imported from India, China, and Australia. These drops are given to patients with glandular difficulties.

## Physiology

72. High-Temperature Effects on Muscular Efficiency

"The Effect of High Temperature on the Muscular Efficiency of Human Beings," by G. A. Goncharuk (Kiev), Institute of Industrial Hygiene and Occupational Diseases; Moscow, Gigiyena Truda i Professional'nyye Zabolevaniya, Vol 2, No 6, Nov/Dec 58, pp 19-22

High temperature irritates the human thermoregulating apparatus, and lessens the ability of the human organism to maintain body temperature at a constant level, thereby inhibiting its muscular activity. Excitation of cortical and subcortical centers of thermoregulation is evidently accompanied by inductive inhibition of motor zones of the central nervous system. The inhibitive effect of high temperature on muscular activity seems to be of a protective nature.

A total of 179 experiments were conducted on 16 healthy people, between 16 and 23 years of age, who were kept at rest in a compartment in which the air temperature was between 40°C and 42°C; the relative humidity was between 30% and 40%. A control group was kept in a compartment where the temperature was between 18°C and 20°C and the relative humidity was between 30% and 40%.

A method developed by M. V. Leynik was used to determine muscular efficiency. Indexes of muscular efficiency were calculated from an ergograph tracing of the force and frequency of flexion of the index finger during 2 one-minute periods of lifting (with one minute rest in between) of a load weighing 4.5 kilograms, averaging one lift per second.

73. Pathologic Motor Reactions Produced in Rats by Sound

"The Role of the Cerebral Cortex in the Development of Motor Pathologic Reactions Produced in Rats by Using Sounds as Irritants," by B. I. Kotlyar, Nauchnyye Doklady Vysshey Shkoly, Biologicheskiye Nauki, No 4, 1958, pp 98-101

The author of this article discusses experiments conducted on 47 white rats selected on the basis of their sensitivity to sound. Results of the experiments produced sufficient evidence that all stages of epileptiform reaction which develop in rats in response to intense sound stimuli are connected with infracortical parts of the brain; the reactions were noted in decorticated animals.

Motor neurosis appears as a supplementary element of epileptiform reaction in rats exposed to repeated sound stimuli. This is an example of specific clonus, the execution of which requires participation of cortical neurons.

The dynamics of the formation of motor neurosis show that strong excitation develops in the cerebral cortex.

The author of this article further states that attempts were made to obtain motor neurosis a second time in decorticated rats; the previous results could not be duplicated even after 40-60 experiments were performed.

74. Experimental "Training" and Its Biochemical Manifestations

"Biochemical Changes in Animal Muscles Subjected to Various Kinds of Experimental 'Training,'" by A. F. Makarova, Sector of Physiology and Biochemistry of Scientific Research Institute of Physical Culture, Leningrad; Kiev, Ukrainskiy Biokhimicheskiy Zhurnal, No 6, 1958, pp 903-910

As a result of the experiments, which were conducted on rabbits by subjecting the sciatic nerve to a faradic current to produce repeated systematic contraction of the muscles, the following conclusions were derived:



"1. Experimental 'training' produces an increase in the amount of structural protein found in the muscles and is greatest when the training is conducted with 'heavy' loads.

"2. Of the structural muscle proteins, the proteins of the myosin complex have the greatest quantitative increase, with the ATP-ase activity of the muscles increasing accordingly. There is a greater increase in the protein content of the muscle stroma with 'heavy' training at a slow pace, when the time of the levatory load is longer.

"3. The degree of glycogen content increase and dehydrase activity as a result of the training depends on the rate of the movement rather than on the size of the effort.

"4. 'Heavy' training at a rapid pace produces more intense variegated biochemical changes than 'heavy' training at a slow pace, or with burdensome loads.

"5. Our data confirm N. N. Yakovlyev's view that the biochemical changes occurring in the muscle as a result of 'training' are a manifestation of the biochemical adaptation to concrete forms of fulfilling work."

## Radiology

### 75. Effect of Radiation Sickness on Blood Coagulation

"The Mechanism of Disturbance in Blood Coagulation in Acute Radiation Sickness," by A. S. Petrova; Moscow, Meditsinskaya Radiologiya, No 6, Nov-Dec 58, pp 25-29

This article reports a study of the mechanism of the origin of the hemorrhagic syndrome and morphological changes in thrombocytes and other components which take part in blood coagulation under the effects of acute radiation sickness. Dogs and rabbits were exposed to total irradiation in doses of 800 and 600 r respectively. The quantity of the thrombocytes, the thrombocyte formula, the diameter of the thrombocytes, the blood coagulation time, and reabsorption of the blood clot were then determined. The experiments established the following points: (1) Changes in all components which enter into the blood coagulation picture begin from the very first days of irradiation; (2) the presence of large numbers of irritating forms and macrothrombocytes in the peripheral blood points to the appearance of atypical regenerative processes in the megacaryocyte apparatus of the bone marrow; (3) the effect which quantitative, as well as qualitative, changes of the thrombocytes in radiation sickness have on the development of hemorrhages is indicated by the fact that blood coagulation time is restored later than the quantity of the thrombocytes; (4) the correlation between the changes in reabsorption of the blood clot and the development of thrombopenia is confirmed by the fact that both take place simultaneously; and (5) a considerable prolongation of the blood coagulation time is noted during the period of the more pronounced qualitative and quantitative changes of the thrombocytes.

76. Relationship of Acetylcholine-Cholinesterase System to Intestinal Motor Activity in Radiation Sickness

"Motor Function of an Isolated Portion of Small Intestine of Dog During Acute Radiation Sickness," by K. V. Smirnov (Moscow); Moscow, Byulleten' Eksperimental'noy Biologii i Meditsiny, Vol 46, No 12, 1958, pp 23-28

Tests were conducted on three dogs to study the motor function of isolated intestinal loops from the small intestines under normal conditions and after X-ray irradiation. Kymographic tracings after the 1st, 2d, 8th, and 14th days of irradiation accompany the article.

Results indicate that the disturbance in intestinal motor activity in irradiated dogs may depend on shifts in the acetylcholine-cholinesterase system which develop during radiation sickness.

