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CENTRAL INTELLIGENCE AGENCY

SCIENTIFIC INFORMATION REPORT

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PLEASE NOTE

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

SCIENTIFIC INFORMATION REPORT

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I. ASTRONOMY

1. Meteoric Bodies in the Atmosphere

"Some Laws of Motion of Meteoric Bodies in the Atmosphere," by N. A. Anfinov, Moscow Physicotechnical Institute; Moscow, Astronomocheskiy Zhurnal, Vol 36, No 1, Jan/Feb 59, pp 137-140

To study the process of heat transfer in meteoric conditions, the relations between nondimensional quantities were analyzed. An empirical formula for the coefficient $\sigma = \frac{\Lambda}{2\rho s}$ has been found. Some conclusions are made on the relation between melting and evaporation in the process of loss of mass of meteoric bodies.

2. Planetary Atmospheres

"The Dissipation of Gas From Planetary Atmospheres. II. The Total Velocity of Dissipation of Gas From a Planetary Atmosphere. The Problem of Terrestrial Helium," by E. K. Byutner, Leningrad State Pedagogical Institute imeni Gertsen; Moscow, Astronomicheskiy Zhurnal, Vol 36, No 1, Jan/Feb 59, pp 89-99

A general expression has been found for the velocity of gas dissipation from a planetary atmosphere from which follow, as limiting cases, the formulas deduced by Lennard-Jones (Trans. Camb. Phil. Soc., 22, 535 (1923)) for a dense and for a rarefied atmosphere. The velocity of gas dissipation and also the thickness and position of the layer from which the dissipating process is most effective were calculated for two cases: a single component atmosphere and an atmosphere composed of a heavy gas with a small admixture of a light gas. It was found that in the latter case, all other conditions being identical, the thickness of the layer is much less than in the former. In all cases, the thickness of the layer increases with increasing kinetic energy of the gas. The distribution of the intensity of dissipation along the effective layer has been calculated and the position of the layer of maximum density determined. With the help of the model of a double component atmosphere, the possibility of dissipation of helium from the Earth's atmosphere under present conditions were investigated. The estimates of the necessary kinetic energy, at a height of about 500 km, are given.

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3. Solar Corpuscular Streams

"Generation of Corpuscular Streams by the Magnetic Field of Sunspots," by P. Ye. Kolpakov; Moscow, Astronomicheskiy Zhurnal Vol 36, No 1, Jan/Feb 59, pp 65-72

The possibilities of generation of corpuscular streams in a nonuniform magnetic field, increasing with time, of a unipolar group of sunspots is analyzed. The most rapid particles of the coronal-chromospheric plasma belonging to the "wing" of the Maxwell distribution, for which the condition $eE_{\perp} \geqslant F_{dec}$ is fulfilled, will acquire energy from the action of the induced electric field according to $W_{\perp} = W_{0\perp} \frac{H}{H} \sim 6.10^3 -- 4 \cdot 10^5$eV. Because of the nonuniformity of the magnetic field, these particles will rise upwards and their energy $W_{\perp}$ will be transformed into the energy $W_{\parallel}$ of motion along the magnetic lines of force of the spot. Particles with energy $W_{\parallel} \sim 6.10^3 -- 4 \cdot 10^5$ eV in the region of the corona can escape from the Sun and form corpuscular streams.

4. Spectral Study of the Chromosphere

"A Spectrophotometric Investigation of the H and K Ca^+ Lines in the Chromosphere and Solar Faculae." by V. L. Khokhlova. Crimean Astrophysical Observatory Academy of Sciences USSR, Moscow, Astronomicheskiy Zhurnal, Vol 34, No 1, Jan/Feb 59, pp 54-64

The study of H and K lines of ionized calcium at various distances from their centers permits the investigation of conditions at different depths of the solar atmosphere. The form of the profiles of the H_2, K_2, H_3 and K_3 lines show that incoherent scattering does not play an essential role in the formation of these lines. The upper limit of the value of turbulent velocity is derived from the profiles of H_3 and K_3 and found to be 8 km/sec. The height of formation of these lines is calculated and equals 5,000 km. Analysis of the published determinations of the turbulent velocity from the half-widths of the lines showed that all metallic lines, as well as hydrogen, give a turbulent velocity in the chromosphere not exceeding 8 km/sec. The high value of v_t derived by A. Unsöld (Physik der Sternatmosphaeren (Physics of Stellar Atmospheres) Berlin, 1955) and by C. de Jager (Bull, Astron, Inst. Nether. 13, No 473, 133, (1957)) resulted from the use of helium lines which are broadened, because of high kinetic temperature.

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5. Radio Emission by Magnetic Bremsstrahlung

"The Distribution of Relativistic Electrons in the Galaxy and the Spectrum of Magnetic Bremsstrahlung Radio Emission," by S. I. Syrovatskiy, Physics Institute imeni Lebedev, Academy of Sciences USSR; Moscow, Astronomicheskiy Zhurnal, Vol 36, Jan/Feb 59, pp 17-32

The problem of the diffusion of particles is solved, taking into account the regular changes of the energy of the particles during this process. The space distribution and energy spectrum for electrons, whose energy changes are caused by losses due to radiation in the magnetic field are found by assuming that the sources occupy an ellipsoidal volume and supply interstellar space with relativistic electrons with an exponential energy spectrum $QE^{-\gamma_0}$. The case when the distribution of the sources coincides with the flat subsystem of the Galaxy and $\gamma_0 = 2$ is considered in detail. The energy spectra of electrons along the line of sight in different directions and the corresponding intensity of magnetic bremsstrahlung radiation are calculated. It is shown that the energy spectrum of electrons along this line of sight can be represented in a limited energy region by the exponential spectrum $KE^{-\gamma}$, where γ varies within the limits between 2 and 3, depending on the assumed diffusion coefficient. The choice of a diffusion coefficient of relativistic particles in interstellar space equal to $D = 10^{29}$ cm/sec and the source intensity $Q = 10^{38}$ ergs/sec ensures an agreement with the observed spectrum of nonthermal radio emission of the Galaxy in the frequency region above 10 Mc.

6. Solar Corpuscular Streams

"The Velocity Spectrum of Corpuscles in Solar Corpuscular Streams," by E. R. Mustel' and O. N. Mitropol'skaya, Astronomical Council, Academy of Sciences USSR; Moscow, Astronomicheskiy Zhurnal, Vol 34, No 1, Jan/Feb 59, pp 5-16

The velocity spectrum of corpuscles ejected from flocculi was studied for the period 1951-1953. Relations between flocculi and geomagnetic activity published earlier by the authors (Izv. Krymsk. astrofiz, observ. 18, 162 (1957)) are revised. Observations indicate that the passage of flocculi over the visible center of the Solar disk explains not only the rise of disturbances but also two other effects: the appearance and disappearance of geomagnetic sequences during the appearance of new flocculi and, correspondingly, the disappearance of old flocculi; and the appearance, disappearance, strengthening, and weakening of geomagnetic sequences during the change of sign of the heliographic latitude of the disk's center. The evident connections between flocculi and geomagnetic disturbances are discussed.

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7. Radio Astronomy Applied to Interstellar Clouds

"The Determination of the Mean Dimension of Magnetized Clouds of Interstellar Gas by Methods of Radio Astronomy," by G. G. Getmantsev, Radiophysics Institute, Gor'kiy State University imeni Lobachevskiy; Moscow, Astronomicheskiy Zhurnal, Vol 36, No 3, May/Jun 59, pp 422-426

The possibility is discussed of the determination of the mean dimensions of magnetized clouds of interstellar ionized gas from measurements of the polarization of nonthermal radio emission and from measurements of the intensity fluctuations of radio emission, when the directional diagram of the radio telescope is swept across the celestial sphere. On the basis of published data it is shown that $l \leq 75$ ps.

8. Variation of Intensity of Solar Radio Emission

"The Variations of Intensity of Radio Emission Scattered on Coronal Nonuniformities," by V. V. Pisareva, Radiophysics Institute, Gor'kiy State University imeni Lobachevskiy; Moscow, Astronomicheskiy Zhurnal, Vol 36, No 3, May/Jun 59, pp 427-433

Simultaneous observations of solar radio emission of 206 Mc made at two stations, separated as to longitude (Gorky and Irkutsk), are described. These were made to detect intensity fluctuations with a diffraction origin. The observations did not reveal such fluctuations for a precision of measurements to 2% from the mean level of solar radio emission. This circumstance may be connected with the sources of radio emission on the sun having too-large angular dimensions. It is shown that observations with an antenna with an effective area of the order of 200 m^2 and a design with a fluctuation threshold of sensitivity 2^o for a time constant of one second could have led to the detection of such fluctuations even for wide-angle sources.

The variation of distribution with the angle of radiation, passing through a layer with nonuniformities, in dependence on the distance of the observer to the layer is considered. The derived results are applied to the scattering of radio emission of Tauri A on coronal nonuniformities. It is shown that at large distances from the Sun's center the apparent increase in the size of the source cannot be explained by scattering on coronal rays. It is necessary to assume that there are also smaller nonuniformities in the corona.

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9. Ephemerides of Artificial Satellites

The computation of Precise and Approximate Ephemerides of Artificial Earth Satellites," by M. S. Yarov-Yarovoy and Ye. A. Grebenikov, State Astronomical Institute imeni Shternberg; Moscow, Astronomicheskiy Zhurnal, Vol 36, No 3, May/Jun 59, pp 524-534

Analytical methods for the solution of four principal problems, arising when computing the ephemerides of an artificial Earth satellite, are given. The first problem is the determination of the interval of latitudes in which observations (optical and photographic) of the sputnik can be made; the second -- the computation of a precise ephemerides; the third -- the computation of an approximate ephemerides. Here the main points are: (1) the determination of the time when a place with a given longitude intersects the orbital plane of the sputnik; (2) the determination of the time when the sputnik crosses a parallel of a given latitude. Therefore the ephemerides of a sputnik should be calculated only for those intervals of time, when the first and second moments of time are close to one another, i.e. when the sputnik in a given place is observed at maximum height. The fourth problem is to determine whether the brightness of the sky at twilight will interfere with observations and whether the sputnik will be in the Earth's shadow. It is necessary to solve this latter problem frequently if the latitude of the place of observation is near the limits of the intervals of latitude, determined in the first problem. A numerical example is given at the end of the paper.

10. Possibility of Latent Stage in Development of Supergiants

"On the Star Association Perseus I," by V A Ambartsumyan, Byurakan Observatory, Armenian Academy of Sciences; Max-Planck-Festschrift 1958, VEB Deutscher Verlag der Wissenschaften, Berlin 1959, pp 97-102

From an analysis of the peculiar characteristics exhibited by the star association Perseus I, the age of which is about $15 \cdot 10^6$ years, it is apparent that the process of star formation is still going on within this association. This is in contradiction to the hypothesis that the stars of the association are produced from diffuse material. Furthermore, kinematic observations show for the stars of several spectral classes of this association a considerably greater age than that indicated by energy studies. It is considered possible that this difference can be explained by the occurrence of a certain latent stage in the life of a future supergiant in which the light energy is now very low.

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II. BIOLOGY

Biophysics

11. Bioelectric Current as Power Source

"Utilization of Bioelectric Current for Purposes of Control," by A. Ye. Kobrinskiy Moscow, Izvestiya Akademii Nauk SSSR, Otdeleniye Tekhnicheskikh Nauk, Energetika i Avtomatika, No 3, May-June 1959, pp 151-154

The author of this abridged text of a report which was read at the general meeting of the Department of Technical Sciences, Academy of Sciences USSR, held on 16 December 1958, states that a group of workers of the Institute of Machine Science, Academy of Sciences USSR and of the Central Scientific Institute of Prosthetics and Prosthetic Design (TsNIIPP) has been conducting research, since 1957, on the utilization of the bioelectric currents of a living organism to operate an external mechanical device. With the invention of suitable systems of control, they were named bioelectric systems of control.

It has been known, from the time Galvani made his first experiment, that living tissue reacts to electric stimulation. It was subsequently found that living tissue can carry electric current and even generate electricity. It is also known that any process of stimulation passing through living tissue is always preceded by the formation of and changes in the electric potentials in these tissues. Thus, any kind of motion by a living organism is preceded by a change in the biocurrents of corresponding muscles.

A definite, well-defined dependence exists between muscle tension and the magnitude of bioelectric currents. Within certain limitations it is linear, i.e. the magnitude of biocurrent in these limits is proportional to the level of on muscle tension. Irritation along the nerve and muscle fibers is diffused in a form of a collection of discrete impulses which are modulated in frequency, depending on level of irritation.

Thus, any voluntary "schedule" of activity by a human organism, no matter how complicated and diverse it may be, finds its reflection in combined discrete biological impulses which pass from the central nervous system to the organs.

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But similar combinations of discrete electric signals are widely used in assigning work schedules in most diverse modern automatic systems. Metal-cutting tools may serve as an example of this. Much in common can be found between the operation of such systems and the picture of bioelectric pulsation.

These analogies carry a purely external character. The nature of the command impulses in both instances is completely different, just as the various methods of transmitting these command impulses to organs that respond to these impulses are different.

It is this cybernetic approach which prompted a new point of view concerning the already existing system of interaction between a living organism and various mechanical devices which lead to the idea which is the basis of the bioelectric systems of control.

Results of experiments on animals and humans, in which various such mechanical devices were used, have been published in the US, England, and in some other countries. Miniature radio receivers, receiving signals from a transmitter located in a laboratory, were attached to the body of white rats. Sensory and motor reactions of animals were recorded. The living organism received external commands produced by a mechancial apparatus.

There were other experiments conducted, the results of which were published in 1954. An apparatus which generated signals was used. The signals, fed by means of electrodes attached to the head of a human being, produced a sensation of the loss of equilibrium. In this case, the signals were produced by an external mechanical apparatus.

A number of other instruments generating signals which control various functions of the human organism have been used widely in medicine. For example, an apparatus which has been used in the electrical stimulation of respiration regulates respiration frequency, and an apparatus used in sleep therapy generates impulses of certain frequency and inhibits nerve cells of the cortex of the brain thereby creating somnolence and sleep; many other apparatuses have been built.

Although the systems of control, pointed out above, are comparatively elementary, they do point to existence of great possibilities in utilization of bioelectric systems for many and varied purposes of control.

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A method of bioelectric control was first conceived in the USSR in 1957. It was briefly described in the Doklady Akademii Nauk SSSR (Reports of the Academy of Sciences USSR) Vol 117, No 1, 1957. The first model of such a system was constructed in the Central Scientific Institute of Prosthetics and Prosthetic Design (TsNIIPP) in 1957. This model was shaped in a form of a human wrist and was controlled by means of biocurrents of muscles which flexed and straightened the fingers of the hand. In spite of the fact that the model was far from being perfect, it demonstrated that is was possible to realize the idea of biocurrent control.

Small biocurrent amplifiers were developed later on. It can be assumed that further myographic research will create the possibility of utilizing various systems to extract useful information. Exploitation of bioelectric systems is being continued. The main efforts are being concentrated on inventing small receiving sets and fitting them with reliable sources of electric current.

It goes without saying that this field is not limited in application to artificial limbs only. Biocurrents of any muscle (not only skeletal, particularly the heart muscles and muscles which control respiratory movements, can be utilized. One such system has been realized as the result of the joint effort of the Institute of Experimental Biology and Medicine Academy of Sciences USSR, Division of Applied Mathematics of the Institute of Mathematics Academy of Sciences USSR and the Institute of Aviation Medicine of the Ministry of Health USSR. The biocurrent of heart muscles has been used in this system to operate a roentgen apparatus.

The author of this article concludes by stating that he has no doubts that any further progress that may be made in the utilization of biocurrents for control purposes will be of great significance. He states further that newspapers have reported that similar work as that described above is being carried on abroad, particularly in the US.

Photographs and schematic diagrams of various devices are shown on pages 151, 152, 153, and 154 of the text.

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12. Cytoembryology of the development of Parthenocarpous Fruits in Tomatoes Sprayed With Growth Stimulators

"The Cytoembryology of the Development of Parthenocarpous Fruits in Tomatoes Sprayed With Growth Stimulators," by O. I. Rybchenko, Department of Cytology and Embryology of the Institute of Botany, Academy of Sciences, UkSSR; Kiev, Ukrayinskyy Botanichnyy Zhurnal, Vol 16, No 3, 1959, pp 20-21

The question of the effect of synthetic growth stimulators on the development of tomato ovaries and the ovules is discussed in this paper.

The author points out that in spraying with TU (sodium salt of 2,4,5-trichlorophenoxyacetic acid) and 2,4-DU (2,4-dichlorophenoxyacetic acid), the tomato ovaries and their ovules in particular become completely identical with the ovaries of parthenocarpous forms. The same disturbances in development are observed, followed by the complete degeneration of the female gametophyte. When sprayed during the later phases of development, the pistils lose their capacity to accept pollen, and the embryo sacs, to be pollinated and to develop normal embryos and endosperms. Instead, the surrounding tissues (endothelium, nucellus) grow profusely and form endothelially sterile ovules. Unpollinated ovaries with such sterile ovules do not drop off but develop into normal-sized, parthenocarpous fruits, with abundant starch in their tissues.

Thus, both in natural parthenocarpy and in parthenocarpy stimulated by snythetic preparations, the disturbances in normal development are of the same nature. This proves that in both cases disturbances in the same metabolic processes are involved, probably the processes of the formation and equilibration of phytohormones in the plant organs.

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III. CHEMISTRY

Fuels and Propellants

13. Nitration of Starch

"Investigations on Nitration With Mixed Acid; Part 2 -- Further Investigation of the Deterioration of Nitrostarch in Mixed Acid on the Basis of Molecular Weights Determined by a Modified Barger Method" by A. Knuz, J. Giber, and O. Dobis, Department of Industrial Organic Chemistry, Budapest Technical University; Budapest, Magyar Kemiai Folyoirat, Vol 65, No 5, May 59, pp 174-177

It was established that the Barger method, as modified by Szabo and Szoke, is suitable for the determination of molecular weights of macromolecular compounds. The limits of errors which occur in determinations by this method amount to ± 2%. The use of this method for the investigation of macromolecular compounds is recommended.

By using the method in question, the deterioration of nitrostarch in two types of mixed acid was investigated. It was established with certainty that nitrostarch does not deteriorate in mixed acid that contains P_2O_5 and has been prepared according to Alexander and Mitchell. On the other hand, there is strong deterioration in mixed acid that contains a high proportion of nitric acid.

The constants of the Staudinger equation modified by H. Mark were determined. In this equation, which reads

$$[\eta] = K [M_n]^{\alpha},$$

alpha was found to be equal to 0.52 and K to 0.99×10^{-2}.

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14. Nitration of Mannitol

"Investigations on the Nitration With Mixed Acid; Part 3 -- Nitromannite", by A. Kunz and J. Giber, Department of Industrial Organic Chemistry, Budapest Technical University, Budapest, Magyar Kemiai Folyoirat, Vol 65, No 5, May 59, pp 78-180

The curves indicating the time necessary for the nitration of d-mannitol showed that the same conditions are apparent from the mixed-acid triangular diagram as those encountered in the nitration of starch. It was established that the time necessary for the nitration of d-mannitol depends principally on the nitric acid activity of the mixed acid.

The parallel curves of the mixed acids corresponding to products with the same nitrogen content likewise indicate that the generally known relationships pertaining to nitrocellulose are valid for the nitration of mannitol. In the mixed-acid triangular diagram, the Shaposhnikov line passes through the plane corresponding to products with a content of nitrogen higher than 18%. One may assume that the mixed acid, which has the maximum nitrating effect as far as the nitrogen content is concerned, has the following composition: 8.5% of water; 44% of nitric acid; and 47.5% of sulfuric acid.

The family of curves which indicates the magnitude of the yield in the mixed acid triangular diagram has a resemblance to the family of curves indicating the nitrogen content. One may therefore conclude that there is a close correspondence between yield and nitrogen content.

15. USSR Work on Solidified Gasoline

"Tverdyy Benzin [Solid Gasoline]" by Prof B. I. Losev, Publishing House, Znaniye, Moscow, 1958, 24 pp

The information given in the article "Solid Gasoline" by Prof B. I. Losev, Priroda, Vol 47, No 9, Sep 58, pp 38-44 (cf. Item 8, SIR T-10, 21 Nov 1958, pp 6-8) is reviewed and supplemented. USSR technological procedures for the production of solidified gasoline are compared with those developed abroad, particularly in work done by the Anglo-Iranian Petroleum Company since 1944.

It is pointed out that in addition to the use of large stationary installations for the liquefaction of solidified gasoline, small installations for this purpose can be mounted on automotive vehicles and planes. When these installations are used on moving vehicles, there is no necessity for fuel tanks. The output of installations of this type can be adjusted to the speed of the automotive vehicle by connecting over a transmission the shaft of the screw press for the liquefaction of solidified fuel with the shaft of the engine supplying motive power to the vehicle.

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Properties of Briquettes of Solidified Liquid Fuels	11
Chemical Reagents for the Solidification of Liquid Fuels	13
Technical Methods for Solidification	15
Applications of Solidified Liquid Fuels	17

16. Shattering of Sealed Tubes by Explosives Contained in Them

"The Physical Properties Which Determine the Thermal Stability of Crystals of Some Explosive Substances," by K. K. Andreyev, Moscow Chemico-Technological Institute imeni V. I. Mendeleyev; Moscow, Nauchnyye Doklady Vysshey Shkoly-Khimiya i Khimicheskaya Tekhnologiya, No 2, May 59, pp 244-247

On the basis of the experimental research described, it is concluded that the facility with which solid explosives on being ignited shatter a sealed tube in which they are contained depends not only on the volume rate of gas formation, but also on phenomena arising as a result of gas penetrating into cracks that are formed in the crystals of the solid explosive. The experimentally determined behavior of a number of explosives is correlated with their tendency to form cracks under the effect of stresses arising at high temperatures.