77. Changes in the Functional Condition of the Cardiovascular System During Radiation Sickness

"Changes in the Functional Condition of the Cardiovascular System During Radiation Sickness," by N. V. Il'chevich and V. A. Kozak, Institute of Physiology imeni A. A. Bogomolov, Academy of Sciences Ukrainian SSR, Laboratory of Physiology of Circulation and Respiration; Kiev, Fiziologicheskiy Zhurnal, Vol 4, No 6, Nov/Dec 58, pp 775-782

The research described in this article was conducted on changes in arterial blood pressure and their relationship to vascular interoceptive reflexes during various phases of radiation sickness. The research was motivated by the observation that functional disturbances occur in patients undergoing radiotherapy and in people working with radioactive substances.

Results indicated the following:

1. During the first 24 hours after irradiation, arterial blood pressure is lowered while reflex excitability is elevated both for pressor and depressor reactions.

2. Restoration of arterial blood pressure is accompanied by the lowering of the reflex response and a drop in the pressure in the carotid sinus region.

3. The lowering of the blood pressure during the terminal period of radiation sickness parallels the decrease and rapid exhaustion of the vascular interoceptive reflexes.

78. Experimental Pneumonia in Radiation Sickness

"Characteristics of the Development, Course, and Outcome of Experimental Pneumonia in Acute Radiation Sickness," by P. N. Kiselev, R. M. Rabinovich, and I. D. Meter, Bactero-Serological Laboratory, Central Scientific Research Roentgenoradiological Institute; Moscow, Meditsinskay Radiologiya, No 6, Nov/Dec 58, pp 3-10

Experiments which were conducted on rabbits and rats established that the animals became highly susceptible to severe and in most cases fatal affection with pneumonia after having been subjected to sublethal doses of ionizing irradiation, the critical period having set in 3-21 days after their irradiation. It was also found that the animals lost their local as well as general immunity during radiation sickness. This latter fact, the authors state, indicates the importance of pneumonia prophylaxis in cases of radiation sickness. The use of antibiotics, chemotherapeutic drugs, and other measures is recommended.

79. Penetration of Radioactive Silver Through Skin and Fresh Wounds

"Penetration of Radioactive Silver Through Uninjured Skin and Wound Surface Under Experimental Conditions," by I. T. Tsilyuryk, Chair of Roentgenology and Radiology, Kharkov Medical Institute; Moscow, Novyy Khirurgicheskiy Arkhiv, No 3, May/Jun 58, pp 46-49

Experimental data indicate the possibility of radioactive silver absorption through the skin. The quantity of the radioactive isotopes absorbed through fresh wounds is quite significant.

The author mentions that contact with radioactive substances such as silver is serious, especially if one considers the long half-life of silver and its significantly hard rays.

80. Intestinal Wounds Combined With Penetrating Radiation

"Characteristics of the Course of Wounds of the Small Intestines in General Affection of the Organism by Penetrating Radiation," by V. I. Filatov; Leningrad, Eksperimental'naya Khirurgiya, No 6, Nov/Dec 58, p 60



"The characteristics of the behavior of incised and lacerated wounds of the small intestine in the onset of radiation sickness, its climactic stage, and during the healing period were studied. Ninety-nine experiments were carried out on 40 dogs and 50 rabbits.



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The dogs were subjected to general roentgen irradiation with a dose of 350 r; the rabbits, with doses of 400 r. It was found that in the period of the initial reactions to acute 2d and 3d degree radiation sickness, the course of wounds of the small intestine in dogs who were not subjected to surgical interference (suturing or intestinal resection) is severe, and results in an early death from peritonitis and radiation sickness.



"Surgical interference in rabbits, carried out 2 hours after the wounds of the small intestines were inflicted and during the initial period of radiation sickness, produced better results than operations carried out 6-8 hours later. The cause of lethal cases was a severe form of acute radiation sickness. All the dogs which were operated on during the initial period of radiation sickness and 8 hours after the wounds of the small intestine were inflicted, but which were not subjected to antiradiation therapy, died of radiation sickness or its complications. Mortality was considerably lowered when complex therapy of radiation sickness was applied. The wounds healed without complications despite the somewhat retarded regeneration. However, in 3 of the 20 dogs, invagination of the small intestine produced complications which were difficult to diagnose because of the development of acute radiation sickness.

"The infliction of wounds in the small intestine during the climactic period of radiation sickness resulted in the death of most of the dogs shortly after operations were performed, even though early surgical interference was undertaken. Repeated wounds of the small intestine inflicted 2-3 months after the combined affection (acute radiation sickness and wounds of the small intestine) were marked by leukopenia and lymphopenia, which are characteristic of acute radiation sickness. Infectious complications frequently marked the healing process of the wounds.

"In additional experiments which were conducted on 19 dogs 13 months after the general irradiation ($Co^{60}$ in a dose of 400 r), hip wounds inflicted by firearms caused the development of lymphopenia only. The wounds healed without complications."

81. Radioactive Cobalt Therapy in Treating Inflammation of Phalanges

"Treatment of Paronychia by Gamma Rays From Radioactive Cobalt," by L. M. Stukova, Central Scientific Research Institute of Roentgenoradiology, Ministry of Health USSR; Kiev, Novyy Khirurgicheskiy Arkhiv, No 6 (216), Nov/Dec 58, pp 23-27

Hand inflammations in 97 patients were treated by gamma-ray radiotherapy from cobalt-60. Patients' ages varied from 20 to 70 years, and the duration of infection before treatment varied from one week to more than a year. Sites of infection were bone, subcutaneous tissue, and paronychia.

Results indicate that radiation therapy brings about complete and stable anatomic recovery of the injured phalanges with comparatively rapid disappearance of all signs of subjective and objective inflammatory effects, and therefore speedily restores the working capacity of the patients.

The author concludes that radiotherapy using cobalt-60 in cases of paronychia accompanied by inflammation of only the soft tissues and by inflammation of the bones has a favorable effect on the course of the disease.

82. Certain Mechanisms of Cell Recovery Following Radiation Studied

"Certain Mechanisms of Postradiation Changes in Resting Yeast Cells," by V. I. Korogodin, Soil Biology Faculty, Moscow State University imeni M. V. Lomonosov; Moscow, Biofizika, Vol 3, No 6, 1958, pp 703-710

The aim of this research was to find a link between postradiation changes of cells and cell division. Postradiation mechanisms studied were cell staining capacity, spontaneous lysis, and the dynamics of postradiation recovery of resting yeast cells maintained in nonnutritive media.

Results indicate that following gamma-irradiation by partially lethal doses of ionizing radiation the death rate of yeast cells in the mitotic rest state does not differ from the death rate of control yeast cells. Following irradiation by absolutely lethal doses of ionizing radiation, the death rate of yeast cells is rapid and a portion of the irradiated cell population disintigrates.

In the author's opinion, the development of radiation sequelae, which lead to inactivation after several reproduction cycles, becomes hampered or impossible if active metabolism is lacking. The decrease in radiation effects on yeast cells surviving gamma-irradiation is attributed to the destruction or diffusion of toxic products migrating from the irradiated cells.

The author suggests that the study of the mechanisms of the recovery of cells surviving irradiation under rest conditions will explain the nature of primary radiobiological disturbances.

## Surgery

83. The Neurodystrophic Process in Experimental Osteomyelitis

"The Development and Compensation of the Neurodystrophic Process in Experimental Osteomyelitis," by L. A. Rabinovich-Narodetskaya; Alma-Ata, Eksperimental'naya Khirurgiya, No 6, 1958, p 61



"Having developed a method of producing experimental traumatic osteomyelitis, we have set as our goal the study of the development of this process under the influence of some effects on the nervous system. A prolonged medically induced sleep was utilized as an additional irritant in some series of the experiments; vitamin $B_1$ was introduced into the peripheral section of a cut and sutured nerve, and into a whole nerve in other series of experiments. In all, there were seven series of experiments on 105 grown rabbits and 10 dogs in whom experimental traumatic osteomyelitis was produced. The periods of subsequent observations were 3-6 months.

"The results of the experiments have shown that an affection of a peripheral link of the nervous system in the form of a high neurotomy of the sciatic nerve followed by immediate suturing has an unfavorable effect on the compensating adaptation of the organism to experimental osteomyelitis and aggravates its development. The introduction of small doses of vitamin $B_1$ into the peripheral end of the cut nerve as an additional irritant has a favorable effect on the course of experimental osteomyelitis.

"The introduction of vitamin $B_1$ into the sciatic nerve or sleep therapy improves the reactivity of the animal organism and more rapidly mobilizes the compensating adaptation of the organism to experimental osteomyelitis. The preliminary cutting of the sciatic nerve followed by its immediate suturing lowers the reactivity of the animals as well as the compensating capacity of the organism with respect to osteomyelitis. The application of medically induced sleep on simultaneous bone infection) does not unfavorably affect the course of experimental osteomyelitis in the animal."

84. Surgical Shock and Shock Reactions

"New Data in the Investigation of Surgical Shock," by Prof M. S. Lisitsyn, Clinic of General Surgery No 2 Military-Medical Order of Lenin Academy imeni S. M. Kirov; Moscow, Vestnik Khirurgii imeni I. I. Grekov, No 9, Sep 58, pp 70-77

A survey of 15 years of clinical and experimental investigations which were conducted to determine the origin and nature of shock and shock reactions in patients undergoing or about to undergo surgical treatment is discussed. On the basis of study and analysis of the data obtained, the author concludes that:

1. Presurgical, surgical, and postsurgical shock reactions and shock are stages of but a single process, that of surgical shock.

2. A perverted neuro-vascular-humoral state provides the background for diathesis to shock reactions and shock. This condition should be taken into consideration and corrected before surgery is undertaken.

3. Disturbances of cortical neurodynamics which develop as a result of emotional trauma, and more frequently as a result of surgical trauma, modify the reactivity of the central nervous system and the ability of the cortical protective mechanisms to restore the disturbed functions.

4. Insidious and unclear forms of shock reactions and shock may and should be diagnosed by determining the volume of the circulating blood, the cardiac rhythm, the rate of the blood flow, the functions of the parotid glands, and other indexes.

5. Predisposition to shock reactions and shock is manifested in patients during the presurgical period when emotional and psychic disturbances and disturbed functions of the central nervous system modify the neuro-vascular-humoral background, disturbing the vascular reflex.

85. Certain Experimental and Clinical Problems of Intra-Arterial Transfusion in Severe Shock

"Certain Problems of Intra-Arterial Blood Transfusion in Severe Shock," by N. S. Yefimishin, Candidate of Medical Sciences, Faculty Surgical Clinic of Stanislavsk Medical Institute; Moscow, Khirurgiya, No 11, Nov 58, pp 19-23

Intra-arterial blood transfusions were administered to 20 patients in severe shock. Regardless of the severity of injury, intra-arterial blood transfusion had favorable effects if it was conducted promptly after the appearance of shock symptoms, and repeated transfusions prolonged the desirable effect. Experiments performed on 13 dogs subjected to severe and prolonged shock also proved that the favorable effects of intra-arterial blood transfusion depend on the dose of the transfused blood, the severity of the shock condition, and the duration of the shock condition preceding the transfusions.

86. Morphological Changes in Preserved Major Blood Vessels

"Morphological Changes in Preserved Blood Vessels With Respect to Preservatives, Time of Blood Vessel Excision, and Duration of Preservation," by T. I. Noskova, Chair of Hospital Surgery, Chernovitskiy Medical Institute; Kiev, Novyy Khirurgicheskiy Arkhiv, No 6(216), Nov/Dec 58, pp 114-117

Sections of major blood vessels (aorta, femoral, and carotid arteries) were removed 2, 4, and 6 hours after death and were preserved in various solutions.

Results indicate that the endothelium is the first tissue to be destroyed due to preservation, but that this tissue is preserved longest when the blood vessels are preserved in citrated blood. Changes in the tunica media and extima (splitting of fibers, degenerative changes in the nucleus, and edema in the adventitia) are seen earliest (5-10 days) in vessels preserved in dry sterile test tubes and in physiological saline solution. Degenerative changes are rapid in all blood vessels removed as late as 4-6 hours after the animal's death.

87. Czechoslovak Anesthesia Instruments

"By Means of Instruments Against Pain" (unsigned article); Prague, Obrana Lidu, 6 Jan 59, p 2

Dr Jaroslav Jaderny, chief anesthesiologist at the Kraj Institute of National Health (Krajsky ustav narodniho zdravi) in Karlovy Vary has successfully solved the problem of administering general anesthesia to ambulatory patients. He designed and constructed simple and easy to manipulate instruments which meet numerous requirements for the surgical treatment of ambulatory patients. The instruments are very inexpensive and to a great extent will take the place of bulky and costly anesthesia equipment.

One of the new instruments is used for inducing analgesia by means of trichloroethylene. It may be used for deliveries, for applying painful bandages, and other purposes where analgesia is required for only a short period of time. Other models of this instrument may be used in hospitals for operations or for anesthetizing children.