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17. The Effects of Turbulence on the Intensity of Combustion and the Velocity of Flame Propagation

"Propagation of Turbulent Flames in Single-Phase and Two-Phase Combustion Systems" by Ye. A. Borovchenko; Minsk, Doklady Akademii Nauk Belorussian SSR, Vol 3, Mar 59, pp 100-102

An investigation of the effects of turbulence on the intensity of combustion and the propagation of flame was made on a typical two-phase system (peat dust suspended in air) and a typical single-phase system (a mixture of butane with air.) The turbulence was produced by using nets of different mesh dimensions. The dependence of oxygen concentration, intensity of combustion, and rate of flame propagation on the turbulence was studied. It was established that small-scale turbulence increases the rate of flame propagation in two-phase combustion systems while large-scale turbulence, which favors formation of a folded structure of the flame front, increases the rate of flame propagation in single-phase systems.

18. Advantages and Disadvantages of Using Lighter Fuels for Jet Engines

"Principles of the Application of Petroleum Products," by N. M. Marketov; Moscow, Khimiya i Tekhonologiya Topliva i Masel, Vol 4, No 6, Jun 59, pp 69-71

In reviewing the book "Osnovy Primeniya Nefteproduktov" (Principles of the Application of Petroleum Products), by B. V. Losikov, N. G. Puchkov, and B. A. Englin, Gostoptekhizdat, Moscow, 567 pp, 1959, the author of the review says that particular attention is being paid in the book of the selection of fuels for jet engines. According to the book, using fuels with a lighter fractional composition has a favorable effect in that it facilitates starting of the engine, improves combustion, increases the efficiency of combustion and flame stability, improves the characteristics of the fuel at low temperatures, and increases the supply of available fuel. However, application of fuels with a lighter fractional composition increases the danger of the formation of vapor locks, makes the operation of the fuel pumps less certain, increases losses by evaporation, and lowers the volume heat of combustion.

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19. A USSR "Rocket" Drill

"A Rocket That Drills Rocks," by V. Pospelov; Moscow, Promyshlenno-Ekonomicheskaya Gazeta, Vol 4, No 87 (542), 26 Jul 59, p 4

Specialists at the Khar'kov Aviation Institute, Ministry of Higher Education USSR, have developed the self-propelled STB-1 rocket drill installation. The STB-1 installation is a rocket drill mounted on a motor truck. By means of this equipment one can carry out thermal drilling in hard rock (e.g., granite) of vertical and inclined wells or holes with a diameter of 120-200 mm going down to a depth of 8 meters. At the required depth in the rock the diameter of the well can be increased to 0.5 meters so that a cavity in which explosives can be placed is formed. The installation consists of a motor truck with a body of the van type on the roof of which a tower (literally "mast") holding the rod-like drill is mounted. At the far end of the drill is a special combustion chamber in which liquid fuel is burned. Its design is similar to that of a rocket engine.

During the drilling, the heated gases flow out of the nozzle of the rocket-type combustion chamber with the velocity of sound. Enormous thermal stresses bring about destruction of the rock being heated. The particles of rock are blown out of the well by the gas stream and thus removed from the well.

The thermal drill equipped with a combustion chamber is the principal part of the installation. During operation, the drill is cooled with circulating water. The drill operates on liquid fuel and gaseous oxidant consisting of oxygen or air.

The STB-1 installation is equipped with two thermal drills. Oxygen is supplied through a hose from cylinders placed on a trailer. When the liquid fuel is burned with air, an air compressor is used.

In addition to being displaced forward along the axis of the well being drilled, the thermal drill rotates around its own axis. This assures uniform distribution of heat in the rock that is to be removed from the well.

The forward motion of the drill along its axis and its rotation around this axis are brought about by means of hydraulic motors. The use of hydraulic motors makes it possible to regulate the operational velocities within a wide range. The installation is equipped with automatic controls which facilitate and make more reliable the operation of the drill. A central control panel is located in the cabin of the truck. Instruments with which the installation is equipped make it

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possible to measure the pressures and rates of use of the fuel, oxygen, air and cooling water -- also the pressure of gasses in the combustion chamber, the volocity of the forward motion of the drill, the depth of the drill's penetration into the rock, the pressure in the hydraulic system, etc.

The new equipment has passed the tests to which it was subjected. It operated without difficulty on different hard rocks. The speed of thermal drilling, not only with oxygen, but also with the use of compressed air is many times greater than that achieved by applying mechanical methods of drilling, which are now being superseded rapidly. One installation of the new type will replace 10-12 complicated and expensive rigs for cable tool drilling and will also facilitate greatly the work of drill operators.

An arrangement for the automatic feeding of the drill into the well is being developed at present. The drill will be moved forward in such a manner that an optimum distance between the nozzle of the combustion chamber and the rock being removed from the well will be maintained automatically. The optimum distance depends on the extent of rock and other physical properties of the rock. Automatic control establishing the optimum conductions of operation will considerably increase the efficiency of thermal drilling.

Preparations are now being made for the series production of multipurpose ("universal") self-propelled installations similar to STB-1, to be applied in the drilling of tough rocks. A working model of an STB-1 installation can be seen at the Exhibition of Achievements of the USSR National Economy.

Industrial Chemistry

20. Trends and Prospective Developments in USSR Chemistry on the Basis of the Eighth Mendeleyev Congress

"The Results of the Eighth Mendeleyev Congress" by N. M. Zhavoronkov, Corresponding Member Academy of Sciences USSR; Moscow, Vestnik Akademii Nauk SSSR, Vol 29, No 6, Jun 59, pp 26-34

Planning and designing of new plant departments and plants for the large-scale production of caprolactam, adipic acid, dimethyl terephthalate, aminoenanthic acid, polyacrylonitrile, polyethylene, polypropylene, and polyamide, polyurethane, and polyester resins as well

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as other products and, on the basis of these products, of new types of synthetic fibers and plastics, is proceeding at full speed. Measures are being taken to increase sharply the production of viscose fiber and high-strength tire cord fibers, acetyl cellulose to be used for fibers and films, carbamide, phenol-formaldehyde, ion-exchange resins, polystyrene and styrene copolymers, plastics containing fluorine, organosilicon polymers, polyvinyl chloride, transparent plastics, and synthetic elastomers. As far as production of synthetic rubber is concerned, there will be a sizeable increase in the relative proportion of butyl rubber, isoprene rubber, and also special elastomers which have a lower permeability to gases, a greater abrasion resistance, a greater resistance to the action of oil, esters, gasoline, and other solvents, a greater heat resistance, and a greater stability at low temperatures. The production of inorganic fertilizers will increase from 12.4 million tons in 1958 to 35 million tons in 1965. Technical progress in the production of nitrogen fertilizers will be achieved by basing this important branch of production on a cheaper raw material, i.e., natural gas. Nitrogen plants will operate as enterprises for the combined production of nitrogen fertilizers and products of organic synthesis: ammonia, acetylene, acetic acid, methanol, formaldehyde, urea, and many other products will be produced at them. Expansion has also been planned in the phosphorus and potassium fertilizer industries, with respect to the production of inorganic acids and soda, and in the production of agricultural poisons, agents for the control of diseases of agricultural plants, growth stimulants, and physiologically active substances which suppress the growth of weeds, act as defoliants, etc.

The rapid development of the chemical industry, which took place as a result of the development of nuclear technology, radioelectronics, rocket technology, machine-building, agriculture, medicine, and other fields of economics, science, and technology, put new demands to chemistry and required a search for new chemical materials, the development of new technological processes, and a considerable expansion of the range of initial substances used for further industrial conversion. Among the problems which have to be solved are those pertaining to scientific aspects of the production of high-molecular compounds and also of initial and auxiliary substances required for the production of other synthetic materials.

Many important problems will have to be solved by chemists as far as the development of methods for the production of graft polymers and the study of the properties of such polymers is concerned and also in connection with the development and application of ion-exchange resins and resins capable of exchanging complexes, films consisting of strong polymeric electrolytes, inorganic polymers exhibiting elastic properties, polymers which have a strong adhesion and can be used as anticorrosion and decorative coatings, etc.

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Particular attention should be paid to research on methods for the synthesis of biologically active polymers.

The development of the industry and the tendency to extend the range of applications of polymers make it necessary that the three following scientific and technical problems of the utmost importance be solved in the field of polymer chemistry. The first of these problems is development of polymers which are chemically stable in an extensive temperature range, particularly at elevated temperatures. A number of applications in present-day technology requires the use of polymer materials which stand temperatures up to 400°-500° and higher. The second problem is the creation of new polymers which not only exhibit superior characteristics, but are also cheap and accessible. The third problem pertains to the development of methods for manufacturing articles from polymer materials.

Research in the field of the chemistry of organoelemental compounds, a branch of chemistry which is on the borderline between organic and inorganic chemistry, is of importance not only from the standpoint of the solution of general problems of theoretical chemistry, but also from the standpoint of practical applications of compounds of this type. Among these applications one may first of all mention those as insecticides, fungicides, drugs, antiseptics, etc., and also as starting materials for the synthesis of polymers which exhibit chemical resistance as well as resistance to high temperatures (e.g., organosilicon compounds and ferrocenes). Organoelemental compounds have been synthesized which can be applied as solvents, plasticizers, catalysts in organic synthesis, special heat-resistant lubricants, anti knock agents to be added to liquid fuels, etc.

The development of new semiconductors which are required in the radio engineering industry and must have definite predetermined properties, necessitates an increased amount of research on interrelationships between chemical composition, the structure, and the characteristics of semiconductors, on the one hand, and the conditions under which they have been synthesized, on the other hand. In this field, one of the most important problems is extension of the range of temperatures at which semiconductor devices are capable of operating. There is an expansion of the application of electrochemical sources of electric current in connection with the development of the new technology. This, in turn, necessitates more research aimed at the development of cheap and compact storage batteries and electric cells.

The industrial use isotopes and of penetrating radiation in the industry will result in developments of considerable economic importance. A very promising line of research is that on the synthesis of chemical products under the action of radiation. This applies particularly to radiation polymerization, treatment of polymers, and radiation-chemical oxidation, nitration, and chlorination of hydrocarbons. One must expand scientific research on the application of stable and radioactive isotopes as tracer atoms and also develop efficient methods for the separation of isotopes and the production of isotopes in a concentrated form.

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Of great actual importance at present is development of methods for the direct and efficient transformation of radiation energy into chemical and electrical energy in the core of nuclear reactors. To introduce the application of radioisotopes and of penetrating radiation into the industry on an extensive scale, one must expand research on radiochemistry, trans-uranium elements, and radiation chemistry, both with respect to the solution of theoretical problems and the development of new practical applications in science and technology.

In connection with one of the most important present-day scientific problems, that of the practical application of controlled thermonuclear reactions, chemists must improve methods for the production of deuterium that will serve as fuel in thermonuclear reactors and also develop new construction materials for reactors and for shields giving protection against nuclear radiation.

In the current 7-year period considerable attention will be paid to research pertaining to the production of rare elements in a pure or ultra-pure state, improvement of the degree of their extraction, many-sided utilization of ores, development of efficient and economical methods of separation and purification, and also expansion of the range of applications of rare elements. A number of important problems must be solved in connection of the synthesis of new inorganic substances including inorganic polymers, the production of new types of inorganic fertilizers, the development of new construction materials including high-temperature refractories based on pure oxides, heat-resistant ceramic coatings, heat-resistant high-strength glasses, etc.

The Eighth Mendeleyev Congress has demonstrated convincingly that progress of chemical science is unthinkable without the development of general theoretical research as well as applied work in the fields of inorganic, organic, and physical chemistry. This refers primarily to theoretical investigations on the structure of molecules, research on valency and the chemical bond, work on reactivity, and problems in stereo-chemistry, thermodynamics, chemical kinetics, and catalysis. Considerable research must be done on such new problems as the production of free atoms and radicals, the synthesis of organic catalysts (enzymes), the development of organic semiconductor materials, etc.

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Nuclear Fuels and Reactor Construction Materials

21. Xenon in Uranium Minerals

"The Isotope Composition and Content of Xenon in Uranium Minerals" by E. K. Gerling and Yu. A. Shukolyukov; Leningrad, Radiokhimiya, No 2, May 59, pp 212-222

A method has been developed for the isolation of xenon from uranium minerals and its determination. When uranium was present in a quantity of 10^{-7} - 10^{-6} cubic centimeters, the precision of determination by the three methods described (those of relative sensitivity, pressures, and isotope dilution) was ± 10% on the average. Investigation of the isotope composition of xenon from uranium minerals showed that up to 35% of this gas contained in the minerals may be derived from neutron-induced fission of U^{235}. Samples were found in which neutron-induced fission is practically absent and only spontaneous fission of U^{238} takes place. It was established that the half-life assumed at present for U^{238} undergoing spontaneous fission is somewhat too high. It was found that the majority of minerals of great age (i.e., an age of approximately 2 X 10^9 years) retained 20%-30% of radiogenic xenon; uranium minerals having an age of approximately 2 X 10^8 were found to have retained 70%-80% of xenon. Samples were found which had retained up to 100% of radiogenic xenon and also minerals that had lost up to 99% of this gas. Because of the inability of the majority of uraninites and nasturans to retain radiogenic xenon, the determination of the absolute age of these minerals by the xenon method is not reliable.

22. Determination of the Half-Life of U^{238} On the Basis of the Content of Xenon in Uranium Minerals

"Determination of the Half-Life of U^{238} Undergoing Spontaneous Fission on the Basis of the Content of Xenon in Uranium Minerals," by E. K. Gerling, Yu. A. Shukolyukov, and V. A. Makarochkin; Leningrad, Radiokhimiya, Vol 1, No 2, May 59, pp 223-226

On the basis of the Content of Xenon in uranium minerals, the half-life of U^{238} undergoing spontaneous fission was found to be equal to (5.8 ± 0.5). 10^{15} years.

23. Hydrates of Uranium Tetrafluoride

"Crystal Hydrates of Uranium Tetrafluoride" by Yu. V. Gagarinskiy and V. P. Mashirev; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 4, No 6, Jun 59, pp 1253-1259

It was demonstrated that anhydrous UF_4 obtained by the dehydration of the lowest hydrate of uranium tetrafluoride in vacuum when the temperature is gradually raised to 225° retains a structure similar to that of

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the initial compound. When the salt is hydrated again, the initial hydrate is obtained. The heat of hydration was found to be equal to 6.09 ± 0.01 kilocalories per mol. By using the calorimetric method it was established that the lowest hydrate of uranium tetrafluoride has a pseudocubic structure and a composition corresponding to the formula UF_4 . 0.4 H_2O. On the basis of tensimetric data, it is assumed that when UF_4.2.5 H_2O is dehydrated a solid solution of water is obtained. This solution corresponds structurally to the initial hydrate. When hydration with liquid water is carried out at 25°, the solid solution phase is transformed into the initial hydrate.

24. The Heats of Fusion and Heat Capacities of Uranium Tetrachloride and Uranium Tetraiodide

"Heat Capacities and Heats of Fusion of UCl_4 and UI_4; Heat of Transformation of UI_4" by M. M. Popov (deceased) G. L. Gal'chenko and M. D. Senin; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 4, No 6, Jun 59, pp 1241-1245

To determine the true heat capacity of UCL_4 and UI_4 a procedure involving direct heating and continuous introduction of the heat being measured was applied. A calorimetric vessel made of quartz was used. Data on the true molar heat capacity (calories per degree per mol) are given. It was established that there is a polymorphous transformation of UI_4 in the range of 453°-505°. The heat of transformation was found to be equal to 3,526 ± 58 calories per mol. The heats of fusion of UCl_4 and UI_4 were found to be equal to 11,938 ± 22 and 5637 ± 100 calories per mol, respectively.

25. Hydrates of Thorium Tetrafluoride

"Crystal Hydrates of Thorium Tetrafluoride" by Yu. V. Gagarinskiy and V. P. Mashirev; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 4, No 6, Jun 59, pp 1246-1252

It was established that when Th F_4 . 2.5 H_2O and Th F_4 . 0.5 H_2O are dehydrated by raising the temperature gradually to 250°, the phase that is formed retains a structure similar to that of the initial hydrate. This facilitates the re-entry of water into the lattice with the result that the initial compound is formed. It was found that the heats of hydration at 25° of the anhydrous phases that form as a result of the dehydration of Th F_4.2.5 H_2O are equal to 2,073 ± 4 and 1174 ± 5 calories per mol, respectively.

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26. Ethylenediaminetetraacetate Complexes of Pentavalent Plutonium

"Investigation by the Ion-Exchange Method of the Formation of Complexes by Pentavalent Plutonium in Ethylenediaminetetraacetate Solutions," by A. D. Gel'man, P. I. Artyukhin, and A. I. Moskvin, Institute of Physical Chemistry, Academy of Sciences USSR; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 4, No 6, Jun 59, pp 1332-1335

The formation of complexes by Pu (V) in ethylenediaminetetraacetate solutions was investigated by the method of ion exchange. It was found that in the range of pH = 4-5 the complex ion PuO_2Y^{3-} with a concentration dissociation constant of 6.8×10^{-11} is formed. The relative capacity of plutonium to form complexes with the anion of ethylenediaminetetraacetic acid Y^{4-} was investigated. It was established that this capacity depends directly on the values of the ionic potentials of plutonium in its different valency states.

27. Stability of the Intermediate Valency States of Plutonium in Nitric Acid Solutions

"Disproportionation of Pu (IV) and Pu (V) in Nitric Acid Solutions," by P. I. Artyukhin, V. I. Medvedovskiy, and A. D. Gel'man, Institute of Physical Chemistry, Academy of Sciences USSR; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 4 No 6, Jun 59, pp 1324-1331

The results of the investigation indicated that disproportionation of Pu (IV) in nitric acid solutions proceeds according to the same mechanism as disproportionation in perchloric acid. It was found that because of the formation of a complex the equilibrium constant of the reaction $3Pu\ (IV) \rightleftharpoons 2Pu\ (III) + Pu\ (VI)$ is inversely proportional to the concentration of nitric acid in the 5.3 power. It was established that the rate of disproportionation of Pu (V) in nitric acid solutions increases with the concentration of hydrogen ions. It was furthermore established that in the beginning the disproportionate process is determined by the reaction $2\ Pu\ (V) \rightleftharpoons Pu\ (IV) + Pu\ (VI)$. Accumulation of Pu (III) leads to predominance of the reaction $Pu\ (V) + Pu\ (III) \rightleftharpoons 2\ Pu\ (IV)$. This reaction brings about autocatalytic acceleration of the process of disproportionation of Pu (V).

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28. The Stability of Hexavalent Plutonium in Aqueous Solutions

"Investigation of the Stability of Hexavalent Plutonium in Some Aqueous Solutions," by L. Ye. Drabkina and A. D. Gel'man, Institute of Physical Chemistry, Academy of Sciences USSR; Leningrad, Radiokhimiya, Vol 1, No 2, May 59, pp 136-140

It was established that in hexavalent plutonium is stable during relatively long periods of time in 1 N nitric acid. When oxalate ions are present, gradual reduction of hexavalent plutonium takes place in nitric acid solutions. Hexavalent plutonium is unstable in solutions of ammonium oxalate: it is reduced completely to low valencies.

29. Alloys of Zirconium With Tin and Molybdenum

"Zirconium Corner of the Constitutional Diagram of the System Zr - Sn - Mo" of O. S. Ivanov and A. T. Semenchenkov; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 4, No 6, Jun 59, pp 1420-1427

It is pointed out that alloys of this type are of importance as construction materials for nuclear reactors. Alloying of zirconium with tin improves the mechanical strength of zirconium and furthermore eliminates the harmful effects of nitrogen on its corrosion resistance. Although molybdenum reduces the corrosion resistance of zirconium, it improves the mechanical characteristics of this metal considerably. Alloying of zirconium with both tin and molybdenum opens up possibilities of producing zirconium alloys of the highest strength.

In the course of the investigation described, it was found that the zirconium alloys investigated, in which Zr was alloyed with molybdenum and tin up to 4 atomic percent, consist, depending on the temperature, of alpha, beta-solid solutions and the intermetallic phases $Zr\,Mo_2$ and Zr_4Sn in quantities corresponding to different isothermal sections. Isothermal sections of the zirconium corner were constructed showing the phase composition of alloys at 525°, 700°, 800°, and 900°.

It was found that the eutectoid horizontal line corresponding to the transformations $\beta \rightleftharpoons \alpha + Zr\,Mo_2$ in the zirconium-molybdenum system is located at 680° rather than 780° as indicated by R. F. Domagala, D. J. McPherson, and N. Hansen in the Journal of Metals, 5 (1), p 73, 1953.

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30. Ferrocyanides of Scandium

"Scandium Ferrocyanides," by G. B. Seyfer and Ye. A. Ionova; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 4, No 6, Jun 59, pp 1362-1368

The results of an investigation on interactions of scandium chloride with the ferrocyanides of lithium, sodium, potassium, rubidium, and cesium are reported. The work in question is a part of a systematic investigation of the ferrocyanides of rare-earth elements with the application of methods of physicochemical analysis. It is a continuation of similar research carried out on lanthanum, yttrium, and cerium.

It was established that an increase in the ionic radius of the alkali metal results in an increased stability of the mixed alkali metal-scandium ferrocyanide. The same relationship was found to apply to the rare-earth metals investigated earlier.

31. Symposium on the State of Microquantities of Radioactive Elements in Solutions

"The State of Microquantities of Radioelements in Solutions" by F. L. Ginzburg and N. G. Rozovskaya; Moscow, Vestnik Akademii Nauk SSSR, Vol 29, No 6, Jun 59, pp 122-124

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"Radioactive isotopes are used extensively in scientific research and also for the solution of many production problems, e.g., those encountered in the control and automation of technological processes, the application of nuclear energy for peaceful purposes, etc.

"Investigation of the state in which microquantities of radioactive elements occur in solutions is of exceptional interest, because the behavior of insignificantly small quantities of matter is determined by the state of that matter in solution under any given set of conditions.

"An All-Union Symposium held at Leningrad on 3-5 March 1959 was concerned with the discussion of these questions.

"In a report presented at the symposium, I. Ye. Starik pointed out that until recently one distinguished between the ionically disperse, colloidal, and pseudocolloidal state of radioelements present in microquantities in solutions. Insufficient attention was paid to the investigation of the molecular state of elements. Using the method of adsorption on hydrophobic adsorbents (polymers), Starik and his collaborators obtained data for a number of elements (Zr, Po, Am, Ce, and Pm) which prove that these radioactive elements [and radioisotopes] are present in the molecular state in solutions. This result is of particular importance as far as strongly acidic media are concerned. It was established that the addition of salts has a salting-out effect, which proves that molecular adsorption takes place.