88. Rehabilitation of Burn Victims in Czechoslovakia

"Rehabilitation of Burn Cases by Balneotherapy," by Pavel Stepanek, and Jana Stepankova, Spa Rehabilitation Institute (Lazensky rehabilitacni ustav), Marianske Lazne; Prague, Vojenske Zdravotnicke Listy, Dec 58, pp 557-560

This article describes the rehabilitation of burn victims before they are sent to spas for treatment, and discusses the prevention of contractures, respiratory system complications, constipation, and osteoporosis. The principles of general physical training, exercises of the burned parts, and exercises for the return of normal stance and gait are discussed and physical therapy is evaluated. Physiotherapy continues and occupational therapy is increased in the Spa Rehabilitation Institute. The article stresses the importance of carbon dioxide and Radon baths.

89. Use of Plastic Films in Czechoslovakia

"The Possibilities of Using Films of Plastic Materials in Peace and War Surgery," by Maj Ivo Macik, Lt Col Engr Dusan Milic, and Engr Antonin Krivanek; Prague, Vojenske Zdravotnicke Listy, Dec 58, pp 555-556

This article describes the preparation of PVAC films and discusses the experimental and clinical evaluation of these films. The article recommends their use in routine surgical work, such as wounds, burns, and certain suppurations.

The article states that plastic films have only limited value in treating second and third degree burns, but that they will be useful at first aid stations and dispensaries for treating first degree burns.

## Veterinary Medicine

90. Virus Left in Aphthae Scabs in Cattle With Foot-and-Mouth Disease

"On the Extraction of the Foot-and-Mouth Disease Virus From Cattle Aphthae Scabs," by E. Kunter, Friedrich Loeffler Institute, Riems; Leipzig, Archiv fuer Experimentelle Veterinaermedizin, Vol 12, No 5, 1958, pp 792-801

Experiments were conducted to investigate the behavior of complement fixing, infectious, and immunizing antigen after extraction from aphthae scabs, both in laboratory experiments and in connection with the production of vaccine concentrate.

Double distilled water and m/150 isotonic phosphate buffer solution proved to be good agents for the extraction of the foot-and-mouth disease virus from cattle aphthae scabs; m/180 phosphate buffer solution is less suitable for the purpose.

The optimal stirring time during the extraction of the virus is between 20 and 30 minutes.

The titer of the complement fixing antigen is reduced to some extent during extraction by the addition of 50 percent chloroform.

The greater part of the virus is removed in the form of complement fixing and infectious antigen along with the first and second extract from the aphthae scabs. The decrease of the two components, complement fixing and infectious antigen titers, is uniform.

In the third and fourth extracts, and in the residue accumulating during the production of the vaccine concentrate, continuously varying amounts of the complement fixing and infectious antigen titers could be determined. The experimental vaccines produced from these extracts and from these residues still had, in part, an immunizing effect.

It is recommended that the raw virus material be extracted three times. Any further extractions must be considered uneconomical for the time being because of present technical conditions and the very small amounts of antigen recovered.

## 91. Survival of Foot-and-Mouth Disease Virus in Cattle Bile

"Investigations On the Occurrence of Foot-and-Mouth Disease Virus in the Bile of Cattle With Special Regard For Its Survival," by E. Kunter, Friedrich Loeffler Institute, Riems; Leipzig, Archiv fuer Experimentelle Veterinaermedizin, Vol 12, No 5, 1958, pp 688-695

The occurrence and survival of foot-and-mouth disease virus was investigated in the bile of 1-2-year-old cattle infected intracutaneously in the tongue with type $O_2$ virus (Koos). The bile was removed at 24, 48, 66, and 168 hours after infection. The virus was found in only 11 (12.2%) of the 90 bile samples examined. The virus titer never exceeded $10^{-1}$. Of the 65 bile samples taken after 24 hours, only 7 (10.8%) contained the virus, whereas 25% of the bile samples taken after 48 hours contained the virus. No infectious virus could be found in the samples taken after 66 and 168 hours.

No conclusions could be drawn on the virus content of the bile at any given time during the viremia stage, since far fewer bile samples were examined 48 hours after infection than 24 hours after infection. At any rate, the occurrence of the virus is hardly to be expected in the bile after 168 hours.

The virus found in the gall had a very low survival period. Its presence could no longer be detected even 24 hours after death at a storage temperature of 4°C.

The pH of the bile varies between 7.4 and 7.8 thirty minutes after death; it reached 8.75 - 9.1 after 24 hours after death.

Investigations on the virucidal properties of cattle and guinea pig bile led to negative results. The foot-and-mouth disease virus type $O_2$ (Koos) and the guinea pig standard A virus were exposed to the effect of the bile in the form of untreated aphthae extracts, centrifuged virus solutions, and virus solutions purified with chloroform.

On the basis of these investigations the foot-and-mouth disease virus seems to be one of the most resistant to bile.

92. Complement Fixation and Inhibition in Brucellosis Abortus Bovinus

"Comparative Investigations With the Complement Fixation Reaction and the Complement Inhibition Reaction for Brucellosis in Cattle," by Ch. Lehnert, Institute of Veterinary Microbiology and Epizoology, Karl Marx University, Leipzig; Leipzig, Archiv fuer Experimentelle Veterinaermedizin, Vol. 12, No 5, 1958, pp 748-755

In comparative investigations of 50 sera of brucellosis-infected cattle with complement-fixation and complement-inhibition reactions, the best results were obtained when active serum was used with the complement fixation reaction.

After inactivation by means of heat (56° C for 30 minutes), prozones or completely negative reactions occurred in the case of a considerable number of the sera.

Antibodies capable of fixing antigen but not complement could be detected with the complement inhibition reaction in these cases.

The complement fixing brucellosis antibodies in the cattle serum must accordingly be considered thermostabile to some extent.

93. The Magnetic Susceptibility of Solid Solutions of Some Carbides, Borides, and Nitrides

"The Magnetic Susceptibility of Solid Solutions of Some Metal-Like Compounds," by G. V. Samsonov, V. S. Neshpor, and N. S. Strel'nikova, Institute of Powder Metallurgy and Special Alloys, Academy of Sciences Ukrainian SSR; Kiev, Dopovidi Akademii Nauk Ukrains'koi RSR, No 8, Aug 58, pp 838-840

The relative magnetic susceptibilities of the solid solutions NbC - ZrC, TaC - NbC, $TaB_2$ - $ZrB_2$, and TiC - TiN were investigated taking the susceptibility of one of the components as unity. An attempt is made to explain the dependence of the magnetic susceptibility on the concentration of components in these alloys.

94. Review of Methods for the Determination of the Creep of Heat-Resistant Alloys

"Parametric Methods for the Evaluation of the Creep of Heat-Resistant Alloys," by L. Ya. Liberman; Moscow, Zavodskaya Laboratoriya, Vol 24, No 12, Dec 58, pp 1501-1509

The subject is reviewed on the basis of information given in published papers. A bibliography consisting of 17 references, two of them USSR, follows the article. The data given in the article refer mainly to alloy steels, but there is also some information on other alloys (e. g., monel, titanium 75A).

95. Chinese Determine Rare-Earth Elements in Alloy Steels

"Determination of Traces of Rare-Earth Elements in Alloy Steels," unsigned article; Peiping, K'o-hsueh Hsin-wen (Scientific News), No 20, 1958, p 475

This item briefly describes the procedure by which the Institute of Metals of the Academia Sinica determines trace amounts of lanthanum, cerium, praseodymium, and neodymium in specimens of alloy steels. As reported, alloying elements are separated out by electrolysis utilizing a mercury cathode and by extraction with organic reagents. Several hundred milliliters of the residual liquid are concentrated to a volume of 0.5 milliliter. The rare-earth elements contained therein are then determined spectrographically using a carbon electrode. Traces as small as a few ten-thousandths percent can be determined by this method, the article says.

96. Chinese Extract Pure Nickel for High-Temperature Alloys

"Preparation of Ultra-Pure Nickel" (unsigned article); Peiping, K'o-hsueh Hsin-wen (Scientific News), No 24, 1958, p 588

This item claims that scientists in the Institute of Metals, Academia Sinica, have worked out a procedure for the extraction of nickel in the degree of purity required for high-temperature nickel-base alloys, i. e., "containing less than 0.0005 percent of any one of the following: arsenic, antimony, bismuth, cadmium, lead, zinc, and tin." As reported, the procedure, which was developed without the help of literature on the subject, is simple, requiring no reagent, and adaptable to large-scale production. It costs about as much as refining steel with a high-frequency induction furnace, and the impurities are recoverable.

[For additional information on metallurgy, see [Item No 26.]

## Nuclear Physics

### 97. Half-Life of Pu-239 and 240

"The Specific Alpha Activities of Pu-239 and Pu-240," by Ya. P. Dokuchayev; Moscow, Atomnaya Energiya, Vol 6, No 1, Jan 59, p 74

The specific alpha activity of Pu 239 and 240 was determined from measurements of 12 Pu samples of various isotopic content. The results showed that a microgram of Pu-239 yields 136,200 ± 200 alpha-decays per minute, corresponding to a half-life of 24,390 ± 30 years. One microgram of Pu-240 yields 500,000 ± 4,000 alpha-decays per minute, corresponding to 6,620 ± 50 years. These values of half-life agree with the most accurate values, as given by M. G. Inghram and others (Phys Rev 83, 1250, 1951 and by E. F. Westrum and others (The Transuranium Elements, Part II, 1717 - 1726, 1950).

### 98. Half-Life of U-233

"The Specific Alpha Activity and the Half-Life of U-233," by Ya. P. Dokuchayev and I. S. Osipov; Moscow, Atomnaya Energiya, Vol 6, No 1, Jan 59, p 73

By analyzing data obtained from measurements of alpha activity of five uranium isotopes, it was established that 20,940 alpha-decays/min correspond to a microgram of U-233. Such alpha activity of U-233 gives an estimate of the half-life of the element of $(16.26 \pm 0.08) \cdot 10^4$ years.

### 99. Electron Capture by Betatrons

"Electron Capture During the Acceleration Phase in Betatrons and Synchrotrons," by P. A. Ryazin and A. B. Minervin; Moscow, Atomnaya Energiya, Vol 6, No 1, Jan 59, pp 68-69

The fundamental electron equations in cylindrical coordinates are derived and analyzed. They are used to evaluate the electron coordinates and the currents in the chamber. Setting the current J=0, equations of single electrons are obtained, applicable to low currents. In the case of strong emission currents it is shown that the mechanism of collective interaction is predominant and that capture may occur on the leading and trailing pulse front.

100. Fission of Am-241

"The Fission Cross Section of Am-241 for 14.6-Mev Neutrons," by A. N. Protopopov, Yu. A. Selitskiy, and S. M. Solov'yev; Moscow, Atomnaya Energiya, Vol 6, No 1, Jan 59, pp 67-68

The method of determining the neutron flux incident on the target and the computation of fission events were described in a previous paper by the same authors (Atomnaya Energiya, Vol 4, No 2, 190 1958.) A xenon-filled scintillation counter was used for recording the fission fragments. Light pulses were recorded by a photomultiplier FEU-33. The differential spectrum obtained for fission fragments of Am-241 is presented in graphs. The cross section of fission of Am-241 by 14.6 Mev neutrons was found to be 2.35 $\pm$ 0.15 barns.

101. Ionization by Gamma Rays

"The Distribution of Ionization Along a Gamma Ray Beam and Reproducing the Roentgen With Normal Ionization Chambers," by K. K. Aglintsev and G. P. Ostromukhova; Moscow, Atomnaya Energiya, Vol 6, No 1, Jan 59, pp 63-66

It was established that the ionizing effect measured in normal ionization chambers for the reproduction of the Roentgen in the region of gamma radiation should be referred to a point in space shifted from the center of the measuring electrode of the chamber of the source by a magnitude of about 0.35 $\frac{R_{max}}{P}$. The correction for the shift of the measuring volume for the gamma radiation of Cs-137 and Co-60 is, respectively, 0.996 and 0.992.

102. Natural Gamma Rays

"Gamma Ray Spectrometry of Natural Radio Nuclides," by G. M. Voskoboynikov and N. P. Kartashov, Moscow, Atomnaya Energiya, Vol 6, No 1, Jan 59, pp 42-48

The results of a theoretical computation of a spectrum of hard gamma rays of equilibrium uranium and thorium uniformly distributed in ores are analyzed. The energy distribution of pulses created by this gamma radiation in a scintillation gamma spectrometer is computed. The results are represented in graphs, which can be used to compute spectral effects expected in spectrometric studies of natural gamma radiation. Such computations are required during analysis of gamma spectrometric methods of prospecting and survey of useful ores, recently more applied in geophysics. Computed coefficients of equations for separate determination of uranium and thorium content in ores are presented. Computed spectrograms are given, and problems of accuracy of spectrometric research are discussed with respect to applications in conditions of geophysical observations.