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"The application of different methods (those of adsorption, desorption, ultrafiltration, centrifuging, electrophoresis, deposition on metals, etc.) made it possible to establish in what pH regions radioactive elements occur in the ionically disperse, colloidal, or pseudocolloidal state. Papers were given on the state in which microquantities of zirconium, polonium, protactinium, and americium are present in aqueous solutions (I. Ye. Starik, I. A. Skul'skiy, N. I. Ampelogova, L. I. Il'menkova, L. D. Sheydina, and F. L. Ginzburg).

"In a report on methods for the investigation of the state of uranium in natural waters, M. M. Yakovleva and M. A. Shushalina emphasized that investigation of the state of microquantities of radioactive elements in solutions enables geologists to foretell in what areas a search for deposits of the elements in question will be most promising.

"A number of reports dealt with the state of radioactive elements in nonaqueous phases. The results reported were obtained by investigating the form in which compounds of these elements are extracted.

"V. M. Vdovenko, L. N. Lazarev, and S. Ya. Khvorostin discussed interesting distinguishing characteristics of the extraction of oxalate complexes of zirconium with aliphatic amines which are apparently related to the polymerization of salts of the amines in the organic phase.

"Data were reported in regard to the degree of hydration of complex compounds of uranyl nitrate and of nitric acid in organic solvents (V. M. Vdovenko, Ye. A. Smirnova, and N. A. Alekseyeva.)

"Formation of complexes of radioactive elements in organic solutions was investigated. A novel method was proposed for the determination of the composition of complex compounds and the calculation of their dissociation constants (V. M. Vdovenko, A. A. Chaykhorskiy, and L. M. Belov).

"Work described in a report by A. K. Lavrukhina demonstrated that the occurrence of radioelements in different states (that of complex compounds, polymers, etc.) depends on the concentration of these elements in solution.

"Possibilities were discussed of the application of combined extraction and precipitation with organic compounds for the investigation of the state of radioelements. V. I. Kuznetsov and P. P. Titov explained the phenomenon of combined extraction by the formation of mixed polymeric anions.

"Application of the method of ionic exchange for the investigation of the state of radioactive elements in aqueous solutions formed the subject of a number of papers.

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"A method for the determination of the magnitude of the charge of ions of radioactive elements in solutions, which has been proposed by A. M. Trofimov and L. M. Stepanova, makes it possible to observe the course of the polymerization of ions at the same time. This method was applied for the determination of the dependence of the magnitude of the charge of zirconium ions on the concentration of nitric acid in solutions.

"It has been shown by S. Ye. Bresler, Yu. D. Sinochkin, A. I. Yegorov, and D. A. Perumov that the use of specific adsorbents based on zirconium may be of practical interest for the investigation of the state in which radioactive elements occur in solutions.

"The participants at the symposium also heard several communications pertaining to research on the chemistry of hot atoms. At present, the number of investigations in this important field is very small and very few attempts have been made to investigate the state in which hot atoms and radicals are present in solutions. A. N. Nesmeyanov reported on the substitution of hydrogen atoms in benzene with recoil atoms of P^{32}, As^{76} and Sb^{124}. He pointed out that formation of phenyl derivatives of different elements may take place as a result of inelastic collisions of recoil atoms with benzene molecules. The reactions which result in the formation of these derivatives are of a "superthermal" type.

"In the course of the discussions which were held, considerable attention was paid to the role which is played by hydrolysis and formation of colloids in the phenomena discussed. In a number of communications, the possibility was pointed out of using extensively the methods of ion-exchange and extraction for the investigation of the state in which elements occur in solutions. At the same time, the necessity of a more rigid thermodynamic approach to the interpretation of data obtained by the extraction method was pointed out.

"In summarizing the results of the symposium, I. Ye. Starik emphasized that one of the principal problems in the field subjected to discussion is the quantitative determination of the size of particles present in solutions. Among methods for the determination of particle size, optical methods and measurement of rates of diffusion will be of great advantage.

"Speaking on behalf of the organizational committee, V. M. Vdovenko pointed out in the concluding address that the scientific community evinced great interest toward the symposium. More than 250 scientists participated in it. In Vdovenko's opinion, there can be no doubt that Soviet radiochemists will accomplish successfully the tasks which they are called on to perform."

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32. A New Method for the Determination of Dissociation Constants of Complex Compounds of Elements Present in Very Small Quantities

"An Electromigration Method for the Determination of Dissociation Constants of Complex Compounds of Elements Present in Microconcentrations; Part 1 -- Determination of the Dissociation Constants of Complex Compounds Formed by Some Lanthanides With the Anion of Ethylenediaminetetraacetic Acid," by V. P. Shvedov and A. V. Stepanov; Leningrad, Radiokhimiya, Vol 1, No 2, May 59, pp 162-167

A new method for the determination of the dissociation constants of complex compounds was developed which is based on the migration of metals in an electric field. The dissociation constants of compounds present in microconcentrations are determined by establishing the dependence between the position of the equilibrium of the reversible reaction of dissociation of the complex and the velocity of the total displacement of metal in the electric field. By using the method in question, the dissociation constants of a number of complex compounds formed by lanthanum, cerium, promethium, europium, and yttrium with ethylenediaminetetraacetic acid were determined. The compounds in question undergo a single step dissociation. A comparison of the dissociation constants measured with potentiometric data for La, Ce, Eu, and Y indicated that there is satisfactory agreement between the two sets of results. The dissociation constant of the complex formed by promethium with ethylenediaminetetraacetic acid was determined for the first time in the work described.

33. The State of Lanthanum in Dilute Solutions

"The State of Microquantities of Radioactive Elements in Dilute Solutions; Part 8 -- The Adsorption of Lanthanum on Quartz Glass and Plexiglass," by I. Ye. Starik and F. L. Ginzburg; Leningrad, Radiokhimiya, No 2, May 59, pp 171-173

In an investigation of the adsorption of lanthanim from nitric acid solutions on quartz glass and plexiglass as affected by the pH of the solution, it was established that at a concentration of lanthanum amounting to 10^{-14} mol per liter, there is a maximum of adsorption at a pH close to 7. It was furthermore established that the adsorption of microquantities of lanthanum on plexiglass is considerably greater than that on glass. The maximum adsorption of lanthanum on quartz glass from solutions in which it is present at a concentration of 10^{-7} mol per liter was found to be in the region of pH = 7-8. The radioactive isotope La^{140} was used in the investigation.

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34. Dependence of the Emanation Capacity of Synthetic Salts and Minerals on the Particle Size

"Dependence on the Size of Particles of the Emanation Capacity of Synthetic Salts and Minerals With Respect to Radon, Thoron, and Actinon," by I. Ye. Starik and O. S. Melikova; Leningrad, Radiokhimiya, Vol 1, No 2, May 59, pp 196-203

When the source of the emission of radon isotopes is adsorbed on the surface of crystals of a synthetically prepared salt, the emanation capacity does not depend on the size of the crystals. On the other hand, when radium isotopes have crystallized together with isomorphous salts, the emanation capacity is proportional to the specific surface. It was established that the emanation capacity of minerals shows little dependence on changes in the specific surface. The increase in the emanation capacity with increased dispersion depends on the degree of preservation of the sample of the mineral and the state in which radium isotopes occur in it. In the investigation of uranium minerals, one can as a rule differentiate the emanation of thoron from that of radon and actinon, while in thorium minerals, the emanation of actinon, and sometimes of radon, can be differentiated. These correlations play an essential role in the determination of the age of the mineral by the lead method. Anomalous behavior of actinon may be caused by a ratio of AcX to Ra deviating from the normal.

35. Spectrographic Determination of Other Rare Earths in Pure Cerium

"Spectrographic Determination of Small Quantities of Lanthanum, Praseodymium, Neodymium, and Yttrium in Cerium," by Hsu Pao-ling (徐 宝 珍), Shen Lien-fang (沈 联 芳), Ch'eng Chien-hua (程 建 华) and Chang Ting-chao (張 定 釗), Institute of Metallurgy and Ceramics and Institute of Applied Chemistry, Academia Sinica; Peiping, Hua-hsueh Hsueh-pao (Acta Chimica Sinica), Vol 24, No 6, 1958

In this paper, two methods for the determination of rare earth impurities in "purified" cerium are described.

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"1. The sample to be analyzed is converted into chlorides (concentration 10 mg CeO_2/ml and acidity 1:19 HCL). Drops of the prepared solution are transferred to the flat top of graphite electrodes previously treated with liquid paraffin. The electrodes are dried on a hot plate and then excited by an AC arc (220 V, 5 Amp). The spectrograph used is of the ISP-51 type (with UF-85 automatically collimating camera tube; slit 0.01 mm; photographic plate, NIKFI II). Using the line pairs

$$\frac{\text{La } 4333.74}{\text{Ce } 4330.90}, \quad \frac{\text{Pr } 4225.33}{\text{Ce } 4229.63}, \quad \frac{\text{Nd } 4061.09}{\text{Ce } 4057.30} \text{ and } \frac{\text{Y } 4374.94}{\text{Ce } 4376.88},$$

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La, Pr, Nd, and Y can be determined quantitatively in the concentration ranges of 0.055-0.62%, 0.089-1.29%, 0.052%-0.59% and 0.025-0.40%, respectively. The root mean square deviations of single determination amount to ± 4.7%, ± 10.8%, ± 7.0% and ± 7.0%, respectively.

"2. For cerium samples of high purity, ether extraction is used to remove most of the cerium so that the rare-earth impurities can be concentrated. Because of its relatively simple spectrum, the element Y has been used as a carrier and an internal standard. The concentrate, also in the form of a chloride solution (concentration one milligram rare-earth oxides/ml), is excited and photographed by the same method as mentioned in (1). The line pairs used are:

$$\frac{\text{La } 4238.38}{\text{Y } 4235.73} \qquad \frac{\text{La } 3988.52}{\text{Y } 3951.60} \qquad \frac{\text{Pr } 4222.98}{\text{Y } 4235.73} \quad \text{and} \quad \frac{\text{Nd } 4232.38}{\text{Y } 4235.73}$$

"With a sample of 100 mg (1 mg Y_2O_3 added as internal standard), the analytical sensitivities reached are 0.01%, 0.025% and 0.028% for La, Pr and Nd, respectively. The error of the method amounts to about ± 10%."

Radiochemistry

36. Determination of Actinium in Uranium Ores on the Basis of Fr^{223} Derived From It

"The Problem of the Determination of Actinium in Natural Objects on the Basis of Fr^{223} Derived From It," by A. K. Lavrukhina, D. Kourzhim, and L. V. Filatova; Leningrad, Radiokhimiya, Vol 1, No 2, May 59, pp 204-207

Among the methods used for the isolation of actinium from uranium ores, the extraction of actinium with a solution of thiophenecarbonyltrifluoroacetone in benzene at pH ≈ 3.5-5 proved to be best. Independently of the method by which the actinium was isolated, the francium preparations separated from actinium had an activity amounting to 12-15% of that calculated from the equilibrium. This indicates that actinium is absorbed by the slimy fraction of the ore, which is insoluble in concentrated nitric acid.

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37. Application of the Method of Impact Retardation for the Collection and Investigation of Fission Splinters

"Possibility of Application of the Method of Impact Retardation and Collection of Fission Splinters in a Gas to Investigate Splinter-Element Isotopes; Part 1 -- Radiochemical Investigation of the Distribution of Splinters According to the Length of Path," by K. A. Petrzhak, Ye. V. Nikol'skaya, Yu. G. Petrov, and E. A. Shlyamin; Leningrad, Radiokhimiya, Vol 1, No 2, May 59, pp 227-230

U^{233} was irradiated in a nuclear reactor. The splinter elements that formed were retarded by means of different gases (air, argon, helium, and hydrogen) introduced at appropriate pressures. Films for the collection of splinter elements were placed at different distances from the uranium target. The distribution of splinter elements according to the length of path was then determined. Data are given on the radioactive isotopes of strontium, yttrium, zirconium, barium, and cerium. On the basis of the results obtained, the conclusion is made that the method of impact retardation and collection of fission elements in the medium of a gas considerably simplifies and accelerates the investigation and chemical isolation of splinter isotopes. The method may be of interest for the investigation of rapidly decaying splinter isotopes and also for the isolation of splinter elements without a carrier.

38. Complexes Formed by Americium

"Investigation by the Method of Ion Exchange of the Complexes Formed by Trivalent Americium in Oxalic Acid Solutions and Solutions of Ethylenediaminetetraacetate," by A. I. Moskvin, G. V. Khalturin, and A. D. Gel'man; Leningrad, Radiokhimiya, Vol 1, No 2, May 59, pp 141-146

The complexes formed by trivalent americium in oxalate and ethylenediaminetetraacetate solutions were investigated by the ion-exchange method using KU-2 cation exchange resin. It was established that the complex ions $[Am(C_2O_4)_2]^-$, $[Am(HC_2O_4)_3]^0$, and $[Am(HC_2O_4)_4]^-$ are formed. The dissociation constants of these ions were found to be equal to 1-2). 10^{-10}; 2.3 X 10^{-10}; and 1.0 X 10^{-11}, respectively. It was found that in solutions containing ethylenediaminetetraacetate, the complex ions $[Am\,Y]^-$ and $[Am\,HY]^0$ are formed in the range of pH = 1.0-2.2. The dissociation constants of these ions are equal to $(9.7 \pm 2.8) \cdot 10^{-19}$ and $(2.0 \pm 0.5) \cdot 10^{-10}$, respectively.

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39. Procedures for the Determination of Radioactive Strontium in Water

"Determination of Radioactive Strontium in the Water of Open Reservoirs," by L. K. Ponomareva and V. L. Zolotavin; Leningrad, Radiokhimiya, Vol 1, No 2, May 59, pp 208-211

Methods have been developed for the determination of Sr^{90} present in permissible concentrations in the water of open reservoirs. The first method determines the activity of Sr^{90}+ Sr^{89}. The time required for the determination is 2 hours. The maximum error amounts to ± 10%. The second method determines the activity of Sr^{90} alone. Application of this method involves keeping the solution for 24 hours. The maximum error in the determination amounts to ± 10%. Both methods make it possible to determine Sr^{90} in a concentration amounting to 5×10^{-11} curie per liter, i.e., a concentration which is lower by one order than that corresponding to the maximum permissible amount of radioactive strontium.

40. The Effect of Ionizing Radiation on Wood

"The Effect of Ionizing Radiation on the Chemical Stability of Wood," by A. S. Freydin, Central Scientific Research Institute for the Mechanical Working of Wood, Leningrad Branch; and Yu. M. Malinskiy and V. L. Karpov, Physico-chemical Institute imeni D. Ya. Karpov; Moscow, Gidroliznaya i Lesokhimicheskaya Promyshlennost', Vol 12, No 4, May 59, pp 4-7

Work on the effects of ionizing radiation on wood conducted by the Central Scientific Research Institute for the Mechanical Working of Wood jointly with the Physicochemical Institute imeni L. Ya. Karpov is reviewed. It is suggested that wood be irradiated before being hydrolyzed, because hydrolysis is facilited by this treatment and a more dilute acid can therefore be used. Because hemicelluloses are more readily subjected to radiolysis than other cellulose materials, it is advisable, in the author's opinion, to treat by irradiation primarily raw materials containing pentosans. These materials will then be used for the production of furfural and other products. Because the products of the radiolysis of wood are easily digested by animals, irradiated wood can be used as fodder for cattle, as has been established in work done in the US and the USSR. Another possibility of applying radiation techniques will be to impregnate wood with a monomer and treat the wood containing the monomer by exposing it to radiation. This method of producing wood plastics eliminates the necessity of applying high pressures, elevated temperatures, and polymerization catalysts. The authors state that in the industrial treatment of wood nuclear reactors, accelerators, or radioactive isotopes can be used as sources of radiation. In the author's opinion, the application of reactors is inconvenient because the radiation induced in the material by the action of neutrons emitted by nuclear reactors is rather high and the handling of

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the material becomes dangerous for that reason. Accelerators would be suitable but the electrons forming the output of this equipment do not penetrate very deeply. If accelerators are applied, a thin layer of the material being treated (for instance, wood chips) will have to be passed continuously under the bundle of rays. Radioactive isotopes such as cobalt-60 and spent fuel elements of nuclear reactors will form the best source of radiation for the treatment of large quantities of material in bulk.

It is stated that installations for killing insect pests in grain are being developed at present. These installations will have an isotope source of radiation with an intensity of 100 kg equivalents of radium.

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IV. EARTH SCIENCES

41. Conference on Volcanology To Be Held in Armenia

"Concerning the Calling of the First All-Union Volcanological Conference in the City of Yerevan," by the Conference Organization Committee; Yerevan, Izvestiya Akademii Nauk Armyanskoy SSR, Seriya Geologicheskikh i Geograficheskikh Nauk, Vol 12, No 3, 1959, pp 63-65

Representatives of 33 Soviet geological organizations and also scientists-volcanologists from foreign countries will participate in the First All-Union Volcanological Conference which is to be held this year from 23 September to 5 October in Yerevan, Armenia. Ninety-eight reports will be presented in the conference program which includes the following:

1. Active volcanism and principles in its study
2. Volcanism and tectonics
3. Volcanogenic formations and related mineral products
4. Symposium on terminology and classification of volcanogenic rocks.

Conference meetings will continue for 5 days and will be followed by tours of volcanic sights along the following routes:

1. Yerevan - Avan - Garni - Gegard
2. Yerevan - Pambak
3. Yerevan - Ashtarak - Artik - Aparan - Golgat - Yerevan
4. Yerevan - Nakhichevan' - Goris
5. Goris - Lachin - Stepanakert - Goris
6. Goris - Dzhermuk
7. Dzhermuk - Yekheknadzor - Martuni - Kamo
8. Kamo - Sevan - Yerevan
9. Yerevan - Mt. Aragats

Publishing of abstracts of conference reports and an excursion guidebook was indicatd as being in progress.

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Staff members of the Conference Organization Committee are the following:

1. I. G. Magak'yan, Academician of the Academy of Sciences Armenian SSR, Chairman

2. G. D. Afanas'yev, Corresponding Member of the Academy of Sciences USSR, Vice-chairman

3. V. I. Vlodavets, Doctor of Geological-Mineralogical Sciences, Vice-chairman

4. B. I. Piyp, Corresponding Member of the Academy of Sciences USSR, Vice-chairman

5. K. G. Shirinyan, Candidate of Geological-Mineralogical Sciences, Institute of Geological Sciences of the Academy of Sciences Armenian SSR, Vice-chairman

6. E. G. Malkhasyan, Candidate of Geological-Mineralogical Sciences, Institute of Geological Sciences of the Academy of Sciences Armenian SSR, Scientific secretary

7. Ye. V. Sveshnikova, Candidate of Geological-Mineralogical Sciences, Institute of Geological Sciences of the Academy of Sciences Armenian SSR, Scientific secretary

Other members of the Conference Organization Committee are the following:

1. Kh. M. Abdullayev, Corresponding Member of the Academy of Sciences USSR

2. A. A. Adamyan, Candidate of Geological-Mineralogical Sciences, Institute of Geological Sciences of the Academy of Sciences Armenian SSR

3. G. M. Arutyunyan, Armenian Geological Administration

4. A. T. Aslanyan, Doctor of Geological-Mineralogical Sciences, Armenian Geological Administration

5. R. B. Baratov, Corresponding Member of the Academy of Sciences Tadzhik SSR

6. G. P. Bagdasaryan, Candidate of Geological-Mineralogical Sciences, Institute of Geological Sciences of the Academy of Sciences Armemian SSR

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7. V. A. Vakar, Doctor of Geological-Mineralogical Sciences, Institute of the Geology of the Arctic

8. G. M. Gapeyeva, Doctor of Geological-Mineralogical Sciences, All-Union Geological Scientific Research Institute

9. G. S. Gorshkov, Candidate of Geological-Mineralogical Sciences, Laboratory of Volcanology of the Academy of Sciences USSR

10. G. S. Dzotsenidze, Academician, Academy of Sciences Georgian SSR

11. M. A. Kashkay, Academician, Academy of Sciences Azerbaydzhan SSR

12. A. P. Lebedev, Doctor of Geological-Mineralogical Sciences, Institute of the Geology of Ore Deposits, Petrography, Mineralogy and Geochemistry of the Academy of Sciences USSR

13. I. V. Luchitskiy, Doctor of Geological-Mineralogical Sciences, Western Siberian Branch of the Academy of Sciences USSR

14. S. S. Mkrtchyan, Academician, Academy of Sciences Armenian SSR

15. S. I. Naboko, Candidate of Geological-Mineralogical Sciences, Laboratory of Volcanology of the Academy of Sciences USSR

16. K. N. Paffengol'ts, Academician, Academy of Sciences Armenian SSR

17. V. P. Petrov, Doctor of Geological-Mineralogical Sciences, Institute of the Geology of Ore Deposits, Petrography, Mineralogy and Geochemistry of the Academy of Sciences USSR

18. K. I. Satpayev, Academician

19. A. Ye. Svyatlovskiy, Candidate of Geological-Mineralogical Sciences, Laboratory of Volcanology of the Academy of Sciences USSR

20. V. S. Sobelev, Academician

21. T. Sh. Tatevosyan, Candidate of Geological-Mineralogical Sciences, Yerevan State University

22. I. S. Usenko, Candidate of Geological-Mineralogical Sciences, Institute of Geological Sciences Ukrainian SSR

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23. Ye. K. Ustiyev, Doctor of Geological-Mineralogical Sciences, Institute of the Geology of Ore Deposits, Petrography, Mineralogy and Geochemistry of the Academy of Sciences USSR

24. M. A. Favorskaya, Doctor of Geological-Mineralogical Sciences, Institute of the Geology of Ore Deposits, Petrography, Mineralogy of the Academy of Sciences USSR

25. G. V. Yakovleva, Moscow State University

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V. ELECTRONICS

Acoustics and Audio Frequencies

42. Ultrasonic Frequency Transducer

"Checkered Barium Titanate Transducer for Ultrasonic Frequencies," A. A. Anan'yer, Acoustics Institute, Academy of Sciences USSR; Moscow, Akusticheskiy Zhurnal, No 1, 1959, pp 14-20

It is often desirable in laboratory measurements to have an ultrasonic frequency transducer operating at a fixed frequency over a wide range of frequencies. Such an unilateral multiresonant transducer can be built by applying several layers of different material between the active peizoelectric material and the medium in which the transducer operates. Such a barium titanate transducer was developed at the Acoustics Institute of the Academy of Sciences USSR.

The construction of the transducer is as follows: on a 6 mm circular plate are attached in a checkerboard pattern twenty-one 20 X 20 X 5 mm plates which are electrically connected in parallel, having a total capacitance of 16.10^3 micromicrofarads. The space between the plate and a plexiglas cover is filled with transformer oil.

Experimental measurements have shown that such a transducer has greatest sensitivity at certain frequencies which recur approximately every 17 kc. The ratio of maximum sensitivity to the minimum in the range of 70 to 140 kc is about 3.3. The experiment was conducted for ultrasonic waves in the frequency range of 40 to 250 kc.

43. Optical Investigation of Large Amplitude Ultrasonic Waves

"Optical Investigation of the Shape of a Large Amplitude Ultrasonic Wave in Liquid," by V. A. Shutilov, Leningrad State University; Moscow, Akusticheskiy Zhurnal, No 2, 1959, pp 231-40

By observing the distribution of light intensity in the diffraction pattern obtained by light diffraction on large amplitude ultrasonic waves, it is possible to determine the shape of the ultrasonic wave and to trace its distortion in the course of propagation through a fluid.

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Experimental graphs showing the dependence of the wave distortion factor on the stress in the radiating quartz crystals and the distance from the source of radiation are given. It is pointed out how the relationship between the shape of the wave and the light intensity distribution in the diffraction pattern can be utilized to determine absolute values of ultrasonic wave intensity of large amplitide in liquids.

The experiment was conducted at a frequency of 583 kc in distilled water with ultrasonic intensities of 22, 12, 4.6 and 1.2 w/cm^2.

44. High-Intensity Ultrasonic Waves

"A Device for Producing a High-Intensity Focused Ultrasonic Wave," by L. D. Rozenberg and M. G. Sirotyuk, Acoustics Institute, Academy of Sciences USSR; Moscow, Akusticheskiy Zhurnal, No 2, 1959, pp 206-211

Generation of a high-intensity ultrasonic wave is important in the study of various physical processes (sonic wind, cavitation, nonlinear absorption, etc.), and the effect of high-intensity sound pressure and velocity on the structure of matter and biological phenomena.

In this work, a half wave spherical resonant aluminum shell with flare angle of 70° was used. This shell was excited by 200 piezoelectric quartz discs (40 mm diameter, X-cut) distributed evenly over the outer surface. The selection of frequency is controlled by several factors: with the increase of frequency, the size of the focal point decreases, i. e., the concentration of ultrasonic energy increases; however, with increase of frequency, the losses in the aluminum shell and the working fluid also increase. Taking the above factors into consideration, a frequency of 500 kc was selected.

The construction of the device is as follows: the spherical aluminum shell with 314 mm internal diameter is attached along its edge to a supporting flange. The space inside the aluminum shell is filled with deaerated water for cooling. A cylinder with two openings is placed over the flange, thus permitting observation of processes in the vicinity of the focal point. Current from a power oscillator is fed to the quartz discs through a system of channel shapes connecting the discs. To increase the oscillation amplitude of the quartz discs, air gaps are left (0.3 mm) in back of the discs. To prevent electrical breakdown and flashover at the edges of the discs, the latter are silver plated at the center only (30 mm). The electrical end of the device is designed to withstand up to 7,000 v. A high-frequency 8-kw oscillator, utilizing a GKO-10 tube, provides power to the ultrasonic wave generator.

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Final tests have shown that this ultrasonic generator (concentrator) can produce an ultrasonic intensity of the order of 70.10^3 w/cm^2 and a peak pressure of an order of 500 atm at the center of the focal point.

Automation and Computers

45. Compensating Devices for Servomechanisms

"Synthesis of Servomechanism Compensating Devices in Presence of Noise," by P. S. Matveyev; Moscow, Avtomatika i Telemekhanika, No 6, Jun 59, p 721-728

The syntheses of compensating devices of a automatically stabilized servomechanism consist in finding a pulse transient function that will have the least rms value of the error for the given constants of the system and given time of the transient process. It is shown that a necessary and sufficient condition for the least value of rms error occurs when the pulse transient function satisfies the derived integral equation.

An example illustrating the procedure is given.

46. Analog Computers for Study of Gyroscope Characteristics

"Application of Mathematical Machines in Testing Gyroscopic Devices," By I. V. Afon'kin and V. S. Tarasov; Leningrad, Nauchno-Tekhnicheskiy Informatsionnyy Byulleten'. Radiofizika, No 5, 1958, pp 86-92

The improvement of gyroscope accuracy and reliability is essential in aviation, navigation, and other guidance systems.

The behavior of gyroscopes on moving objects is generally described by a system of nonlinear differential equations, which often have variable coefficients. Integration of such equations, as a rule, is very difficult by conventional means. The solution of gyroscopic-system equations with the aid of analog computers permits determining the following parameters: gyroscope kinetic moment, moment of inertia for individual components of the system, damping factor, time constant of the amplifying devices, etc.

At present, none of the scientific and research institutes or other organizations engaged in the development of new, and the improvement of existing gyroscopes, utilize computers to the full extent.

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An electronic analog computer was designed and built at the Chair of Mathematical and Computing Instruments and Devices of the Leningrad Polytechnic Institute imeni M. I. Kalinin, under the direction of Doctor of Technical Sciences T. N. Sokolov.

The application of analog computers to the study of gyroscope behavior will speed up the design of new gyroscopes with higher performance characteristics.

47. Electrolytic Bath Used as Transducer of Functional Relationships

"The Use of an Electrolytic Bath as a Computer Device," by G. P. Prudkovskiy, Institute of Physical Problems, Academy of Sciences USSR: Moscow, Pribory i Tekhnika Eksperimenta, No 3 May/Jun 59, pp 77-79

Using an instrument similar to that described by L. Hollway (Proceedings of the Institute of Electrical Engineers, 1956, 103B, No 8), the author explains how charts of the equipotentials of a harmonic field, simulated in an electrolytic bath, may be traced, thus permitting the bath to be used as a transducer of given functional relationships.

The basic components of the instrument are an electrolytic bath, a pantograph-type drawing device which transfers movements of a probe in the bath to the chart, a voltage divider, and a null indicator with a marker.

48. Automation of Quality Control

"Reliable Automation of Quality Control," by S. Rumyantsev, Candidate of Technical Sciences; Moscow, Pravda, 27 May 59, p 3

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"Problems of automatic quality control of a number of welded, cast, or other parts must be solved by means of realization of an uninterrupted, remote view of the defects in the parts and other items in the process of their production." This is achieved with the help of electronic and optical converters and amplifiers of radioactive or Roentgen rays in combinations with other instruments.

Soviet engineers have developed a series of devices which enable one to obtain an amplified stereoscopic representation of the defects developed in metals and other materials. With their help it is possible to determine the form, dimensions, and depth of the occurrence of the defect in the controlled object.

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The author recommended an all-union conference to consider the plan described above for control of the quality of production.

49. Czechoslovakia Makes New "Elan" Analog Computer

"The Giant 'Elan' Analog Computer," by Engr Zdenek Moravec, Prague, Veda a Zivot, No 5 & 6, May-June "international double issue," pp 358, 359

In 1958, construction of one of the largest analog computers of its type was completed in Czechoslovakia. The large universal network analyzer, bearing the appellation of "Elan" (electrical analyzer), was built on the plans of the Power Research Institute (Vyzkumny ustav energeticky), which drew on its experience in constructing alternating [current] network models previously developed for the needs of the Czechoslovak power system. The analyzer is composed of 30 bays set in the form of a horseshow with a total length of 36 meters, with a control console situated in the center, power lines, and other equipment. The total weight is about 15 tons. The work of the analyzer can be observed from the desk, which contains, among other equipment, an automatic center, with a relay memory for the selection of the unit which can thus be measured and even controlled. The work at the desk is controlled by two people, one of which serves as a manipulator and measuring technician, while the other only records the results achieved in the analyzer.

An "Elan" was built for the Institute for Power (Institut fuer Energetik) in Leipzig, where it will also be installed, and turned over to the use of East German scientists and research workers, who will be assisted thereby in solving complicated problems in the field of power, in the second half of 1959. "Elan" has a total of 450 various so-called "units (jednotky) of which the generator and load units may also be remotely controlled. The load units (zatezne jednotky) are also outfitted with equipment for automatic regulation, which is a particular feature of this analyzer. There is a total of 840 measurement points, and all can be centrally controlled from the desk. The 13-kw feeder is directed by electronic automatic equipment with a crystal oscillator. The above-mentioned and much other equipment and servomechanisms, which facilitate, accelerate, and refine the work of the analyzer, and which are without parallel in the presently known analyzers of this type, make "Elan" the most modern analog computer used in the electric power field and in related fields.

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50. Electric Relay Binary Computer Assembled in Budapest University

"The New, Fast Electric Computer of the Technical University," by Robert Fuhrmann; Budapest: Muszaki Elet, 9 Jul 59, Vol XIV, No 14, p 7

Since the designing and manufacture of computers will probably not be attempted in Hungary in the near future, we will be buying such equipment abroad and we must learn to operate it. Thus the training of computer experts has become a timely task.

Recognizing this fact, the Hungarian Academy of Sciences commissioned Dr Laszlo Kozma, a professor in the land-line signal technology faculty of the Electrical Engineering School [of the Budapest Technical University], to design a program-guided, fast-operating computer. This device will be used for training and for calculations connected with research work at the university. This is the first computer to be set up at the university, and it is called MESZ I [Technical University Computer No 1].

The power source is a 60-network rectifier; the equipment draws 600-800.

For material and didactic reasons, the computer was assembled with the cheap R-type relays made by the Beloiannisz Factory [Hungarian]. Computation and storage are carried out by 200 relays placed in three cabinets. Two cabinets contain computation relays and the third contains storage relays.

The instructions are put on a punch card and the computer reads this to obtain information at all times on what operation to perform on the numbers in the various registers [banks].

For example, in calculating the roots of a quadratic equation, the a, b, and c coefficients must be placed in advance into the appropriate registers [banks]. The roots are calculated on the basis of the formula:

$$x_{1,2} = -\frac{b}{2a} \pm \sqrt{\left(\frac{b}{2a}\right)^2 - \frac{c}{a}}$$

The machine solves this task in the following manner: it switches to the register containing a and multiplies by 2, storing the 2a obtained; it takes the (-b) and divides by the previously calculated 2a; the value for $-\frac{b}{2a}$ thus obtained is recorded in the storage unit; it then sets up the $\frac{c}{a}$ and the $\left(\frac{b}{2a}\right)^2$ and the root of the difference between the two; then this root is added to or subtracted from the value for $-\frac{b}{2a}$.

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The program reading circuit reads the program card a step at a time, transmitting the operational instructions to the operational instruction control circuit and the necessary memory assignments to the storage unit.

The directions indicate only register and operation but the coefficients for the several operations (in our case, the values for a, b, and c) can be selected as desired. Instead of the usual punched tape, we use a key board for coefficient input. The MESZ I uses the binary system and conversion from decimal to binary is accomplished automatically in the converter circuit.

We can store the first 27 binary symbols from the most significant digit, the rest are lost. The order of magnitude and the sign are stored elsewhere (a floating point binary system).

We reduce the fundamental operations to addition; thus, multiplication is multiple addition, etc. The soul of the device, therefore, is the adder, the arithmetic unit. The local value of each binary corresponds to one relay triplet, two of which represent the two values to be added and the third represents the sum. They switch in such a manner as to take account of the "carried digit" from the preceding local value. In the arithmetic unit, the tenth point is always in the same place and the local value of every number is placed accordingly (a fixed binary point system). Thus there are 27 plus 27 addition cells for each 27 cell sum.

The control unit is a 54-position 27-branch switch. It can feed the 27 place binary numbers from the storage unit into the arithmetic unit two at a time, in correspondence to their order of magnitude; or it can take them out of the arithmetic unit and put them into the storage unit.

The several operations (subtraction, multiplication, division, extracting roots, comparisons, etc.) can be performed by the operational instructions control unit and when these are completed, it gives an order to the program reading circuit for activation of the next instruction; or, if the computation is complete, for printing of the results.

The same converter circuit converts the binary results into the decimal system. A typewriter types out the results.

The MESZ I is most important from the didactic viewpoint. The equipment can be operated step by step by using the key board. The position of the relays can always be seen visually in the stopped machine and directions can be read from lamps.

The computer can handle a maximum of eight decimal places before and after the decimal point. It can store 12 numbers; thus it can solve tasks containing up to 12 elements, for example, linear equation systems with three unknowns. It is not as fast as an electronic computer, but it can solve the three roots of a third degree equation having eight place coefficients in about 3-4 minutes. This would take many hours with a table calculator.

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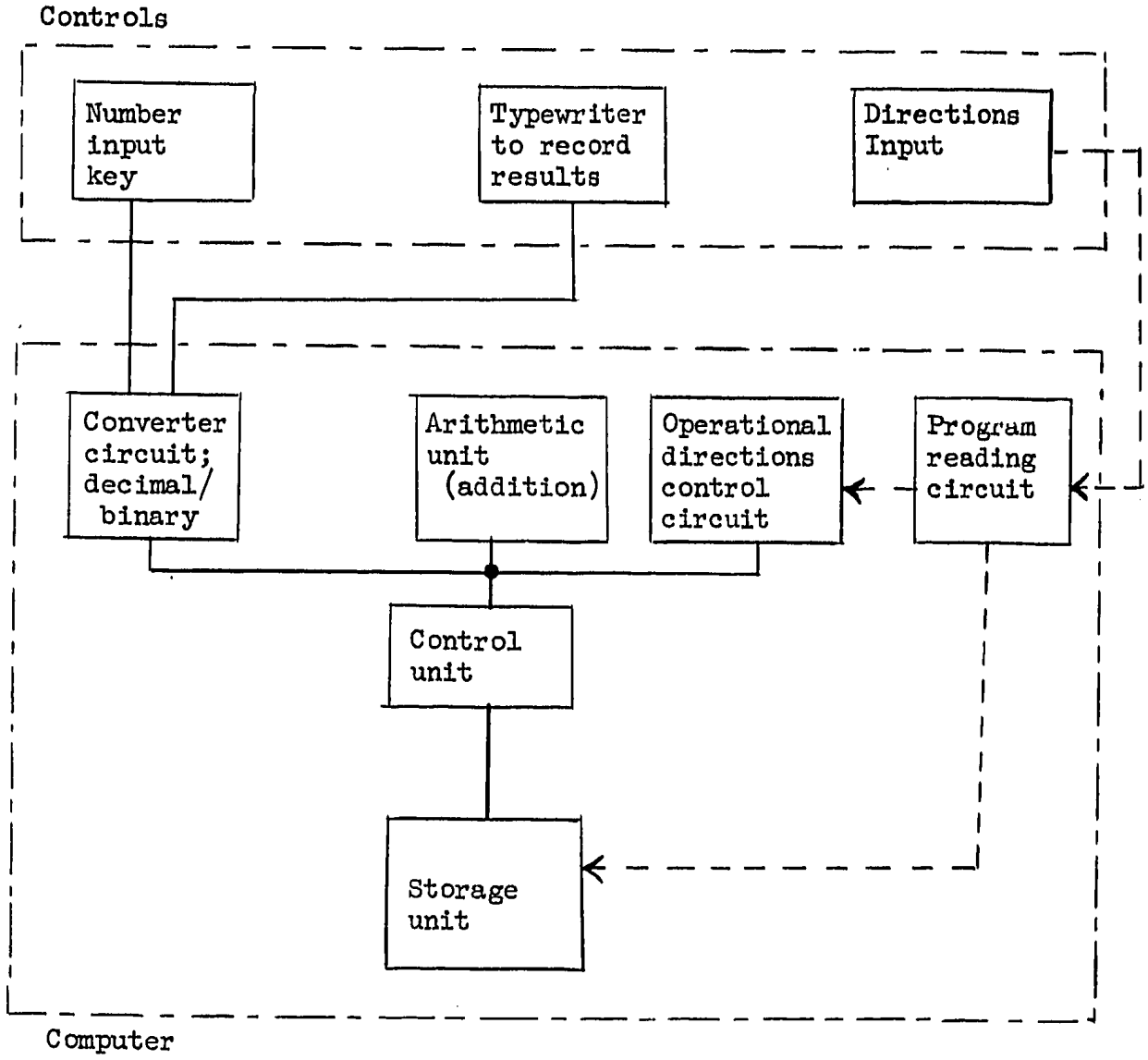
Block Diagram of Mesz I



Solid lines are paths of numbers

Broken lines are paths of directions

[For additional information on automation and computers, see also under Engineering].

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Components

51. Hungarians Give Advanced Degree for Work in Magnetic Amplifiers

"Reports of the Scientific Qualifications Committee," (unsigned note); Budapest, Magyar Tudomany, May 59, Vol 4, No 5, p 262

The Scientific Qualifications Committee has qualified Andor Frigyes as Candidate of Technical Sciences on the basis of his dissertation titled "Output Relationships of Half-Wave Magnetic Amplifiers." His opponents were Frigyes Csaki, Candidate of Technical Sciences, and Laszlo Vitalyos, Candidate of Technical Sciences.

Instruments and Equipment

52. Highly Sensitive Photon Counter Developed

"Photon Counters for Precise Measurements of Ultraviolet Radiation," by L. S. Shelkov, I. A. Prager, and A. G. Kostin, Physics Institute of the Academy of Sciences USSR and the Moscow Electric Bulb Plant; Moscow, Pribory i Tekhnika Eksperimenta, No 3, May/June 59, pp 50-56

A study is made of the operating conditions and electrical and photometric characteristics of photon counters with cathodes of various materials and the effect of design and technological factors on these characteristics. The experiments were conducted with self-quenched counters filled with a mixture of inert gas and an organic quenching component.

Results of experiments led to the design of a highly sensitive photon counter having a Cu-Be cathode and a protective grid of tungsten wire. The counter, which may serve as a sensitive receiver of ultraviolet radiation in the range of 1,900-3,000 A, has stable characteristics and is suitable for precise photometry at comparatively small exposure times.

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53. Multichannel Recorder for Ionization Chambers

"Recording Device With 128 Channels for Ionization Chambers," by N. N. Goryunov, Scientific-Research Institute of Nuclear Physics, Moscow State University; Moscow, Pribory i Tekhnika Eksperimenta, No 3, May/Jun 59, pp 84-89

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"A 128-channel amplifier-recording device is described which is designed for operation with ionization chambers. Each channel of the device has a large dynamic range of amplitudes for the recorded pulses (the amplitudes may differ by 8000). A record of the amplitudes is made by photographing the pulses from the screen of a cathode-ray tube. With the aid of an electronic commutating device, 64 pulses are simultaneously recorded on the screen of one tube. Recording accuracy is approximately 10%."

The author expresses his thanks to G. T. Zatsepin, G. B. Khristiansen, S. S. Glagolevskiy, Yu. A. Nechin, V. D. Sofronov and B. V. Subbotin for their assistance in the development and exploitation of the device.

54. Improvements in Modern Soviet Electron Microscopes Described

Izvestiya Akademii Nauk SSSR, Seriya Fizicheskaya, Vol 23, No 4, Apr 59

[The Second All-Union Conference on Electron Microscopy held in Moscow, 9 to 13 May 1958, was sponsored by the Department of Physicomathematical Sciences, Academy of Sciences USSR, and the Section of Electron Microscopy of the Society imeni Popov. The materials of this conference occupy the entire issue of the source, whose contents are summarized as follows.]

V. N. Vertsner, "Basic Tendencies in Modern Electron Microscope Design. Microscopes for Research in Passing Electron Rays," pp 426-435 -- Review of modern equipment, mostly foreign.

N. M. Popov, "Electron Microscope-Electronograph With an Accelerating Voltage of 400 kv," pp 436-441 -- The author devised an electron microscope electronograph with a 400 kv accelerating voltage to clarify the possibilities provided by higher electron speed in electron optical research of the microstructure of matter. Its regular operation started in 1957 as an electronograph and in 1958 as a microscope.

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N. A. Stoyanov, G. A. Mikhaylovskiy and V. V. Moseyev, "Electron Microscope UEMB-100 with a Double Lens Condenser," pp 442-449 -- The microscope has correcting lenses (stigmators), a mechanism for adjusting of optical elements and diaphragms, and a highly stabilized power supply yielding a resolving power of 15 Å.

V. V. Polivanov, V. V. Il'in, A. V. Iz'yurov, N. I. Pyatakov, and R. V. Shumova, "Power Supply Installation of the Electron Microscope UEMB-100" pp 450-453 -- The problem of reducing the instability of the lens currents was solved by refining the supply circuit designed in 1955 for the microscope UEM-100. High-voltage instability was reduced by the introduction of electron stability.

V. I. Milyutin, D. V. Fetisov, K. K. Raspletin, F. U. Spektor and B. I. Pochtarev, "Small Electrostatic Microscopes," pp 454-459 -- A design for a cheap electron microscope with electrostatic lenses is proposed.

A. N. Kabanov, V. I. Milyutin and D. V. Fetisov, "Electrostatic Analyzer of Electron Speeds at 75 kv," pp 459-461.

B. I. Pochtarev, K. K. Raspletin and D. V. Fetisov: "Equipment for Measuring the Resolving Power and the Light Yield of Fluorescent Screens," pp 462-466 -- The resolving power of the instrument exceeds 500 lines per millimeter.

P. A. Stoyanov: "Compensation of Axial Astigmatism in Lenses of a multilens Electron Microscope," pp 467-472 -- Correction of the near-axis astigmatism of weak and strong lenses is attempted by means of a magnetic cylindrical lens.

Ya. Yu Komissarchik, V. N. Vertsner, and L. S. Gol'din, Psychoneurological Institute imeni Bekhterev, State Optical Institute imeni Vavilov, "A Simplified Ultramicrotome," pp 473-477.