103. Neutron Moderation

"Neutron Moderation Lengths," by V. P. Kochergin and V. V. Orlov; Moscow, Atomnaya Energiya, Vol 6, No 1, Jan 59, pp 34-41

An approximate solution of integral equations for space moments of neutron distribution function in an infinite medium with an infinite plane isotropic source is presented. The energy-angular moments of the neutron scattering function are expressed in the experimentally determined angular distribution of neutrons of various energies in the case of an anisotropic elastic scattering on nuclei. By using experimental data of total cross sections and angular distribution at elastic neutron scattering on nuclei of H-1, D-2, Be-9, C-12, and O-16, the neutron moderation lengths were computed for moderators: water, heavy water graphite, beryllium, and beryllium oxide. Experimental and theoretical values were in satisfactory agreement.

104. Betatron Studies at Tomsk Polytechnic Institute

Referativnyy Zhurnal -- Fizika, No 12, Dec 58

Abstracts of the following articles on the betatron from Izv. Tomskogo politekhn, in-ta, Vol 87, 1957 appear in the source.

"The Stability of the Equilibrium Electron Beam in a Betatron," by P. A. Cherdantsev, pp 41-47 (Abstract No 26785)

"Problems of Thermal Design of Betatron Electromagnets," by I. V. Shipunov, pp 106-199 (Abstract No 26787)

"Inductive Parametric Oscillator as Exciter of a Resonant Circuit in the Betatron," by V. M. Vysotskiy, pp 157-160 (Abstract No 26788)

"Design of the Compensating Transformer," by I. P. Chuchalin and M. F. Filippov, pp 231-235 (Abstract No 26789)

"Computation of Extinction of Reverse Voltage in a Pulse Scheme," by V. M. Razin, pp 236-246 (Abstract No 26790)

"A Betatron Without an Iron Yoke or Poles," by G. I. Dimov and D. A. Noskov, pp 101-105 (Abstract No 26791)

"Design of the Electron Injection Diagram of a Betatron," by V. M. Razin, pp 16-177 (Abstract No 26792)

"Testing the Injector Properties of a Betatron," by N. M. Goloshchanov, pp 288-296 (Abstract No 26793)

"Injectors for Betatrons of 15-25 Mev," by A. G. Vlasov, pp 297-300 (Abstract No 26794)

"Computation of Elements of Shift of Electrons in a Betatron," by V. M. Razin, pp 178-186 (Abstract No 26795)

"The Problem of Relation of Radiation Intensity to the Frequency of the Feeding Current," by D. A. Noskov, pp 252-255 (Abstract No 26796)

"Spatial Distribution of Radiation of a 10-Mev Betatron," by V. A. Moskalev, pp 387-392 (Abstract No 26797)

"The Use of a Betatron as an Electron Injector for Synchrotrons of High Energies," by A. A. Vorob'yev and G. I. Dimov, pp 329-332 (Abstract No 26798)

"Peculiarities of Induction Acceleration in an Electromagnet With Rectilinear Sections," by G. I. Dimov, pp 351-357 (Abstract No 26799)

"Design of Electron Synchrotrons of Medium Energies With Preliminary Inductive Acceleration," by G. I. Dimov and V. A. Kochegurov, pp 360-365 (Abstract No 26800)

## X. MISCELLANEOUS

### 105. Science Coordinating Committee To Be Established in USSR

"Establish Scientific-Educational Centers," by M. Nuzhin, rector, Kazan' University imeni V. I. Ul'yanov (Lenin); Moscow, Sovetskaya Rossiya, 23 Nov 58

To improve scientific research and the training of scientific cadre, the establishment of a Committee for Science and Higher Education under the Council of Ministers USSR (Komitet po Delam Nauki i Vysshego Obrazovaniya pri Sovete Ministrov SSSR) has been proposed. This committee is to coordinate the work of the Academy of Sciences USSR, the republic academies, scientific-educational centers, and individual vuzes (higher educational institutions) of the all-union level. All other institutions and enterprises including tekhnikums are to be subordinate to individual sovnarkhozes. No intermediate organizations are to exist between the committee and the scientific-educational centers.

### 106. Mining Machine Building Institute and Other Mining Enterprises To Be Established by Sverdlovskiy Sovnarkhoz

"Urgent Problems in Metallurgy in Central Ural Area," by S. Stepanov, chairman, Sverdlovskiy Sovnarkhoz; Moscow, Izvestiya 22 Nov 58

To fully exploit the metallurgical resources of Central Ural, the Sverdlovskiy Sovnarkhoz is in the process of establishing a new Scientific Research and Planning-Design Institute of Mining Machine Building (Nauchno-Issledovatel'skiy i Proyektno-Konstruktorskiy Institut Gorno Mashinostroyeniya). The institute will have a pilot plant in Sverdlovsk. In the outlying areas, the sovnarkhoz plans to establish enterprises which will conduct the major overhauling of mining and transportation equipment. It is also expected that the establishment of these organizations will warrant the formation, in the near future, of a major specialized trust, the "Shakhtorudstroy."

107. Academic Center Planned for Tadzhik SSR

"For a Close Tie Between Science and Industry," by Prof S. Umarov, president, Academy of Sciences Tadzhik SSR; Stalinabad, Kommunist Tadzhikistana, 4 Nov 58

In keeping with the planned expansion of scientific centers in union republics, the Tadzhik SSR is to have an academic center. The center is to be built during the next 7 years and is to encompass all the basic scientific research institutions of the Academy of Sciences Tadzhik SSR. An area of 60 hectares has been assigned for this center near Komsomol'skiy Lake. A sum of 50 million rubles has been allocated for this project.

108. Professors Ye. M. Margorin and L. A. Zil'ber Receive Prizes

"Prizes for Scientific Work" (unsigned article); Moscow Meditsinskiy Rabotnik, 13 Jan 59

The Presidium of the Academy of Medical Sciences USSR has awarded the Prize imeni Academician N. N. Burdenko, awarded annually for the most outstanding scientific work in the field of surgery, to Prof Ye. M. Margorin for his work, "Gunshot Wounds of the Skull and Brain."

The Presidium also awarded the Prize imeni Honorary Academician N. F. Gamaleya, awarded every third year for the most outstanding work in the field of microbiology, epidemioloy, and immunology, to Prof L. A. Zil'ber for his monograph, Osnovy Immunologii (Fundamentals of Immunology).