G. A. Bogdanovskiy, V. V. Kuprevich, V. N. Vertsner, and I. V. Stepanov "Light and Electron Microscope Using Monocrystalline Screens of High Resolution," pp 478-480 -- The final stage of electron optical magnification was replaced by a light-optical stage. The use of a monocrystalline screen in an electron microscope facilitates the focusing of the image and permits the lowering of the current density on the object.

G. O. Bagdyk'yants and A. V. Shishatskiy: "X-Ray Shadow Microscope," pp 481-484 -- An experimental model of the instrument devised by the authors is described.

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V. N. Vertsner, M. G. Ivanov, V. V. Kozelkin, G. A. Bogdanovskiy, Yu. V. Vorob'yev, Yu. V. Chentsov, B. Ye. Klyukin, and V. A. Nikiforova, "Series-Produced Electron Microscope EM-5," pp 485-489 -- A high-resolution electron microscope based on the design of the EM-3 is now in series production.

I. G. Stoyanova: "A Chamber for Electron Microscopic Investigation of Objects in Gaseous Medium" pp 490-493 -- Research by the author on the construction of a gas chamber which would satisfy certain requirements is described.

N. M. Popov, "High Voltage Electron Gun," pp 494-500 -- An electron gun with an accelerating voltage over 100 kv and a V-shapped cathode of tungsten wire is described.

V. V. Polivanov, A. V. Iz'yurov, and V. V. Il'in "Some Design and Construction Problems of Power Supply Devices for Electron Microscopes," pp 501-505 -- Possible ways to lower the instability of the high voltage to a level necessary for a resolving power of 10 Å are investigated. Experimental high-frequency sources of 50 and 125 kv which gave good results are described.

G. V. Der-Shvarts and K. A. Netrebenko, "Computer Equipment for Computing of Fields of Electron-Optical Systems," pp 506-510 -- The authors have designed and partially completed computer equipment intended for computing fields with rotational symmetry.

P. A. Stoyanov and V. V. Moseyev, "Screening of Electron Microscopes From the Effects of External Magnetic Field," pp 511-518 -- The best screening effect was found in a device consisting of several coaxial cylinders.

Yu. V. Chentsov, V. N. Vertsner, and G. A. Bogdanovskiy, "Some Structural Improvements of the Electron Microscope EM-3," pp 519-521 -- The instrument was modernized and will be put into series production.

A. V. Druzhinin and B. N. Popov, "High Vacuum Electron Microscope for Cathode Testing," pp 522-526 -- A brief description is given of a new design for the microscope and of the method applied for checking cathodes.

A. M. Rozenfel'd and P. V. Zaytsev, "A New Model of an Emission Electron Microscope for Studying Thermal and Secondary Emitters (EEM-50)," pp 527-530 -- The new model of the emission electron microscope differs from the previous model EEM-75 in that the construction of the immersion objective and the vacuum system have been changed.

N. P. Levkin and Yu. M. Kushnir, "A New Model of a 100-kv Universal Electronograph With an Armored Cable (EG-100 A)," pp 531-536 -- The EG-100A electronograph is intended for the study of solid and gaseous bodies by means of electron diffraction.

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55. USSR Work on Cells for the Transformation of Energy of α and β-Radiation Into Electric Energy

"On the Functioning of Nuclear Sources of Electric Current With Two Energy Transformation Stages," by V. S. Vavilov, D. M. Vul, G. N. Galkin, and S. A. Fridman, Physics Institute imeni P. N. Lebedev; Leningrad, Fizika Tverdogo Tela, Vol 1, No 5, May 59, pp 826-827

One of the principal shortcomings of semiconductor crystals with p-n junctions, when these crystals are used as transducers converting energy emitted by a powerful source of β particles, is the relatively rapid reduction of the current strength because of the recombination of electrons and holes at defects arising as a result of irradiation. A more persistent effect can be obtained by selecting an energy source emitting soft β radiation which does not produce defects in the crystal lattice. However, it has been established recently that even electrons with an energy of 145 kilo-electron-volts are capable of bringing about the formation of stable centers of recombination in silicon, which at present is the best semiconductor material for transducers with p-n junctions.

In view of the fact that photocells with p-n junctions located close to the surface of the crystal are very sensitive to light in the visible and near infrared regions of the spectrum, whereas a number of crystal phosphors which give a high yield on excitation with electrons are at the same time highly resistant to irradiation, it appeared of advantage to investigate the possibilities of a two-stage conversion of energy. In other words, the energy of the β -particles is first transformed into light, and the light is subsequently transformed into electric energy. Experiments to investigate possibilities along this line have been carried out by the authors with silicon photo-cells, phosphors exhibiting different spectral characteristics, and a source of radiation using $Sr^{90} - I^{90}$ as a β -emitter.

The spectral characteristic of the photocell, i. e., the dependence of the collection coefficient α on the wave-lenght γ is represented by a curve in the diagram accompanying the article.

The yield of phosphors on a zinc sulfide-cadmium sulfide basis rapidly drops as the maximum of the radiation spectrum shifts toward longer waves, so that carefully selected phosphors must be used. The phosphor which gave

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the best results had an emission maximum at the wave length of 0.70 microns. To develop a silicon photocell with a collection coefficient close to unity, one should apply a phosphor which emits in the region of short wave lengths and therefore gives a better luminescence yield.

According to an article by V. M. Malovetskaya, V. S. Vavilov, and G. N. Galkin, which has been submitted for publication in Zhurnal Tekhnicheskoy Fiziki, a considerable improvement in the coefficient of conversion (by 25-30%) can be achieved by increasing the transparency of the surface of the silicon (see also a paper by V. S. Vavilov, G. N. Galkin, and V. M. Malovetskaya in Atomnaya Energiya, Vol 4, No 6, p 6, 1958, p 571)

Experience has shown that because of the self-absorption by the phosphor of its own radiation, it is not advisable to use layers of the phosphor thick enough to absorb all β particles emitted by the Sr^{90} - I^{90}. It is better to use thin layers. For β - radiation emitted by Sr^{90} - I, the optimum thickness of the layer of the phosphor is not determined by the length of the path of the particles, but by the phosphor's self-absorption of luminescence. The optimum thickness corresponds to approximately 80 milligrams per square centimeter. The problem in regard to the optimum thickness of phosphor layers excited by α - particles has been discussed in detail by S. A. Fridman and A. A. Cherepnev in "Svetyashchiyesya Sostavy Postoyannogo i Peremennogo Deystviya" [Luminescent Compositions of Permanent and Intermittent Action], Academy of Sciences USSR, 1945.

The use of promethium -147, the radiation emitted by which is completely absorbed by a layer of a thickness corresponding to 50 milligrams per square centimeter, will increase the efficiency of the conversion of the engery of β -particles into light energy by a factor of 10. Experimental results pertaining to this have been described in US work. One may expect that shielding from bremsstrahlung emitted by the source of radiation consisting of pure Pm^{147} will not be cumbersome. Application of Sr^{90} - I^{90} will require more effective shielding. Furthermore, the photocells must be separated from the phosphor by a layer of glass or of some other transparent material which will not darken under the action of β - particles.

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56. USSR Work on the Recovery of Germanium From Coal

"Content and Accumulation of Rare and Dispersed Elements in Coal" by K. P. Medvedev and I. A. Batrakova, Khar'kov Scientific Research Institute of Coal Chemistry (UKhIN), Koks i Khimiya, No 6, Jun 59, pp 13-17

The recovery of rare and dispersed elements from coal is discussed with particular attention to information given in non-USSR publications. USSR work on the occurence of germanium in coal and the concentration of germanium contained in coal is reviewed.

Radar

57. Panoramic Ionosphere Station

"Automatic Panoramic Ionosphere Station," by Ye. V. Ryzhkov, A. Ya. Bukhterin, N. D. Dymovich, N. I. Ivanov and Yu. V. Markov, Leningrad Electrical Engineering Institute of Communications; Kiev, Izvestiya Vysshikh Uchebnykh Zavedeniy, Radiotekhnika, No 2, Mar/Apr 59, pp 227-233

The automatic panoramic ionosphere station described in this article is the outcome of several years' effort on the part of the Chair of Antennas and Radiowave Propagation of the Leningrad Electrical Engineering Institute of Communications imeni M. A. Bonch Bruyevich.

The performance characteristics of this station satisfy the basic requirements prescribed by the IGY program. The operating characteristics of the station are as follows: the frequency range is 0.5 -28Mc; power in the pulse is 15 kw; pulse repetition rate is 50 per sec; pulse duration is 100 microsec; sensitivity of the receiver is 1-2 microvolts when the signal-to-noise ratio is not less than 3; the linear-scan indicator provides for observations at altitudes up to 4,000 km; the panoramic indicator permits observation at altitude up to 1,500 km; the scanning time for the whole frequency range (0.5-28 Mc) is 15 sec. An automatic device permits registering altitude-frequency response 1, 2, 4 or 12 times every hour.

The station comprises the following units: antenna transmission line, transmitter and modulator, A-scope, B-scope, automatic control unit, master oscillator, receiver, receiving antenna transmission line, power supply

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unit, electric clock, and registering device. The altitude-frequency response curve is recorded photographically on film. A rhombic antenna with an angle of 160° and supported 50 m above the ground is used with this station.

At present, this station is conducting IGY observations at the Leningrad Branch of the Institute of Terrestial Magnetism and Radiowave Propagation.

Wave Propagation

58. Irregularities in the F Layer of the Ionosphere

"Investigation of the Effect of Irregularities in the F Layer of the Ionosphere on Angular Scattering of Reflected Energy," by N. T. Tsymbal, Khar'kov Polytechnic Institute; Kiev, Izvestiya Vysshikh Uchebnykh Zavedeniy, Radiotekhnika, No 2, Mar/Apr 59, pp 221-226

The spatial and time diversity of amplitude and phase of a single magnetically split signal reflected from the ionosphere, are the principal experimental factors confirming the irregularity of ionosphere structure. As a result of the irregular structure of the ionosphere, we observe "flickering" of radio stars, microwave propagation for very long ranges, and fading of radio signals.

An ionosphere station was used for investigation of angular diversity of reflected waves from an ionosphere layer and the degree of irregularity of such a layer for different hours of the day and various seasons of the year. The transmitter of the ionosphere station had a frequency band of 17 Mc, the power in the pulse was 30 kw, the pulse duration was 100 microsec and pulse repetition rate was 50 per sec. A 20 meter high delta antenna was used for transmission of the signal. Three receiving antennas placed at the corners of a rectangle with a 80-m base were used. The superheterodyne receiver had an amplification factor of 10^6 and band-pass of 17 kc. Its amplitude response was linear up to 80 v at the output. The receiver output was connected to an oscillograph which displayed the pulse in the form of a horizontal bright line. The measurement of angular scattering of waves reflected from the F layer and the degree of irregularity of the layer was begun in August 1957 and were conducted up to the present. The measurements were conducted for 24 hours at 2-hour intervals

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during certain days of the month (8-10), which, as a rule, included the international days of the IGY program. Single reflected waves from the F layer in the range of 3-17 Mc were investigated. Two hundred and six measurements were obtained which were suitable for detailed statistical processing.

The investigation has shown that reflections from the F layer in 90% of the cases during the day and in 50% of the cases during the night were of the specular nature.

The author thanks Prof S. Ya. Braude for guiding the major phases of the investigation.

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VI. ENGINEERING

59. Laboratory for Study of Electric Power Systems

"Electric System Problems Laboratory of the Moscow Power Engineering Institute," by V. A. Venikov, Moscow, Nauchnyye Doklady Vysshey Shkoly, Energetika, No 1, 1959, pp 5-16

The Electric System Problems Laboratory of the Moscow Power Engineering Institute is conducting theoretical and experimental investigations of the most urgent problems arising during design and exploitation of electric power networks. The principle methods of investigation used at this laboratory are based on the theory of similarity and physical simulation in close association with modern mathematical procedures.

Thus, the procedures followed at the Laboratory can be characterized as a combination of methods of physical similarity and simulation with those of cybernetics, the latter being understood not as a separate entity, but as being closely related to the experimental-engineering approach.

During the next 2-3 years, the work of the Laboratory will be directed to the study of performance of complex and highly automated electric power systems, mainly from the standpoint of their transmission capability, reliability, and stability. These research problems can be roughly divided into three main groups: the first group is related to the development of methods to improve the performance of automated electric power systems with long-distance alternating current networks; the second group is concerned with the protection of direct current power networks and the control of their rectifying and inverting devices; the third group relates to the problems of refinement of the theory of physical simulation of electric power systems, and the utilization of analog computers in conjunction with mathematical analysis.

60. Laboratory Testing Air Turbine

"Experimental Air Turbine of Leningrad Metal Plant," By A. O. Lopatitskiy, Leningrad, Energomashinostroyeniye, No 7, Jul 59, p 42

The laboratory testing air turbine ETV-1 is used extensively to investigate the blade design of new steam and gas turbines at the Laboratory of the Leningrad Metal Plant. This air turbine has a precision instrument for measuring the rpm of the rotor with an accuracy of $\pm$ 0.1%, an optical device for determining the clearance of rotating blades, etc.

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This turbine was used to investigate the performance of the high-pressure stage of steam turbines with blades of constant cross-section. In the process of investigation of more than 30 variants of turbine stages with the aid of this testing air turbine, a series of individual factors affecting the performance of the turbine stage have been determined in addition to the basic characteristics needed in design of turbines.

61. Hydraulically-Supported Thrust Bearings for Large Hydrogenerators

"Thrust Bearings for Large Hydrogenerators," by K. F. Kostin; Moscow, Vestnik Elektropromyshlennosti, No 7, Jul 59, pp 32-35

The hydraulically-supported lower segment plates of the main thrust bearing for a large hydrogenerator have proven in a long test run to be highly efficient. Such hydraulically-supported thrust bearings are highly reliable for specific loading of 60 to 80 kg/cm^2 at the bearing surface. At present sufficient data has been accumulated to assert the advantages of this type of Soviet-developed thrust bearing. Since 1954 the first such thrust bearing has been successfully operating with a total carrying load of 1,500 tons, which is equivalent to specific loading of 60 kg/cm^2. This thrust bearing later withstood a successful test for specific loading of 80 kg/cm^2. Six hydraulically-supported thrust bearings carrying a total load of 2,000 tons (specific loading of 60 kg/cm^2) have been in operation for the past two years at one of the Siberian hydroelectric stations.

It is believed that a hydraulically-supported thrust bearing can be designed for very large hydrogenerators, with rotors weighing up to 6,000 tons.

62. 500-kv Power Circuit Breakers

"High-Voltage Equipment Manufactured at 'Uralelektroapparat' During the Past 25 Years," by B. V. Belkov; Moscow, Vestnik Elektropromyshlennosti, No 7, Jul 59, pp 14-20

The All-Union Electrical Engineering Institute has developed a 500-kv, 2,000-a air circuit breaker designated as VV-500 with power-interrupting capacity of 20,000 Mva. In 1959 such circuit breakers will be installed at the Stalingrad Hydroelectric Station and on the Stalingrad-Moscow transmission line. The VV-500 circuit breaker has a highly efficient, gas-filled arc-extinguishing element. To lower switching overvoltage, the circuit breaker is provided with special shunting resistors, which are also utilized to distribute uniformly the voltage between ten arc-quenching chambers. The current of the shunting resistors is interrupted by a disconnecting element with eight gaps arranged in series. The VV-500 circuit breaker has several improvements over the previously manufactured and tested VV-400 breaker (400 kv).

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For operations under severe climatic conditions, like those prevailing in Siberia and the Urals, a unique 500-kv oil-filled circuit breaker designated MKP-500 has been developed and put into production. Two such circuit breakers have already been installed on the Kuybyshev-Ural line. The three-phase MKP-500 circuit breaker consists of a bank of three single-pole breakers, operated by individual dc electromagnetic drives of the ShPE-504 type. According to existing test data the MKP-500 breaker has a power-interrupting capacity of 10,000 Mva, but there are good reasons to believe that with slight improvement in the arc-quenching device it would be possible to raise the power-interrupting capacity of the circuit breaker to 15,000 Mva.

63. Effective Method of Generator Excitation

"New Regulation System for Effective Excitation of Synchronous Generators," by M. N. Rozanov and V. A. Karpov, Chair of Electric Systems, Moscow Power Engineering Institute; Moscow, Nauchnyye Doklady Vysshey Shkoly, Energetika, No 1, 1959, pp 29-35

Great attention has been given lately to the problem of increasing the transmitting capability of long-distance power lines with the help of automatic excitation regulators which respond to the derivatives of certain functions. Such excitation regulators are now referred to as effective regulators.

For analysis of such a system of effective excitation regulation, a schematic network of the following three parallel-connected elements is used: measuring, differentiating, and double differentiating.

At the All-Union Electrical Engineering Institute automatic excitation regulators were designed for the generators of the Volzhskaya (Volga) Hydroelectric Station. V. A. Venikov, M. N. Rozanov, and V. A. Karpov were issued the patent rights for such a regulator on 28 February 1958 under No 581549/24.

The efforts to develop new complex excitation regulators are now directed toward the creation not merely of a device which would regulate certain operating parameters, but of one which would change the characteristics of the system in a desired manner. It is claimed that such a system of effective excitation regulation has the following advantages: the amplification factor of differentiating elements is defined only by time constant of the excitation system of the generator, and not by the parameters of the external power network.

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64. "Rotary Lines" Employed in Automation

"Rotary Lines-New Word in the Automation of Industry," by L. Koshkin, Candidate of Technical Sciences, Stalin Prize Winner, B. Boris, engineer; Moscow, Pravda, 24 May 59, p 4

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The author asked the following question:

"Does there exist at the present time a means for simultaneously solving the fundamental problems of complex automation?"

The author answered his own question in the affirmative and added that the means was already being applied in practice.

The method he referred to is the so-called "rotary lines" method. The method originated in the USSR, and at the present time is being employed more extensively. A "rotary line" consists of several operating rotors. The important peculiarity of operating rotors is that parts are machined in them during the process of transportation together with the tool.

A simplified rotor may be represented in the form of assemblies on a common, continuously rotating shaft with two drums, on one of which are distributed the parts to be machined, and on the other, tools, each of which, during the process or rotation, permits the required machining of parts. The fundamental property of rotary machines is the fact that their productivity, contrary to the productivity of machine tools of interrupted operation, is not bounded by the velocity of the moving tool relative to the detail and duration of the operation. If it is necessary to obtain greater productivity, it is only necessary to design the rotor with an increased number of tools. For that reason, it is always possible to design a rotary line to any previously determined productivity.

65. New Patent Regulation

"New Regulations for Inventions and Efficiency Suggestions," (unsigned article); Moscow, Vestnik Svyazi, No 7, Jul 59, pp 10-11

The new "Regulations for Discoveries, Inventions, and Efficiency Suggestions" and "Instructions on Remuneration for Discoveries, Inventions, and Efficiency Suggestions" became effective 1 May 1959. The new "Regulations" and "Instructions" differ substantially from the previous ones. The new "Instructions" provide for increased remunerations to the inventors and efficiency experts. The minimum compensation is set at 200 rubles for an invention and 100 rubles for efficiency suggestions which do not result in any saving. The Compensation is paid to the inventor even if the invention relates to the field in which he regularly works.

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VII. MATHEMATICS

66. Stability of Motion Investigated

"Several Problems Concerning Stability of Motion," V. I. Zubov; Moscow, Matematicheskiy Sbornik, Vol 48(90), No 2, Feb 59, pp 149-190

The present work is devoted to the investigation of the following three kinds of problems: first, the problems of analytical representation of the solutions of systems of equations with partial derivatives and of systems of ordinary differential equations of particular initial data in a neighborhood; second, the problems of the quality characteristics of the neighborhood of the state of equilibrium of a dynamic system of ordinary differential equations from the point of view of stability according to A. M. Lyapunov; third, problems clarifying the question concerning stability of the null solution of a system of ordinary differential equations in a series of dubious cases.

The first section of the paper is related to the results of Briot and Bouquet, Poincare, Picard, Horn, and Lyapunov and gives a further development of these results.

The second section is related to the works of N. P. Yerugin, A. A. Shestakov and A. M. Lyapunov. The foundations of almost all these results are based on the works of A. M. Lyapunov.

The subject of the present work arose upon the appearance of the works produced by the chair of differential equations at Leningrad State University.

The author expressed appreciation for the interest manifested in his work by V. I. Smirnov and V. V. Nemytskov.

67. Laplace Equation for a Region within an Ellipsoid Solved

"On the Solution of the Laplace Equation in a Region within an Ellipsoid," by A. I. Vzorova; Moscow, Vychislitel'naya Matematika, No 3, July, 1958, pp 88-98

A continuous function, given on an ellipsoid, is expanded in the form of a series of harmonic polynomials.

The Dirichlet problem for the Laplace equation defined within an ellipsoid is solved.

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68. Difference Stochastic Equation Analyzed

"Statistical Analysis of a Difference Stochastic Equation," by A. Ya. Dorogovtsev, Kiev State University; Kiev, Doklady Akademii Nauk Ukrainskoy SSR, No 2, Feb 59, pp 120-124

The author considers a random process x_t (where t is an integer) satisfying the difference equation

$$x_t + \alpha_1 x_{t-1} + \cdots + \alpha_p x_{t-p} + \alpha_o = b_o \xi_t + b_1 \xi_{t-1} + \cdots + b_\nu \xi_{t-\nu}$$

where α_i and b_i are unknown parameters and ξ_t are independent variables with a mean equal to zero and a variance equal to unity. The parameters α_i, b_i are estimated by a sequence of observations $x_1, x_2, \ldots, x_N$ of the process. The case of biased estimates is discussed, and estimates of the α_i parameters are given, these estimates being consistent, and their joint distribution tending toward the normal law when $N \to \infty$.

69. Asymptotic Estimates for Spectral Function Derivatives

"Concerning Asymptotic Estimates of the Derivatives of the Spectral Function for the Schredinger Operator on a Plane," by I. S. Sargsyan; Yerevan, Izvestiya Akademii Nauk Armyanskoy SSR, Vol 11, No 6, Nov/Dec 58, pp 15-30

A finite, singly-connected region in the two-dimensional Euclidean space E_2 is denoted by D and the boundary of the region is denoted by Γ. The following problem is considered at the characteristic values:

$$\Delta u + \{\lambda - q(x,y)\} u = 0, \tag{1}$$

$$\left.\frac{\partial u}{\partial n}\right|_\Gamma = 0, \tag{2}$$

where $\Delta = \frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2}$ (the Laplace operator), $q(x,y)$ is a real continuous function in $D + \Gamma$, and n is the exterior normal to D. The author designated the characteristic values of the problem (1) - (2) by $\lambda_1, \lambda_2, \ldots, \lambda_n, \ldots$ and the corresponding characteristic functions of the problem (1)-(2) by $\varphi_1(x,y), \varphi_2(x,y), \ldots, \varphi_n(x,y), \ldots$

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Since the function $q(x,y)$ is continuous in $\overline{D}$, it is bounded; for that reason it does not violate the generality of the argument and we may assume that the spectrum of the problem (0.1)-(0.2) is non-negative.

Let $\mu_n^2 = \lambda_n$, $(\lambda_n > 0)$.

Set

$$\theta(x, y, u, v; \mu) = \sum_{\mu_n < \mu} \varphi_n(x, y)\, \varphi_n(u, v), \qquad \mu > 0,$$

$$\theta(x, y, u, v; \mu) = 0, \qquad \mu = 0,$$

$$\theta(x, y, u, v; -\mu) = -\theta(x, y, u, v; \mu), \qquad \mu < 0.$$

The function $\theta(x, y, u, v; \mu)$ is called the spectral function of the problem (1)-(2).

In the present work an asymptotic estimate of the derivatives of the spectral function $\theta(x, y, u, v; \mu)$ is given for large μ. Analogous questions in the three dimensional Euclidean space E_3 for the equation (1) and for the Laplace operator in any measurable space were studied by B. M. Levitan in his works, "Concerning Differentiation of Expansions of Characteristic Functions of the Schredinger Equation," Trudy Moskovskogo Matematicheskogo Obshchestva, Vol 7, 1958 and "Concerning the Differentiation of the Spectral Function of the Laplace Operator," Mat. Sbornik, Vol 39(81), No 1, 1956. The one-dimensional case of the problem (1)-(2) was considered in the works by the author, "Concerning Differentiation of Expansions by Characteristic Functions of the Sturm-Liouville Operator," Izvestiya AN SSSR, ser. Mag., Vol 21, 1957 and "Asymptotic Behavior of Derivatives of the Spectral Function of the Sturm-Liouville Operator," Izvestiya AN Arm SSR, Vol 10, No 3, 1957.

The fundamental results of the above-mentioned works concerning obtaining asymptotic estimates for the derivatives of a spectral function lead to the study of questions of summability of differential expansions by characteristic functions found in another work being published.

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70. System of Infinite Linear Equations Solved by Method Requiring Fewer Hypotheses

"Solution of One System of Infinite Linear Equations," by E. N. Lebedeva, Central Asia State University imeni V. I Lenin; Tashkent, Izvestiya Akademii Nauk Uzbek SSR, No 2, Apr-Jun 59, pp 7-13

During the investigation of a series of problems of probability theory (for example, the so-called Erlang problem for an infinite pencil or the problem arising during consideration of systems with expectation, as in the case of the exponential distribution of the length of telephone conversations), one is obliged to consider the following systems of linear equations:

$$P'_0(t) = -\lambda P_0(t) + \beta P_1(t),$$

$$P'_k(t) = \lambda P_{k-1}(t) - (\lambda + k\beta) P_k(t) + (k+1)\beta P_{k+1}(t) \quad (k > 0) \quad (1)$$

or;

$$P'_0(t) = -\lambda P_0(t) + \beta P_1(t),$$

$$P'_k(t) = \lambda P_{k-1}(t) - (\lambda + k\beta) P_k(t) + (k+1)\beta P_{k+1}(t) \quad (0<k<n) \quad (2)$$

$$P'_k(t) = \lambda P_{k-1}(t) - (\lambda + n\beta) P_k(t) + n\beta P_{k+1}(t) \quad (k \geq n),$$

where $P_k(t)$ is the probability that at the moment t, the system is in condition k.

The probabilities of transition for system (1) as well as for system (2) have the form:

$$P_{k-1,k}(\tau) \approx \lambda\tau \quad (k \geq 0), \quad P_{kk}(\tau) \approx 1 - \lambda\tau - n\beta\tau \quad (k > 0)$$

$$P_{ik}(\tau) \approx 0 \quad (|i-k| > 1), \quad P_{oo}(\tau) \approx 1 - \lambda\tau .$$

The probability of reversion, that is, transition from condition $(k+1)$ to condition k for the system (1) has the form:

$$P_{k+1,k}(\tau) \approx (k+1)\beta\tau \qquad \text{for } k > 0.$$

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However, for system (2) the probabilities $P_{k+1,k}(\tau)$ have different values for the cases $k < n$ and $k \geq n$:

$$P_{k+1,k}(\tau) \approx (k+1)\beta\tau \qquad (k < n) \text{ and } P_{k+1,k}(\tau) \approx n\beta\tau \qquad (k \geq n).$$

All values of the probabilities of transition are taken with an accuracy as far as infinitely small values of the form $0(\tau)$.

To investigate the system (1) or (2) means to demonstrate the existence of limits of the quantity $P_k(t)$ for $t \to \infty$, and also to demonstrate the possibility of a limit transition in the entire system.

A. Ya. Khinchin in his work "Mathematical methods of the theory of extensive servicing," Trudy Matematicheskogo Instituta imini V. A. Steklov, Vol 10, 9, 1955, noting the possibility of proving the existance of solutions of the systems of equations (1) and (2) wrote:

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"We do not know in the literature one account of that proof, although the same problem was considered many times (A. N Kolmogorov,"Sur le problems d'attente," Matematicheskiy Sbornik, Vol 38, No 1-2, 1931; T. Fray, Teoriya Veroyatnostey dlya Inzhenerov Theory of Probability for Engineers Gostekhizdat, Moscow, 1934; A. K. Erlang, "The Life and Works of A. K. Erlang," The Copenhagen Telephone Company, 1948; and V. Feller, Introduction to the Theory of Probability and its Application, (Translated into Russian) Izd. Inostrannoy Literatury, 1952). Erlang introduces the possibility of a limit transition as a general postulate; all the remaining mentioned authors are limited by a short reference to the possibility of proof."

The purpose of the present work is to obtain the solution of the systems of infinite, linear equations (1) and (2) without making any assumption concerning the existence of the limits $\lim P_k(t) = P_k(k = 0, 1, 2, \ldots)$ for $t \to \infty$ and concerning the possibility of a limit transition simultaneously in all equations of the systems.

71. Integral Equation with Fixed Singularity Approximated

"Method of Successive Approximations for an Integral Equation with Fixed Singularity," by A. R. Khvoles, Academy of Sciences Georgian SSR, Computer Center, Tbilisi; Tbilisi, Soobshcheniya Akademii Nauk Gruzinskoy SSR, Vol 21, No 5, Nov 1958, pp 519-522

E. Picard, Ann. Ec. norm. (3) 28, 1911, pp 313-324; Fubini, Rend. Acc. Lincei, Vol 21, 1912, pp 325-330; P. Nalli, Rend. del Circolo Matematico di Palermo, Vol 50, 1926; and the author, in Soobshcheniya AN Gruzinskoy SSR, Vol 2, No 5, 1941, studied an equation of the form

$$\varphi(x) - \lambda \int_{-1}^{1} \frac{k(x,s)}{s} \varphi(s)\, ds = f(x), \qquad (1)$$

where the integral is understood in the sense of Picard or the principal value.

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In the present work a method of successive approximations is presented for equation (1) assuming that the functions $K(x,s)$ and $f(x)$ satisfy the following conditions:

$$|K(x,s)| < P, \quad |K(x+h,s+j) - K(x,s)| \leq P(|h|^{\mu} + |j|^{\mu}), \qquad (2)$$

$$|f(x)| < P, \quad |f(x+h) - f(x)| \leq P|h|^{\mu}. \qquad (3)$$

72. Isotropic Random Fields of the Markov Type

"Isotropic Gauss Random Fields of the Markov Type on a Sphere," by M. Y. Yadrenko, Kiev State University; Kiev, Doklady Akademii Nauk Ukrainskoy SSR, No 3, May/Jun 59, pp 231-236

The author describes the indicated random fields, on a sphere S_m in a $(m-1)$-dimensional space and on a sphere S_∞ in a Hilbert space. The fields were assumed to possess a certain Markov property. In the case of $m = 2$, this property is reduced to the requirement that whatever the curve K dividing S_2 into two parts may be, and whatsoever the points P_1 and P_2 separated by K, the random functions $\xi(P_1)$ and $\xi(P_2)$ are independent if the values $\xi(P)$ on K are known.

73. Theorem of A. A. Markov Generalized

"Generalizations of a Theorem of A. A. Markov Concerning an Estimate of the Derivative of a Polynomial," by V. S. Videnskiy, Mathematics Institute imeni V. A. Steklov, Academy of Sciences USSR; Moscow, Doklady Akademii Nauk SSSR, Vol 125, No 1, Mar 59, pp 15-18

In the work of the author which appeared in DAN, Vol 120, No 3, 1958, the problem concerning an exact upper bound of sequences of derivatives of the polynomial $P_n(x)$ of degree $\leq n$ on the segment $[-1,+1]$ was investigated on the assumption that on this segment the inequality

$$|P_n(x)| \leq \left|\alpha x + i\sqrt{1-x^2}\right| = [1 + (\alpha^2 - 1)x^2]^{1/2}, \quad \alpha \geq 0$$

is satisfied.

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The author now takes $G(x)$ as the majorante where $G(x) = \prod_{k=1}^{m}(1+a_k^2 x^2)$, $a_k \geq 0$, $k = 1, 2, \ldots, m$.

He let $n \geq m$, and set $\alpha_k = \sqrt{1 + a_k^2}$ $(k = 1, 2, \ldots, n;\ a_{m+1} = \ldots = a_n = 0)$ and

$$M_n(x) = R\prod_{k=1}^{n}(\alpha_k x + i\sqrt{1-x^2}),$$

$$\sqrt{1-x^2}\, N_{n-1}(x) = L_n(x) = I\prod_{k=1}^{n}(\alpha_k x + i\sqrt{1-x^2}).$$

It is clear that the identity

$$G(x) = M_n^2(x) + (1-x^2) N_{n-1}^2(x) \text{ is justified.}$$

The functions $M_n(x)$ and $N_{n-1}(x)$ are polynomials of degrees n and n-1 respectively. It is known that all their zeros lie in the segment $(-1, +1)$ and are mutually alternate (see S. N. Bernshteyn, Sobr. soch., (Collected Works), Vol 1, article No 46, 1952, pp 452-467).

The following two theorems were proved in the work:

Theorem 1. If the polynomial $P_n(x)$ of degree $n \geq m$ satisfies the inequality

$$|P_n(x)| \leq \left\{\prod_{k=1}^{m}(1 + a_k^2 x^2)\right\}^{1/2} = \prod_{k=1}^{n}|\alpha_k x + i\sqrt{1-x^2}, \quad -1 \leq x \leq 1,$$

then $|P_n'(x)| \leq M_n'(1) = n\alpha_1\alpha_2\ldots\alpha_{n-2}$, $-1 \leq x \leq 1$, where $\sum\alpha_1\alpha_2\ldots\alpha_{n-2}$ is a symmetric function of $\alpha_1, \alpha_2, \ldots, \alpha_n$. The equality appearing in the statement to be proved in theorem 1 is attained only for polynomials $P_n(x) = \gamma M_n(x)$, $|\gamma| = 1$, and at the points $x = \pm 1$.

For $\alpha_1 = \alpha_2 = \ldots = \alpha_n = 1$ we obtain the theorem of A. A. Markov, since the right side of the hypothesis is equal to 1 and the right side of the conclusion is equal to $T_n'(1) = n^2$, where $T_n(x) = \cos n \arccos x$.

Theorem 2. If the polynomial $P_n(x)$ of degree less than or equal to n satisfies the inequality

$$|P_n(x)| \leq |\alpha x + \beta + i\sqrt{1-x^2}|, \quad -1 \leq x \leq 1, \ \alpha, \beta \text{ real, and } 0 \leq |\beta| < \alpha,$$

then

$$|P'_n(x)| \leq \max\,[\,|M'_n(-1)|, M'_n(+1)\,], \quad -1 \leq x \leq 1, \text{ where}$$

$$M_n(x) = \frac{\alpha+1}{2} T_n(x) + \beta T_{n-1}(x) + \frac{\alpha-1}{2} T_{n-2}(x).$$

The equality appearing in the statement to be proved in theorem 2 is attained only for the polynomials $P_n(x) = \gamma M_n(x)$, $|\gamma| = 1$ at the points $x = \pm 1$.

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74. Theorems of L. A. Sakhnovich Generalized

"On the Theory of Integral Operators of the Volterra Type," by Ishtvan Fen'ye; Moscow, Doklady Akademii Nauk SSSR, Vol 125, No 1, Mar 59, pp 51-54

L. A. Sakhnovich, in his work which appeared in Izv. AN SSSR, ser. matem., Vol 22, 1958, p 298, proved an interesting theorem, in concurrence with which any integral operator of the Volterra type satisfying known requirements is linearly equivalent to the integral operator

$$Hf = \int_0^x f(t)\,dt \quad (f(t) \in L^2[0,a]).$$

The criterion was also given when a given integral operator of the Volterra type is the n-th degree iteration of another operator.

In the present work a new and, in the opinion of the author, a simpler proof of Sakhnovich's theorem is given as well as assertions and proofs of generalizations of some of his other theorems.

75. Integral Equations of the Volterra Type Studied

"On the Growth of Solutions of Systems of Integral Equations of the Volterra Type," by E. I. Gol'dengershel', Odesskiy State University imeni K. D. Ushinsky; Moscow, Doklady Akademii Nauk SSSR, Vol 125, No 1, Mar 59, pp 19-22

The exponential growth of systems of integral equations of the Volterra type

$$\int_0^x K(x,y)\,\varphi(y)\,dy - \lambda\,\varphi(x) = f(x),\ 0 \le x < \infty,$$

is investigated in its dependence on the growth of the right sides and values of the parameter λ .

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Bacteriology

76. Effects of Ultrasound on Tubercle Bacilli

"The Antigenic Characteristics of Suspensions of Tuberculosis Mycobacteria Exposed to Ultrasound," by A. I. Togunova; A. V. Karsanova, and G. I. Stepanchenok, Institute of Epidemiology and Microbiology imeni Gamaleya; Moscow, Zhurnal Mikrobiologii, Epidemiologii i Immunobiologii, Vol 30, No 5, May 59, pp 95-98

In the experiments described in this article, attempts were made to use suspensions (containing a minimum amount of live bacterial components and exposed to ultrasound) as antigens in serological reactions with specific sera, i.e., in the complement fixation reaction and by double diffusion in gel (Ouchterlony's method). The complement fixation reaction was performed with rabbit hyperimmune sera and phosphatide antigens prepared from cultures of virulent tuberculosis strain R-44, its vaccine variant No 35, avirulent variant No 852_{II} and BCG_{I}. polysaccharide complexes from R-44, and avirulent variant No 35. Dry, purified tuberculin (Leningrad and Tashkent) were also used as antigens for the reaction.

A number of experiments were performed with BCG and No 35 suspensions in distilled water which were exposed to ultrasound (Soviet apparatus UL-1, 800 and 1,200 kc in 2-2 1/2 hours). The use of the double diffusion method in agar is also described, as are filtration and centrifugation procedures.

The following conclusions are presented on the basis of the results obtained:

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"Under the action of ultrasound (800-1,200 kc. 2-4 hours) on a suspension of live mycobacteria strains of BCG and No 35 in distilled water, specific soluble antigens, the presence of which was clearly detected by the double diffusion reaction in gel with corresponding specific rabbit sera, were produced.

"The precipitation lines from the soluble antigens ran together with the lines from the polysaccharides isolated from the same mycobacteria. This permitted us to assume that the soluble antigens were on the whole, polysaccharides.

"The soluble antigens of a suspension of cultures of BCG and No 35 strains reacted with specific rabbit sera in the complement fixation reaction.

"The soluble antigens of the suspensions of live tuberculosis bacteria (vaccine strains) were serologically active."

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77. Fluorescent Antibody Method for Rapid Detection of Pathogens

"Accelerated Detection of the Pathogens of Several Infections by the Fluorescent Antibody Method," by V. P. Blokhov, I. M. Markelov, and V. F. Mukhin; Moscow, Voyenno-Meditsinskiy Zhurnal, No 6, Jun 59, pp 71-75

The purpose of the research reported in this article was to study the possibility of accelerated detection of several pathogens by the fluorescent antibody method under military bacteriological laboratory conditions. It is pointed out that the experimental work of Soviet investigators in detecting enteric bacteria and B. anthracis and that of foreign investigators in detecting the melioidosis pathogen in urine and diagnosing influenza, attests to the promise of this method.

A study of specificity, method sensitivity, and rapidity of the investigation in the presence of definite pathogens was done. Typhoid, brucellosis, tularemia, anthrax, and normal sera tagged with fluorescein-isocyanate and 1-dimethylaminonaphthalene-5-sulfochloride were used. To increase the objectivity of the results, the specificity of each serum was tested in advance, and only the most specific were used. Standard diagnosticums were employed as homologous antigens.

The second series of experiments was an examination of antigens, homologous with the standard sera, obtained from objects found in the environment (tap water, glass, laboratory equipment, dried fruits, butter, etc.). The methodology of the experiments is given in detail and results are shown in two tables.

Analysis of the results of these experiments led to the following conclusions:

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"The highly specific and sensitive fluorescent antibody method is suitable for the rapid detection of various pathogens.

"The use of the method has been most successful in the detection of pathogens in water and washings from slightly contaminated surfaces, in which the findings can approach 100%.

"Satisfactory results were obtained from the use of the method in investigating highly contaminated surfaces and certain products. The possibility of detecting typhoid, brucellosis, and tularemia pathogens was demonstrated. Bacilliform bacteria with well defined morphology are easily diagnosed."

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78. Formation of Hyaluronidase by Bacteria

"Hyaluronidase of Bacteria and Its Properties," by V. N. Veltistova, Tr. Novosib. med. in-ta (Works of the Novosibirsk Medical Institute), 1958, 30, 97-104 (from Referativnyy Zhurnal--Khimiya, Biologicheskaya Khimiya, No 9, 10 May 59, Abstract No 11035, by the author)

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"The ability of pathogenic as well as nonpathogenic bacteria to form hyalunirodase has been noted. Strains forming hyalunirodase have been found, for the most part, among staphylococci and streptococci bacteria; in lesser numbers, among dysentery and paratyphoid bacteria; and in insignificant numbers, among typhoid bacteria. The hyalunirodase of dysentery bacteria is inactivated within 30 minutes at temperatures of 75-80 degrees, while the hyalunirodase of Staphylococcus aureus is inactivated within the same period of time at temperatures of 55-60 degrees."

Contagious Diseases

79. Combined Q-Fever and Brucellosis Infection Induced Experimentally

"Experimental Combined Q-Fever and Brucellosis Infection; Report I. Characteristics of the Course of Q Fever," and "Experimental Combined Q Fever and Brucellosis Infection; Report II. Characteristics of Brucellosis," by A. G. Somova, V. A. Silich, I. I. Polyakov, Z. D. Khakhina, and G. L. Gerasyuk, Rostov-na-Donu Institute, Ministry of Health USSR, and Institute of Epidemiology and Microbiology imeni Gamaleyva; Moscow, Zhurnal Mikrobiologii, Epidemiologii i Immunobiologii, Vol 30, No 3, Mar 59, pp 100-106 and 106-110

Proceeding from the fact that agricultural animals are natural reservoirs of the pathogens of both brucellosis and Q fever, the authors of these articles performed a series of experiments on combined infection of guinea pigs with these diseases. The following aspects of combined infection were studied: the course of combined infection after simultaneous infection of guinea pigs with brucellosis and Q fever; the development of brucellosis in those animals which were infected with Q fever earlier; and the development of Q fever in those animals which were infected with brucellosis earlier.

The experimental animals were divided into seven groups. The animals of the first group were simultaneously infected with Brucella melitensis and Rickettsia burneti. Pigs of the second and third groups were infected with Rickettsia burneti, and 14 or 30 days later, with Brucella melitensis. The fourth and fifth groups were first infected with Brucella melitensis,

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and with Rickettsia burneti 14 or 30 days later. The sixth and seventh groups, which were used as controls, were infected with brucellosis and Q fever, respectively. Highly virulent Brucella melitensis strain No 599, of which one infecting dose was2 microbial cells, was administered subcutaneously to produce brucellosis infection; a standard culture of the Grita strain of Rickettsia burneti was introduced subcutaneously in a dilution of 10^{-2} per ml for Q fever infection. Phenomena observed and biological tests performed under all these conditions are discussed in detail in the texts of the two articles.

On the basis of the study of the course of Q fever, the authors conclude, in general, that cross serological investigation of Q fever and brucellosis demonstrated the absence of antigenic similarity in Brucella and Rickettsia burneti; their experiments substantiated the opinions of foreign investigators that positive serological reactions in Brucellosis and Q fever are a result of mixed infection.

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The concluding comments from the article concerning the study of the course of brucellosis following mixed infection follow.

"Analysis of the results of the experimental study of the course of brucellosis in combined infection showed that simultaneous infection of guinea pigs, either with both pathogens or with Q fever first and then with brucellosis, led to a less pronounced course of brucellosis. Low titers of antibrucellosis antigens were noted in animals of these groups, and allergic reactivity and phagocytic activity of the leukocytes were essentially unaltered. Infection of guinea pigs with Rickettsia burneti against a background of brucellosis led to a decrease in seroallergic reactions and in the phagocytic activity of the leukocytes; the degree of seedability of the animals with Brucella either is not changed in this process (on infection with Rickettsia after 14 days), or is increased somewhat (on infection with Rickettsia after 30 days)."

80. Chinese Infect Ducks Experimentally With Japanese Encephalitis

"The Absence of Clinical Manifestations of Disease in Ducks Experimentally Infected With Japanese Encephalitis," by Wang I-ming, Jen Kuang-hung, Hsueh Feng-chu; Peiping, Chung-hua Wei-sheng Tsa-chih (Chinese Journal of Public Health), No 3, 1958, pp 194-197 (from Meditsinskiy Referativnyy Zhurnal, No 6, Jun 59, p 61)

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"Antibodies to the Japanese encephalitis virus were discovered in 17 of 78 clinically healthy ducks examined. Seven healthy ducks were infected subcutaneously with different doses of virus, after which specific antibodies were observed in their blood. Viremia was observed in all ducks within 12-32 hours after infection."