109. Microbiology Journal Begins 30th Year of Publication

"Thirty Years of Publication" (unsigned article); Moscow, Zhurnal Mikrobiologii, Epidemiologii i Immunobiologii, Vol 30, No 1, Jan 59, pp 3-5

This issue of the journal begins with a brief article heralding the journal's 30th year of publication. The article contains statements concerning the purpose of the journal, past Soviet successes in the fields to which the journal is devoted, and contributions of Soviet public health workers to the construction of the Communist society. The importance of scientific investigations directed toward the better understanding of the etiology, pathogenesis, and epidemiology of infectious diseases and toward the development of prophylaxis measures, control and ultimate eradication of these diseases is emphasized. The editorial board appeals to readers to submit their own scientific, articles, reviews, and notes for publication. More extensive treatment of the following fields in proposed:

associated immunization, new methods of administering vaccines, and accelerated methods of laboratory diagnosis and detection of pathogenic microorganisms in the environment. Programs for improving the training of young physicians and bacteriologists are also mentioned.

As has been done in the past, the journal will devote about 50% of each issue to a definite theme. The following subject breakdown is proposed for the 12 1959 issues:



"1. Problems of immunity and inoculation prophylaxis. Anaerobic infections.

"2. Problems of microbiology and methods of laboratory diagnosis and detection.

"3. Problems of diseases with natural foci.

"4. The epidemiology, etiology, diagnosis, and prophylaxis of enteric infections.

"5. The epidemiology, etiology, diagnosis, and prophylaxis of respiratory infections.

"6. Problems involving the chemotherapy and chemoprophylaxis of infectious diseases. Problems in disinfection, disinsection, and deratization.

"7. The epidemiology, etiology, diagnosis, and prophylaxis of enteric infections.

"8. Problems of training and advanced training of cadres. Instruction in epidemiology, microbiology, and infectious diseases.

"9. The epidemiology, etiology, diagnosis, and prophylaxis of respiratory infections.

"10. Problems of immunity and inoculation prophylaxis.

"11. The 42d anniversary of the Great October Socialist Revolution. Experience in the prophylaxis of infectious diseases in the USSR. Problems in general epidemiology.

"12. Problems in microbiology and methods of laboratory diagnosis and detection."

110. The Eighth Mendeleyev Congress on General and Applied Chemistry To Be Held in March 1959

"Toward the Forthcoming Eighth Mendeleyev Congress," by N. M. Zhavoronkov, Corresponding Member, Academy of Sciences USSR, deputy chairman, Organizational Committee of the Eighth Mendeleyev Congress; Moscow, Nauchnyye Doklady Vysshey Shkoly, No 4, Oct-Dec 58, pp 613-616

In March 1959, the Eighth Mendeleyev Congress on General and Applied Chemistry will be held in Moscow. The last Mendeleyev Congress was held in 1935. The eighth congress has been called to help solve the major problems that have developed during the past 24 years in chemical research and development.

Over 1,250 reports will be given at the various sections of the congress which will include all subdivisions of chemistry and chemical technology.

111. New Chemical and Technological Institutes To Be Opened in Yaroslavl, RSFSR

"There Should be Closer Ties Between Industry and Science," by I. Fetisov, chairman, Yaroslavskiy Sovnarkhoz; Moscow, Izvestiya, 13 Nov 58

It has been decided to establish in Yaroslavl a series of scientific research institutes and design bureaus and to expand and enlarge the existing institutions. Among the institutes to be established are the Yaroslavl Technological and Scientific Research Institute (Yaroslavskiy Tekhnologicheskiy i Nauchno-Issledovatel'skiy Institut) and the Design-Technological Institute for Equipment for the Working of Plastics, Caoutchouc, and Rubber (Konstruktorsko-Tekhnologicheskiy Institut po Oborudovaniyu dlya Pererabotki Plastmass, Kauchuka i Reziny). Among those to be expanded is the Scientific Research Institute of Monomers for Synthetic Rubber (Nauchno-Issledovatel'skiy Institut Monomerov dlya Sinteticheskogo Kauchuka). In addition, the Yaroslavskiy Sovnarkhoz will expand and enlarge a series of plant laboratories.

112. Establishment of New Institutes in Sumgait, Azerbaydzhan SSR

"Sumgait -- A Growing Center of the Chemical Industry," by G. Aliyev, secretary, Sumgait City Party Committee; Baku, Bakinskiy Rabochiy, 10 Oct 58

According to this article, the Azerbaydzhan Scientific Research Institute of Construction Materials and Structures is being transferred to Sumgait. To make the city of Sumgait a chemical center, the following institute will be established in the City: Scientific Research Institute of Petrochemical Processes (Nauchno-Issledovatel'skiy Institute Neftekhimicheskikh Protsessov), Academy of Sciences Azerbaydzhan SSR; and there will be a major expansion of the Azerbaydzhan Scientific Research and Planning Institute for the Automation of the Petrochemical Industry (Neftekhimavtomat).

113. Hungarian Research Facilities Surveyed

"The Status of Hungarian Science and the Major Trends in its Development," by Academician Ferenc Erdei, Budapest Magyar Tudomany, No 11-12, Vol III, Nov-Dec 58, pp 495-513

In September 1953, the Central Statistics Office completed the collection of data pertaining, as much as possible, to all areas of Hungarian science. These data were not published and are now out of date. The Science and Higher Education Council (Tudomanyos es Felsooktatasi Tanacs) decided to collect such data again for the period up to 31 December 1957. These data have now been processed by the Secretariat of the Science and Higher Education Council and by the Central Statistics Office.

As of the end of 1957 there were 114 scientific research institutes in Hungary (this number has increased since then), and research work was being conducted in more than 600 university and college faculties.

The permanent fund of the scientific institutes represents a value of nearly one billion forints, and the 1957 budgetary expenditures of these institutes was 466.8 million forints. A similar sum was expended for higher education and associated research in 1957.

At the end of 1957, there were 9,770 persons working in the scientific institutes and 8,531 working in higher education. All together, 0.4 percent of the working population was engaged in science or in higher education. Scientific workers in the research institutes numbered 3,665 (out of the 9,770); 144 of these were regular or corresponding members of the Hungarian Academy of Sciences, 186 were doctors of the sciences, and 789 were candidates in the sciences.