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81. Chinese Report Placental Globulin Effective for B Encephalitis

"Preliminary Clinical Observations of 76 Cases of Epidemic B Encephalitis Treated With Placental Globulin," Kao I-ch'eng (高 毅 成) et al, Ho-fei Infectious Hospital; Peiping, Jen-min Pao-chien (People's Health), Vol 1, No 6, Jun 59, pp 498-500

This article presents an analysis of 76 cases of Japanese B encephalitis treated with placental globulin in 1958. Reportedly, the therapeutic effect of placental globulin was good. The corrected case fatality rate was only 2.6 percent as compared with 15-20 percent in previous years when the hospital was not using placental globulin. Temperatures returned to normal in an average of 4 1/2 days after the first administration of globulin. A total of 82.7 percent of cases in lethargy and coma regained consciousness after 1-3 days.

The placental globulin was prepared by the Shanghai Vaccine and Serums Institute. Dosages were provisionally scheduled according to age as follows: under 3 years, 10-15 ml; 3-5 years, 15-20 ml; 5-8 years, 20-25 ml; 8-12 years, 20-30 ml, and over 12 years, 30 ml daily for 5 days.

82. In Vitro and Clinical Experiments in Treatment of Bacilliary Dysentery With Portulacca Extract

"Portulacca Oleracea in the Treatment of Bacilliary Dysentery--Report on 70 Cases," by Chu Feng-lin et al; Peiping, Chung-chi I-k'an (Intermediate Medical Journal), No 6, Jun 59, pp 11-13

This report presents an analysis of 70 cases of bacillary dysentery treated with extract of Portulacca oleracea. The rate of cure was 95.7 percent. There were no untoward side effects.

Also given are the details of controlled experiments in which different concentrations of the portulacca extract prepared by a variety of methods were added to a culture medium and tested in vitro for activity against different types of Shigella paradysenteriae (including antibiotic-resistant strains), Salmonella typhosa "H," and Salmonella paratyphi. It was found that concentrations of portulacca extract, 25 percent and higher, demonstrated bacteriostatic activity against Shigellae flexneri, new castle, and sonnei. Some 40-50 percent concentrations were needed to inhibit the activity of antibiotic-resistant types. Further research is indicated.

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Epidemiology

83. Factors Affecting Preservation of Japanese Encephalitis Pathogen in Mosquitoes

"The Effect of the Body Temperature of Mosquitoes on the Preservation of the Virulence of the Japanese Encephalitis Pathogen," by Wang I-ming and Jen Kuang-hung; Peiping, Chung-hua Wei-sheng Tsa-chih (Chinese Journal of Public Health), No 3, 1958 pp 194-197 (from Meditsinskiy Referativnyy Zhurnal No 6, Jun 59, p 61)

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"Mosquitoes artificially infected with the Japanese encephalitis virus were kept at temperatures of 18-31° C; the virus titer was then determined in mice. Temperatures of 26-31° C were found to be optimum for the preservation of the virus in the mosquito organism."

84. Brucellosis in Chinese Province

"Determination of the Type of Pathogen and Primary Observation for Brucellosis in the Province of Heilungkiang," by Meng Ching-hai, Liu Hsueh-li, and Liu Ai; Peiping, Chung-hua Wei-sheng Tsa-chih (Chinese Journal of Public Health), No 3, 1958, pp 218-221 (from Meditsinskiy Referativnyy Zhurnal, No 6, Jun 59, p 51)

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"Brucellosis was not known in Heilungkiang Province before 1954; sheep were brought here from Inner Mongolia in 1954, and within a few months 102 persons who had been engaged in sheep raising (shepherds and other workers) in the province contracted brucellosis. Nine strains of Br. melitensis were isolated from the patients."

85. Tick-Borne Encephalitis Vectors in Northeastern China

"The Study of Vectors of Tick-Borne Encephalitis in the Forest Regions of Northeastern China," by Ying Ti-ning, Yen P'ei-han, and Tung Kuo-hsien; Peiping, Chung-hua Wei-sheng Tsa-chih Chinese Journal of Public Health), No 3, 1958, pp 222-226 (from Meditsinskiy Referativnyy Zhurnal, No 6, Jun 59, p 60)

The virus of tick-borne encephalitis was first isolated in Northeastern China in 1953-1954 from I. persulcatus and Haem. concinna ticks. The ticks were collected from the ground in forests."

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86. Q Fever and Ornithosis Diagnosed During Influenze Epidemic in Sofia.

"The Concomitant Evolution of Influenza With Q Fever and Ornithosis," by B. Zogravski, M. Doinov, and I. Beloev; Bucharest, Mikrobiologia, Parazitologia, Epidemiologia, No 2, Mar/Apr 59, pp 131-132

Following a brief introductory paragraph concerning Prof S. Silov's theory on the concomitant occurrence of influenza with other transmissible diseases, the authors discuss an outbreak of influenza in Sofia in the fall of 1957, during which Q fever was diagnosed in 6.9% of the patients, and ornithosis, in 15.86%.

Results of clinical observations and serological tests performed at the Institute of Microbiology, Bulgarian Academy of Sciences, are presented; complement-fixing antibody titers are given for Q fever and ornithosis. The authors state in conclusion that an epidemiological analysis of this combined infection will be the object of further study.

Hematology

87. Method for Quantitative Determination of Erythrocyte Production by Bone Marrow

"Concerning the Problem of the Quantitative Determination of Erythrocyte Production by Bone Marrow," by Yu. P. Popov, Chair of Propedeutics of Internal Diseases, Kazan Medical Institute; Moscow, Problemy Gematologii i Perelivaniya Krovi, Vol 4, No 6, Jun 59, pp 13-18

The quantity of erythrocyte production per unit time by the bone marrow is valuable in determining erythropoiesis in general, and in evaluating the reaction of bone marrow in response to therapeutic or other factors. In this article the author describes an original method for determining the quantity of erythrocytes based on the assumption that if the number of reticulocytes in the blood during a certain period of time is unchanged, one may assume that the number of reticulocytes leaving the bone marrow per unit time is equal to the number of reticulocytes maturing into normocytes in that same period of time. The number of reticulocytes (per 4,000 erythrocytes) is calculated before and after incubation (in vitro for 14 hours). The formula for erythrocyte production is as follows:

$$PRmm^{24} = (M-N) \times E \times 1.7$$

where $PRmm^{24}$ represents the production of reticulocytes per cu mm of blood in 24 hours; M is the number of reticulocytes before incubation; N is the number of reticulocytes after incubation; E is the number of erythrocytes per cu mm in thousands; and 1.7 is the correction factor.

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By applying this method it was found that the production of erythrocytes was low in patients with pernicious anemia and renal insufficiency, and high in cases of acute posthemorrhagic anemia.

Immunology and Therapy

88. Chinese Study Enteric Trivaccine

"A Serological Study of the Comparative Effectiveness of a Trivaccine (Typhoid and Paratyphoid A and B) After the Use of Subcutaneous and Intracutaneous Methods of Introduction," by Ni Ta-shih, Ch'eng Tse, and Liu Shao-tang; Peiping, Chung-hua Wei-sheng Tsa-chih (Chinese Journal of Public Health), No 3, 1958, pp 177-179 (from Meditsinskiy Referativnyy Zhurnal, No 6, Jun 59, p 51))

CPYRGHT

"Three-time inoculations were given at one-week intervals to persons ranging in age from 30 to 40 who were divided into groups. In the first group, 0.1 ml of the vaccine was introduced intracutaneously; the second group was inoculated intracutaneously with 0.2 ml doses; the third group was inoculated subcutaneously with 0.5 ml doses (one ml of the vaccine contained 500 million typhoid and 250 million paratyphoid A and B bacilli). Serological examination of 498 vaccinates was done twice: the day before inoculation, and one month after the final injection of the vaccine. It was determined that the specific antibody content in the blood of the vaccinates of the second and third groups was identical one month after inoculation."

89. Yugoslavia Produces Salk Vaccine

"The First Quantities of Domestic Vaccine Against Polio Have Been Produced," by A. Misic; Belgrade, Politika, 16 Jul 59, p 7

In the past 6 months, 70 liters of Salk polio vaccine have been produced by the Polio Division of the Serbian Institute of Hygiene under the supervision of Dr Ljubinko Stojkovic and Dr Mileva Dimic. It is expected that 300 liters of this vaccine will be produced by the end of the year. In the fall of 1959, the Polio Division in Torlak will begin preparations for the development of a polio vaccine containing live viruses according to the Sabin method.

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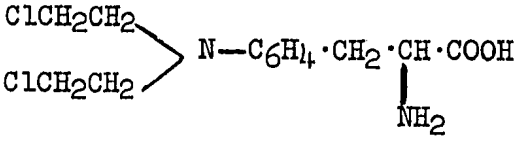
Oncology

90. Chinese Synthesize Oncolytic Amino Acids

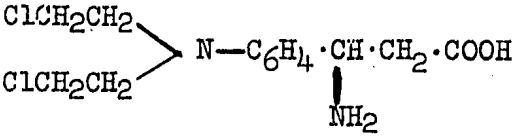
"Research on Chemotherapy for Tumors (V.) Synthesis of Amino Acids Containing the Bis (Beta-Chloroethyl) Amino Group," by Ch'en Pao-chen (陈宝珍), Tsou Heng-liang (鄒恒亮), Chang Ch'un-nien (張椿年), and Yuan Ch'eng-yeh (袁承业), Institute of Organic Chemistry, Academia Sinica; and Research Institute of the Pharmaceutical Industry, Ministry of the Chemical Industry, Shanghai; Peiping, K'o-hsueh T'ung-pao (Scientia), No 10, 26 May 59, pp 331-332

The authors present a modified method for the synthesis of the para and meta isomers of two amino acids containing the bis (beta-chloroethyl) amino group. The empirical formulas are:



(I)

and



(II).

The physical properties and results of quantitative analyses of the products are given.

The authors state that bio-assays, performed by Hsu Pin (胥彬) of the Institute of Materia Medica of the Academia Sinica, showed that the meta isomers have no oncolytic effect and that the para isomer of (II) inhibited the growth of tumors but was more toxic than the already known oncolysin, para-(1).

91. Chinese Studies Effect of Hypophysectomy on Thyroid Tumor and Cellular Nucleic Acid

"Studies on Experimental Rat Thyroid Tumor II. Effect of Hypophysectomy on the Morphology of Tumors and the Histochemical Changes in Cellular Nucleic Acid," by Ch'en Han-yuan (陳汉源), Institute of Experimental Biology, Academia Sinica, Shanghai; Peiping, Sheng-li-Hsueh-pao (Acta Physiologica Sinica), Vol 6, No 1, Jun 58, pp 37-51

Thirty experimental white rats and 23 controls were used in the experiments reported in this paper. The experimental rats were treated with propylthiouracil for 12 months, in which time all should have developed

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thyroid tumors, according to evidence reported in the author's previous paper. At the end of 12 months, a small group of experimentals and controls were sacrificed and their thyroid glands taken to provide basis for later comparison. The rest were hypophysectomized and then sacrificed at various postoperative intervals. Their thyroids were examined for the progressive changes induced by hypophysectomy.

CPYRGHT A summary of the author's observations and conclusions follows:

"Following hypophysectomy, there was regression in hyperplastic tissue, adenomatous growths, and follicular adenomas, indicating that tumors of these types are dependent on the pituitary thyrotropic hormone. On the other hand, solid cell tumors continued to grow in size and number, indicating that they are independent of thyrotropic hormone.

"In the course of regression, the follicular adenomas underwent morphological changes characterized by (1) atrophy, reduction in cell height and cytoplasmic volume, and decreased pyronin staining capacity; (2) loss of colloid content; (3) desquamation of tumor cells; and (4) fibrosis and hyalization of tumor matrices.

"Parafollicular cells, which were rarely seen in thyroid tissue before hypophysectomy, occurred frequently in hypophysectomized rats. Their resemblance to solid cell tumors in morphology, physiology, and nucleic acid content seem to support the view that parafollicular cells are the main source of solid cell tumors. This, however, does not preclude the author's original theory that stratification and deaggregation of follicular cells may be histogenetically connected with solid cell tumors.

"After hypophysectomy, morphological changes also occurred in the cell nuclei of thyroid tumors. The originally fine nuclear chromatin of the glandular cells and of the follicular adenomas became coarse and arranged in wheels. When the tumors became malignant, the nuclear chromatin became fine and dispersed again. The fine granular state of solid cell tumors were not affected by hypophysectomy. These facts seem to indicate that the various types of thyroid tumors differ in sensitivity to pituitary thyrotropic hormone and that the differences are detected in the morphological changes which occur in the cell nuclei.

"After hypophysectomy, the normally high ribonucleic acid content of adenomatous growths and follicular adenoma cells dropped suddenly. Colloid content was also reduced or absent. On becoming malignant, the adenoma cells slightly increased in ribonucleic acid content (as compared with atrophied tumors) but remained deficient in colloid. In solid cell tumors, the ribonucleic acid content did not fluctuate but remained low. On the basis of these observations, the author believes that the ribonucleic acid content of thyroid tumor cells is conditioned not only by cell growth potential but also by secretory activity."

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Pharmacology and Toxicology

92. Effect of Tetraethyl Lead on the Enzyme Systems

"Data on the Characteristics of the Action of Tetraethyl Lead on the Enzyme Systems," by Ye. I. Velling and A. A. Preobrazhenskaya, V sb.: Materialy po voprosam prom. toksikol. i kliniki prof. bolezney (Gorky) (Data on the Problems of Industrial Toxicology and the Clinical Observations of Occupational Diseases) (Gor'kiy), 1957, 36-44 (from Referativnyy Zhurnal--Khimiya, Biologicheskaya Khimiya, No 9, 10 May 59, Abstract No 12053, by I. Elman)

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"A single administration of tetraethyl lead (0.05-0.1 milligrams per kilogram of body weight subcutaneously) to rabbits sharply depressed carboxylase and cholinesterase activity in the blood. From one to three hours after the administration of tetraethyl lead, an increase in the acetylcholine content in the blood of the animals was noted; the quantity of acetylcholine in the blood of the animals reached its maximum (0.13-0.15 milligram percent) on the third to fifth day after the intoxication; it then dropped somewhat, and again increased on the 20th, 30th, and 40th days after the intoxication. By the end of the third month after the intoxication, only traces of it were found in the blood. An increase in acetylcholine content was found also in all organs of the intoxicated animals. Very large quantities of acetylcholine were found in the medulla oblongata --- 29.9 milligrams (8.4 milligrams in control) and in the cerebral hemispheres 5.5 milligrams (1.33 milligrams in control). Almost no change in the acetylcholine content of the spinal cord was noted. Considerable accumulations of acetylcholine were found in the liver (eight times that of normal) and in the cardiac muscle. To the contrary, the acetylcholine content in the suprarenals of the intoxicated animals decreased somewhat."

93. Distribution of Tetraethyl Lead in the Organism

"On the Problem of the Distribution of Tetraethyl Lead in the Organism of Animals," by Ye. I. Velling and V. V. Piskunova, V sb.: Materialy po vopr. prom. toksikol. i kliniki prof. bolezney (Data on the Problems of Industrial Toxicology and the Clinic of Occupational Diseases), 1957, 27-35 (from Referativnyy Zhurnal--Khimiya, Biologicheskaya Khimiya, No 9, 10 May 59, Abstract No 12052, by I. Elman)

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"Tetraethyl lead administered to rabbits (0.1 milliliter per kilogram of body weight subcutaneously) was deposited in the organs mainly in the form of organic lead. The main mass of the lead that was administered was concentrated in the brain tissue: its content in the cerebral hemispheres

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was equal to 2.9 milligram percent, and in the medulla oblongata, 2.8 milligram percent. As to the internal organs, the larger concentrations of organic lead were found in the liver (0.91 milligram percent), in the cardiac muscle (0.87 milligram percent), and in the lungs (0.61 milligram percent). In the blood, the organic lead is found in the corpuscular elements."

94. Toxic Effect of Malathion on the Organism

"Data From the Investigation of the Chronic Toxic Effect of Malathion on Rats," by L. Vrbovsky, L. Rosival, and F. V. Selecky, Bratisl. lekar. litsy (Slovakia), 1958, 1, No 9, 518-529 (from Referativnyy Zhurnal--Khimiya, Biologicheskaya Khimiya, No 9, 10 May 59, Abstract No 12048, by the author)

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"In experiments carried out on rats it was found that malathion [O,O-S-(1,2-dicarbethoxyethyl)-dithiophosphate] in doses of 100-330 milligrams per kilogram of body weight possesses cumulative properties, producing cholinergic symptoms of intoxication. Anematization of the animals, and leucocytosis, neutrophilia, eosino- and lymphopenia were noted. The authors assume that the maximal allowable concentration for parathion is 0.1 milligram per cu m, and for malathion--10 milligrams per cu m."

95. Curarelike Substances in Therapy of Diseases of the Central Nervous System

"Experimental Therapy of Diseases of the Central Nervous System Accompanied by a Rise in the Muscular Tonus With Curarelike Preparations," by D. A. Alelekov, Tr. Kliniki nervn. bolezney. Gorkovsk. Med. in-t (Works of the Clinic of Nervous Diseases. Gor'kiy Medical Institute), 1958, No 1, 76-80 (from Referativnyy Zhurnal--Biologiya, No 9, 10 May 59, Abstract No 41995)

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"Elatine (1) [$C_{38}H_{50}O_{10}N_2$, an alkaloid obtained from Delphinium elatum L., Lekarstvennyye Sredstva, by M. D. Mashkovskiy, Moscow, Medgiz, 1957, pp 153-154] and methyllycaconitine were clinically studied on 32 patients afflicted with disturbed motor functions and a rise in the muscular tonus of a pyramidal and extrapyramidal character. To determine individual sensitivity and the optimal dosages of the drugs, elatine was administered in the beginning at the rate of 10 milligrams once every 24 hours and then gradually increased to four to five times every 24 hours; methyllycaconitine was administered in the beginning at the rate of 20 milligrams every 24 hours and then gradually increased to three to four times every

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24 hours. The course of treatment continued for periods of 7-30 days. In addition, the patients received iodine preparations, and physical therapy was applied. Observations established that elatine and methyllycaconitine possess highly effective curarelike action, and their use in the treatment of patients suffering from a rise in the muscular tonus and disturbed motor activity is advisable."

96. Isoverine, a Hypotensive and Ganglionic Therapeutic Agent

"Isoverine " by N. A. Serova and L. M. Utkina, Materialy po obmenu peredov. opytom i nauchn. dostizh. v khim-farmatsevticheskoy prm-sti (Data of the Exchange of Advanced Experiences and Scientific Achievements in the Chemicopharmaceutical Industry), 1958, No 1/12, 10-13 (from Referativnyy Zhurnal--Khimiya, No 7, 10 Apr 59, Abstract No 24446, by A. Vavilova)

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"Isoverine (dihydrochloride of N-isoamylcadaverine; I) is a white crystalline powder with a melting point of 293 to 295 degrees; it is readily soluble in water and alcohol, but poorly soluble in ether and acetone; it is noninflammable and nonexplosive. Aqueous solutions are stable and transparent. Pharmacologically it is close to spherophysine and can replace the latter. The initial material for the synthesis of isoverine is caprolactam which is readily available and from which isoverine in the form of a dihydrochloride is obtained following a number of stages: 6-benzoyl amino caproic acid (II); the acid chloride of (II); the amide of (II); monobenzoylcadaverine; bromine hydrate; N-isoamyl-N -benzoylcadaverine, and the saponification of the latter. The structural formula and a scheme of the technological process for the synthesis of isoverine are given. Isoverine is an active hypotensive and ganglionic drug, and is used also in obstetrical and gynecological clinics."

97. Chlorazine -- Antimalarial Preparation

"Chlorazine," by O. Yu. Magidson, Materialy po obmenu peredov. opytom i nauchn. dostizh. v khim-farmatsevt. prom-sti (Data of the Exchange of Advanced Experiences and Scientific Achievements in the Chemicopharmaceutical Industry), 1958, No 1/12, 85-86 (from Referativnyy Zhurnal--Khimiya, No 7, 10 Apr 59, Abstract No 24443, by A. Vavilova)

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"Chlorazine is the monohydrochloride of 1-(p-chlorphenyl)- 2,4-diamino-1,6-dihydro-6,6-dimethyl-1,3,5-triazone. It has a melting point of 205-207 degrees, is soluble in water (1:35), and readily soluble in alcohol. When acted upon by alkaline solutions, NH_3, and amines it is transformed into an iso-form. Chlorazine is used in the therapy of all forms of malaria. Into a flask with an agitator and reflux condenser, 12.8 grams of p-choraniline,

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85 grams of dicyandiamine, 100 milliliters of acetone, and 110 milliliters of 32 percent HCl are placed. The mixture is heated on a water bath to the boiling point for a period of 2 hours. The crystals of chlorazine which separate on cooling are drawn off and then recrystallized with carbon in 700 milliliters of hot water. The chlorazine yield is 130 grams (45 percent of the theoretical). An additional 20 grams of chlorazine is obtained from the mother solution, making a total chlorazine yield of 150 grams (52 percent of the theoretical), in individual cases up to 59 percent). The formulas of chlorazine, iso-chlorazine, the reaction schemes for the derivation of chlorazene, and the melting temperature of the dihydrochloride of chlorazine are given."