From 1953 to 1957, the permanent fund for scientific research increased 160 percent. The yearly budget increased 50 percent. The number of workers in scientific research institutes increased from 8,531 in 1953 to 9,777 in 1957. The number of scientific research institutes increased from 81 to 114. The number of scientific workers increased from 2,416 to 3,665. The number of assistants and administrative workers decreased from 6,115 in 1953 to 6,015 in 1957. This means that some scientifically trained workers are now involved in administrative work.

In 1953, technical research was predominant and basic research was forced into the background; 66 percent of all workers in research institutes and 58 percent of the researchers themselves were in the industrial research institutes; the industrial research institutes got 66 percent of the budgeted expenditures and had 60 percent of the permanent fund and they received 58 percent of the investments effectuated in 1953. Only 12 percent of the workers of industrial research institutes were working in the area of light industry and foodstuffs industry.

This situation substantially changed in 1957. The distribution of all institute and faculty personnel was as follows: 32.6 percent in technical sciences, 22.8 percent in medical sciences, 20.7 percent in natural sciences (mathematics, physics, chemistry, biology, and geology), 14.9 percent in agricultural sciences, 8.1 percent in social sciences, and 1.1 percent in transportation sciences.

Of the research institutes, 31.5 percent (36 institutes) were concerned with technical sciences, and had 45.2 percent of all institute personnel. Agricultural sciences had 31 research institutes and 18.1 percent of the institute personnel. The natural sciences had 15.8 percent of the institutes (15 institutes) and 17.5 percent of the institute personnel. The social sciences had 10 percent of the institutes (12 institutes) and 5.2 percent of the institute personnel.

The research institutes in technical sciences got 42.9 percent of the 1957 budgeted expenditures, those in agricultural sciences got 21.4 percent, those for natural sciences got 17.1 percent, and those for social sciences got 3.4 percent.

About half the institutes in the natural sciences belong to the academy; the other half are distributed among several ministries. The independent research institutes (both academic and ministerial) and the faculties are about equally loaded with research work in this area.

Most of the research work in medical sciences falls on the faculties which belong to the Ministry of Health. A larger part of the medical sciences institutes belong to the Ministry of Health; the smaller part belong to the Academy. Counting special support [for external research projects], academy participation in medical sciences research is less than 10 percent of the total.

The institutes do most of the research in the agricultural sciences. There are 31 agricultural science institutes with 1,770 workers whereas only 763 persons work in the 87 agricultural science faculties. Most of the institutes and all the faculties belong to the Ministry of Agriculture. Counting special support, academy participation in agricultural sciences research is about 10 percent of the total.

The 36 institutes for technical sciences have 4,413 employees, whereas the 72 faculties of a technical nature have only 1,152 employees. The technical institutes are distributed among several ministries, listed here in order of priority: Heavy Industry, Metallurgy and the Machine Industry, Construction Affairs, Light Industry, Transport and Postal Affairs, Food, and Health Ministries, the National Water Affairs Main Directorate, the Geology Main Directorate, and the National Council of Trade Unions (one institute). Counting special support, academy participation in this branch is less than 10 percent.

In the area of social sciences, the burden of the Ministry of Culture and that of the academy are more equal. A significant part of the social sciences research is done in the faculties (157 faculties with 887 workers) which belong to the Ministry of Culture. Of the 12 institutes (which have 506 workers), 10 belong to the academy. Still, the larger part of the research falls to the ministry.

To sum up: only 33 of the 114 institutes are academy institutes, and, although as there are 4,464 instructors-researchers in the faculties belonging to the various ministries, only 438 are working in the framework of academy special support. But these academy workers in the faculties are engaged exclusively in research, whereas faculty workers, as such, spend most of their time in instruction.

114. Czechoslovak-Soviet Scientific Cooperation

"The Word 'Life,'" by Miroslav Kroh; Prague, Obrana Lidu, 21 Dec 58, p 5

This article, based on information received from the Czechoslovak Academy of Sciences, discusses past and present Czechoslovak-Soviet scientific cooperation.

The article states that Soviet and Czechoslovak technicians shared in the construction of the 14-meter spectrograph at the observatory in Ondrejov. This unique solar spectrograph was the first in the world to record the course of a solar eruption simultaneously on five wave lengths.

The article discusses Czechoslovak-Soviet cooperation in mathematics. A school in Prague, under the direction of scientist L. Kurzweil, spent 3 months in the Soviet Union working on the theory of differential equations. Scientist Babuska is working on the theory of partial differential equations in Prague. He was inspired by the work of N. I. Muskhelishvili, and was personally acquainted with and collaborated with the Soviet mathematician, S. L. Sobolev. The Czechoslovaks and the Soviets work together in the fields of functional analysis, mathematical logic, and other subjects on a permanent basis.

Discussing scientific research on proteins, the article states that a group of scientists at the Chemical Institute of the Czechoslovak Academy of Sciences has had some success in solving problems pertaining to the structure of proteins, and will begin collaborating with the Institute of High-Molecular Compounds of the Academy of Sciences USSR.

The article gives the following statistics about plans: Soviet and Czechoslovak scientists are scheduled to work jointly for 220 weeks; Soviet and Czechoslovak scientists will directly collaborate on 24 projects at 39 Soviet and Czechoslovak laboratories; the work of Soviet and Czechoslovak scientists on 57 research projects at 73 laboratories will be coordinated.

Discussing research on synthetic materials, the article states that the Chemical Institute of the Czechoslovak Academy of Sciences is in contact with the laboratory of A. D. Petrov at the Institute of Organic Chemistry of the Academy of Sciences USSR in Moscow. Scientists in both Czechoslovakia and the Soviet Union are studying unsaturated organosilicon compounds and substituted aryl-silicon compounds. Research is aimed at increasing the number of practical basic concepts and at studying the characteristics of these compounds. Specific tasks have been outlined for Soviet and Czechoslovak laboratories in order to avoid duplication. Results achieved by one group are immediately communicated to the other, with no waiting for publication, and both groups keep in contact on a personal basis and through correspondence.

As another example of cooperation, article states that the Soviet scientist Prof M. G. Brazhnikova spent 3 months in Prague in 1951 and that it was in Prague that she succeeded in isolating albomycin.

The article also discusses archaeological cooperation between Soviet and Czechoslovak scientists in Dolni Vestonice and Pavlov in Czechoslovakia and in Kostenki in the Ukraine.

The final example of scientific cooperation is the participation of the Czechoslovak scientist Dr Mrkos in the Soviet expedition to the Antarctic. The article points out that the trip is costing the Soviet government 100,000 rubles a day for each member of the expedition.

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