98. Leukogen-Leukopenia Therapeutic Agent

"Leukogen," by I. T. Strukov, Materialy po obmenu peredov. opytom i nauchn. dostizh vkhim-farmatsevt. prm-sti (Data of the Exchange of Advanced Experiences and Scientific Achievements in the Chemicopharmaceutical Industry), 1958, No 1/12, 62-65 (from Referativnyy Zhurnal--Khimiya, No 7, 10 Apr 59, Abstract No 24445, by A. Vavilova)

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"Leukogen [2-(alpha-phenyl-alpha-carbethoxymethyl)-thia-zolidine-4-carboxylic acid] is used in the therapy of leukopenia caused by Roentgen radiation or by the action of a chemical agent which depresses hemopoiesis. Leukogen is a white crystalline substance with a melting point of 169-171 degrees; it dissolves with difficulty in water and alcohol, is unstable in solutions, and is decomposed upon boiling. Leukogen is supplied in the form of tablets prepared according to the following prescription: 0.02 gram of leucogen, 0.039 gram of lactose, 0.04 gram of starch, and 0.001 gram of Ca stearate. The tablets should be kept in a cool and dry place. A detailed description of the technological process of the production of leukogen which takes place in the following stages is given: (1) the hydrochloride of l-cysteine from l-cysteine; (2) the ethyl ester of HCOOH; (3) the ethyl ester of formyl phenyl acetic acid; (4) leukogen."

99. Czechoslovak Drugs for the Nervous System

"Drugs Which Affect the Nervous System" (unsigned article); Prague, Obrana Lidu, 26 Jul 59, p 4

This article reviews the progress of Czechoslovak pharmacological and biochemical research and production of selected drugs over a period of years. One of the first drugs mentioned in the article is a derivative of phenothiazine, namely chlorpromazine, which, according to the author, has been available to Czechoslovak physicians for quite some time.

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The article also states that research in this field is within the framework of the Czechoslovak Academy of Sciences and is actually conducted by the Research Institute for Pharmacy and Biochemistry in Prague.

Recalling the beginning of research on ataractic drugs, the author states that in 1953, Czechoslovak researchers synthesized theadryl, obtained from alphadryl, which has proved very useful in "major" and "minor" psychiatry and which is still used clinically.

Beginning in 1955, the author continues, a group under the direction of Dr Hebky began working on phenothiazine derivatives and produced a number of new compounds, the most promising of which, dichlorpromazine, is currently undergoing wide clinical testing.

Another group of modern drugs, the author continued, are the tranquilizers, which act against anxieties without producing drowsiness, etc. In this connection, the research done by the Research Institute for Pharmacy and Biochemistry has resulted in the production of benactyzine, and the institute has worked out a production process for the manufacture of meprobamate and trihexyphenidyl.

Good results are also anticipated for the manufacture of mebrophenhydramine; clinical tests have begun with mebrophenhydrinate, a new drug against motion sickness.

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Physiology

100. Cobalt Ion and Adrenalin

"Effect of the Cobalt Ion on the Action of Adrenalin," by Tibor Szilagyi, Laszlo Coczar, and Imre Szatai, Kiserl orvostud. (Hungary), 1957, 9, No 5-6, 581-585 (from Referativnyy Zhurnal--Khimiya, Biologicheskaya Khimiya, No 9, 10 May 59, Abstract No 11015, by A. Laufer)

CPYRGHT

"Co^2 exhibited an effect on the pupil of a rabbit and a frog, prepared according to the Trendelenburg method, opposite that of adrenalin. In their effect on the isolated intestine and heart of a frog, no antagonism between Co^2 and adrenalin was noted."

101. Chinese Study Irradiation of Impulses to Sensorimotor Cortex

"Pathways Mediating the Electrical Response of the Motor Cortex to Brief Auditory and Visual Stimuli in the Cat," by Liu Yu-min (刘 育 民) and Shen O (沈 鈺), Institute of Physiology and Biochemistry, Academia Sinica, Shanghai; Peiping, Sheng-li Hsueh-pao (Acta Physiologica Sinica), Vol 22, No 2, Jun 58, pp 104-117

This article, which is well-supported with brain maps and electroencephalograms, presents details of cat experiments conducted to elucidate the nervous pathways which mediate the electrical response elicited in the motor cortex by brief auditory and visual stimuli. The authors say that the problem has more than clinical significance.

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"In a cat under the influence of a suitable combination of anesthetic and convulsant, e. g., chloralose and semicarbazide, both click and flash elicited electrical response in extensive regions of the cerebral cortex. Making use of the response in the sensorimotor cortex as the indicator, the nervous pathways mediating the productions of such response were analyzed.

"The initial, complex, positive phase of the electrical response in the sensorimotor cortex, elicited by a click, showed three distinct wavelets having latencies of 8-9, 18-20, and 30-35 milliseconds, respectively, the second and third wavelets being much larger than the first. The response persisted essentially unchanged after complete bilateral destruction of the auditory cortex, but disappeared completely after bilateral destruction of the MG (medial geniculate bodies). Conversely, direct stimulation of MG elicited a response in the sensorimotor cortex practically the same as that called forth by a click. When the regions around the

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thalamic nuclei of the VM (ventralis medialis) and the VA (ventralis anterior) were destroyed, the second and third wavelets of the response disappeared together. The first wavelet appeared to be a subcortical event electrically spread to the cortex, as it could be still picked up from the white matter after the removal of the cortex.

"Under the same experimental conditions the response set up in the sensorimotor cortex by a flash of light as compared with that elicited by a click, appeared to have a longer latency of 29-33 milliseconds. Three successive positive wavelets could also be distinguished in this response, although the separation of these wavelets was not always as distinct as in the case of auditory stimulation. The second wavelet had a latency of about 38-42 milliseconds and the third, 48-52 milliseconds. Complete bilateral removal of the visual cortices decreased the size of the response and increased its latency. However, even in the complete absence of the visual cortices, stimulation of the LG (lateral geniculate body) could elicit virtually the same electrical response in the sensorimotor cortex as was usually called forth by a flash of light. The only difference was in latency. Analogous to auditory stimulation, bilateral destruction of the LG caused a complete disappearance of the response to the flash. Destruction in the VA and VM, region, if sufficient to abolish completely the second and third wavelets of the response due to a click, usually also greatly diminished the second and third wavelets of the response to a flash, leaving the first wavelet almost unaffected. This first wavelet in the response to a flash, like the first wavelet in the response to a click, was also due to thalamic activity electrically spread to the cortex.

"Our general conclusion regarding the irradiation of auditory and visual impulses to the sensorimotor cortex, as indicated by the kind of responses studied, is that the pathways involved are basically subcortical, the chief routes being from the geniculate bodies via the thalamic diffuse projection system. However, the effective working of the subcortical pathways may require varying degrees of facilitation from the cortex. Results such as the fact that the removal of the visual cortex decreased the size and lengthened the latency of the response of the sensorimotor cortex to the photic stimulus, may be interpreted on this basis.

"We wish to thank Prof Feng Te-p'ei (馮 德 培) for his guidance and advice in the course of this work."

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102. Electrical Charges of Bacterial Aerosol Particles Studied

"The Electrical Charge of Particles and Droplets in a Bacterial Aerosol," by V. V. Vlodavets, Central Institute for the Advanced Training of Physicians; Moscow, Biofizika, Vol 4, No 3, May/Jun 59, pp 360-364

This article reports a study of the electrical charges of the microflora of the air by means of an apparatus designed by the author. In emphasizing the theoretical and practical significance of this research, the author states that the nature of a charge affects the entrapment of bacterial particles in the respiratory tract and on filters, and may also affect the processes of precipitation and coagulation of the particles in a bacterial aerosol.

In the research described, the electrical charges of the dust phase of a natural bacterial aerosol in the air of a laboratory room and a synthetic aerosol of Staphylococcus albicans in the droplet phase in an experimental chamber were studied. The apparatus used to determine the charges of the suspended bacteria consisted of a wooden case containing plane-parallel electrodes and a step-up transformer with a rectifier; it is described in detail and illustrated. Discussions and results of the experiments are divided into two parts: a study of the electrical charge of the microflora of the air of a room (dust phase of a bacterial aerosol), and the electrical charge of the droplet phase of a bacterial aerosol in an experimental chamber. Tables are given to show results. The following conclusions are presented on the basis of these experiments:

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"1. The microflora of the air of a laboratory room in the dust phase of a bacterial aerosol frequently carry a positive electrical charge (in 55.2%).

"2. A positive electrical charge predominates in microorganisms frequently encountered in the air such as Sarcina aurea and Staphylococcus albicans, whereas mold fungi, actinomycetes, and gram-positive sporogenous bacilli often have a negative charge.

"3. After studying the electrical charge of a synthetic bacterial aerosol of Staphylococcus albicans in the droplet phase, it was noted that the bacterial cells very frequently carried a negative charge (in 62.4%) within an hour after dusting."

The author expresses his appreciation to Prof S. S. Rechmenskiy for the suggested research and for his valuable advice during its completion.

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103. Czechoslovak Study of Tick-Borne Encephalitis Virus

"Survival of the Tick-Borne Encephalitis Virus in Milk and Milk Products," by M. Gresikova-Kohutova, Ceskoslov. Epidemiol., Microbio., Imunol., (Czechoslovak Epidemiology, Microbiology, Immunobiology), No 1, 1959, pp 26-32 (from Meditsinskiy Referativnyy Zhurnal), No 6, Jun 59, p 61

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"It was established that the tick-borne encephalitis virus is well preserved in cow's milk at refrigerator temperatures. The author proposes that milk has a protective effect on it. This virus was preserved for 2 months in sour cream and butter."

Radiology

104. Chronic Effects of Radiation on Higher Nervous Activity of Rats

"The Condition of the Higher Nervous Activity of Rats Subjected to Daily X-Ray Irradiation During Their Embryonic Development," by V. N. Semagin, Laboratory of Radiobiology, Institute of Higher Nervous Activity, Academy of Sciences USSR; Moscow, Meditsinskaya Radiologiya, Vol 4, No 6, Jun 59, pp 16-21

Work over the past 2 years at the Academy of Sciences USSR by I. A. Piontkovskiy and others has shown the various changes occurring in the higher nervous activity of animals subjected to the effect of ionizing radiations at various periods of prenatal development. Along with the significant retardation of brain development, changes were noted in the behavior of the rats (aggressiveness, and increased motor excitation, and also disorders were noted in the higher nervous activity as studied by the conditioned reflex method. Such changes included disturbance in the switching function of the cerebral cortex of animals, change in intensity, equilibrium, and mobility of the basic nervous processes of excitation and inhibition.

The present research, which is a continuation of these studies, presents results of observations on the higher nervous activity of rats subjected to daily irradiation all through the embryonic period of life (10 r for 20 days).

The method of study -- that of L. I. Kotlyarevskiy -- is described in detail. Three tables present data on the latent periods, values of conditioned reflexes, and number of intersignal reflexes in control and experimental animals in stereotype; results of function tests against a background of caffeine and starvation; and results of function tests with the use of a super strong stimulus and with alternating positive and inhibitory stimuli. Results are compared with previous work, and numerous references are cited. The author draws the following conclusions:

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"Irradiated rats exhibit increased motor activity during the third week of postembryonic development.

"The irradiation of rats during the period of embryonic development by fractional doses totaling 200 r produces a weakened condition in the excitation processes and a disturbance in equilibrium with a predominance of the process of internal inhibition in them when fully grown.

"The irradiation of animals all through their embryonic development by fractional doses amounting to 200 r retards the development of the brain and decreases its weight [in this case by 13.5%]."

105. Study of Bactericidal Action of Ionizing Radiations

"The Bactericidal Action of Ionizing Radiations," by Z. G. Pershina and T. D. Yesakova, Institute of Epidemiology and Microbiology imeni Gamaleya; Moscow, Zhurnal Mikrobiologii, Epidemiologii i Immunobiologii, Vol 30, No 6, Jun 59, pp 62-66

Following a brief discussion of previous research on the subject, the authors describe their own experiments on vegetative and spore forms of B. coli, B. proteus, staphylococcus, sarcinia, and B. subtilis. Irradiation was effected by an experimental EGO-2 gamma unit with preparations of radioactive Co (general activity, 5 kilocuries; dose, 600 r/min). The thickness of the microbial suspensions irradiated varied from 800,000 to 40 billion microbial bodies per ml. Four charts show results of the experiments. Conclusions presented on the basis of these results are as

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follows:

"1. The bactericidal action of ionizing radiations was found to depend on the concentration of microbial cells per ml of irradiated medium.

"2. Doses of 400,000-600,000 r are required for the complete sterilization of thick suspensions (40-50 billion/ml) of vegetative forms, and doses of 1.5 million r, for spore forms.

"3. Of the microorganisms investigated, B. subtilis and sarcinia were found to be the most resistant to X irradiation; a suspension of these bacteria with a thickness of 40 billion/ml was killed by a 1.5-million r dose. The most sensitive was B. coli, a concentrated suspension (40 billion/ml) of which was sterilized by irradiation with a 400,000 r dose. Staphylococcus occupied an average position under the same conditions--sterilization was achieved upon irradiation with an 800,000 r dose."

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106. Qualitative Changes in Protein Synthesis Due to Radiation Sickness

"The Problem of the Characteristics of Protein Synthesis in Organoids of Cells in Tissues of Normal and Irradiated White Rats," by L. I. Il'ina and R. V. Petrov; Moscow, Tsitologiya, Vol 1, No 3, May/Jun 59, pp 289-292

The purpose of the research described was to investigate whether not only quantitative changes but also qualitative changes occur in protein synthesis as a result of the effects of acute radiation sickness caused by X rays.

Tests were conducted on rats, and the following conclusions are presented:

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"1. The ratio of S^{35}-methionine to C^{14}-tyrosine in the total proteins of the organoids in the cells of hepatic tissue and in the cells of the mucous membrane of the small intestine of normal rats is 1.6-3.5.

"2. Following acute radiation sickness in white rats, this ratio in the nuclei, mitochondria, and 'glialoplasma' of the cells of the above-mentioned tissues is characteristically unchanged.

"3. The ratio of S^{35}-methionine to C^{14}-tyrosine in the total proteins of the microsome of the cells of both tissues is sharply changed following radiation sickness. In irradiated rats, it is characterized by a value of 0.7 in the liver, and 0.9 in the mucous membrane of the intestines."

107. Penetration of Radium Bromide Through Intact Skin of Animals

"The Permeability of Radium Bromide Through the Intact Skin of Animals," by M. A. Khodyreva; Moscow, Meditsinskaya Radiologiya, Vol 4, No 6, Jun 59, pp 77-82

Although the problem of the entrance of radium into organisms via the respiratory system, the gastrointestinal tract, and the parenteral route has been studied both by Soviet and non-Soviet scientists, the problem of the penetration of radium through the intact skin has been neglected. This paper reports studies of this problem in which the intact skin of rabbits (15 full-grown animals) was used.

Two radiograms of the blood of rabbits taken 3 and 6 hours after the application of radium bromide on the skin are included, as is a graph showing changes in the leukocyte count of the control and experimental rabbits.

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CPYRGHT The author makes the following conclusions:

"1. Radium bromide in the form of a solution (4 microcuries/cm^2) applied on the skin penetrates through the intact skin of rabbits.

"2. A regularity in the increase in the specific radioactivity of the blood in relation to time has been revealed.

"3. In the experimental animals, in contrast to control animals after the action of radium salt on the skin, a change in the leukocyte count in the peripheral blood was observed.

"4. Loss of weight in the experimental animals was observed."

108. Radiation Injuries Alleviated by Excess Histidine Content in Diets

"The Effect of Ionizing Radiation on an Organism With a Varied Histidine Content in the Diet," by Prof A. E. Sharpenak, O. A. Shishova, and L. A. Gorozhankina, Laboratory of Biochemistry, Institute of Nutrition, Academy of Medical Sciences USSR; Moscow, Meditsinskaya Radiologiya, Vol 4, No 6, Jun 59, pp 37-41

This research is a continuation of previous work done by the author (A. E. Sharpenak, et al, 1958), in which it was established that by increasing the histidine in the diet, the activity of the enzymes participating in histidine metabolism (histidase, histidine decarboxylase, and histamine) was increased, and that there was some increase in the content of globin, heme, red and white blood corpuscles, and carnosine of muscles. Thus, since the favorable effect of histidine on the process of hemopoiesis was evident, it was considered advantageous to repeat these observations under the effects of ionizing radiation.

Tests were conducted on three groups of rats: rats recieving rations deficient in histidine, rats recieving rations with a normal histidine content, and rats receiving rations with a surplus histidine content. The method is described in detail, and two graphs show oxygen absorption by rat tissues and the activity of histidinase in the rat liver and brain.

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"1. Under the effect of ionizing radiation the activity of the histidase of the liver is sharply increased in rats fed small amounts of histidine which aggravates the histidine deficiency of the diet.

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"2. The histidase activity of brain tissue is completely depleted 10-12 days after irradiation even in animals receiving surplus amounts of histidine in their ration.

"3. Within 10-15 days after irradiation, a tendency toward increased blood pressure is observed, and this rise in blood pressure is clearly shown in animals receiving small amounts of histidine in their rations.

"4. The decreased leukocyte count is less marked in rats which received surplus histidine with their food for 10-15 days after irradiation.

"5. The decrease in the content of globin, heme, and erythrocytes, and the decreased weight of the spleen, in the majority of cases, can be alleviated by increasing the histidine content of the food.

"6. Extracts of liver, brain, and small intestines of rats which had received deficient or normal amounts of histidine with their rations and which were subjected to the effect of ionzing radiation completely last their capacity to absorb oxygen when they were incubated with histamine. Extracts of the organs of animals which received surplus amounts of histidine in their rations but were irradiated under identical conditions retained their capacity to absorb oxygen.

"7. Histidine can decrease the deleterious effects of ionizing radiation in an organism, and judging by many indexes, it is one of the protective factors against radiation. This fact must be considered in prescribing prophylactic diets against radiation sickness."

109. Ionizing Radiation Effects on Preserved Blood

"The Effect of Ionizing Radiation on Preserved Blood and Plasma," by V. N. Vorob'yev, Z. I. Sheremet, and Prof M. O. Raushenbakh, Central Order of Lenin Institute of Hematology and Blood Transfusion; Moscow, Meditsinskaya Radiologiya, Vol 4, No 6, Jun 59, pp 65-73

The purpose of this research was to explain the morphological, biochemical, and physicochemical changes caused by the irradiation of preserved blood and plasma, and also to test the possibility of using irradiated preserved blood for transfusion purposes.

Tests were conducted on preserved human and animal (dog) blood.

The author presents the following conclusions:

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"1. The injurious effect of ionizing radiation on preserved blood and plasma is evidenced by the decreased minimum osmotic resistance of the erythrocytes and the acceleration of their spherulation and hemolysis, i.e., changes arise in them which characterize blood preserved for long periods. The degree of the injurious effect depends on the magnitude and intensity of the irradiation dose and on the individual properties of the blood.

"2. The above-noted changes (hemolysis and spherulation) in freshly preserved blood, as a rule, appear on the 4th-7th day after irradiation.

"3. Results of biochemical tests of irradiated, preserved blood indicate a more rapid decrease in the activity of metabolic processes.

"4. The effect of irradiation by a dose up to 50,000 r does not essentially change the protein system of native or of dry plasma.

"5. The transfusion of preserved blood which has been irradiated by a 50,000 r dose during its first 5 days of storage does not cause essential clinical or hematological changes in the animals.

"6. Research results make it possible to consider preserved blood which has been subjected to gamma-irradiation suitable for transfusion, provided there are no signs of injury as determined by the usual tests of the quality of preserved blood, especially hemolysis and spherulation."

110. Distribution Differences of Ca^{45}, and P^{32} in Growing Bone

"The Nature of the Distribution of Radioactive Calcium (Ca^{45}) and Phosphorus (P^{32}) in Bones of Growing Organisms Under Normal Conditions," by O. S. Kvirkveliya, Tr. Resp. Ob'yedin. Detsk. Klinich. Bol'nitsy, Gruz SSR (Works of the Georgian Republic Joint Children's Clinical Hospital) 1957, No 1, 3-39 (from Referativnyy Zhurnal -- Khimiya, Biologicheskaya Khimiya, No 5, 10 Mar 59, Abstract No 5732)

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"An investigation was conducted on Ca^{45}, and P^{32} metabolism in the bones of a growing organism. In nonirradiated rabbits 15-42 days old, a sharp increase was noted in the quantity of Ca^{45} found in the various bones which were examined. Different bones, and different parts of the same bone, absorbed Ca^{45} and P^{32} in different amounts; the metaphysis of the femur absorbed four times as much as the diaphysis and twice as much as the epiphysis, and the shaft section, three times as much as the crown."

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111. Medical Application of Radioactive Isotopes in USSR

"Radicactive Isotopes," by Prof A. Kozlova; Moscow, Meditsinskiy Rabotnik, 10 Jul 59, p 2

This article is the summary of a report on the application of radioactive isotopes in the USSR.

On the whole, radioactive isotopes in Soviet medicine are used in treating diseases of the skin, and hemopoietic, organs, thyrotoxicosis, and malignant and benign tumors.

Polycythemia, which is often accompanied by neuroendocrine disturbances, is treated with P^{32} plus the irradiation of the hypophyseal-hypothalamic region, and remission results are very stable. When polycythemia is accompanied by disturbances in the cerebral circulation, it is advantageous to irradiate the superior cervical ganglia, followed by treatment with P^{32} with a total dose as low as 4-5 millicuries. Treating leukosis with P^{32} only alleviates the course of the disease.

The diffused form of thyrotoxicosis responds in 80-90% of the cases when treated by radioactive iodine.

Beta-emitting radioactive isotopes (P^{32}, Sr^{90}, and Ce^{144}) are used in treating eczema, neurodermatitis, premalignant conditions of the mucous membranes, and of the skin and capillary angiomas.

Radioactive isotopes are most significant in the treatment of patients with malignant and benign tumors. Recently, much better results have been attained by using isotopes with different penetrating capacity and selectivity, by using apparatus which generates radiations of high energy and great magnitude and by creating depots of radioactive isotopes in tumors. This is done by infiltrating the tumors with solutions or suspensions of radioactive isotopes, or by introducing the isotopes into the body cavity. Examples are the use of radioactive gold in radiosurgical and intracavity methods of treatment, i.e., after the removal of the malignant tumor, the operated area is irradiated by preparations of cobalt, gold, or radium, and the incision is sutured with nylon thread onto which are attached wire fragments containing radioactive cobalt; or the area is infiltrated with a solution of radioactive colloidal gold; or radioactive gold is administered into the peritoneal cavity in cases of cancer of the ovaries. In irradiating small areas, it is possible to use a collection of beads with a 6-mm diameter or a macrosuspension of radioactive cobalt-containing beads with a 2-mm diameter.

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An important step forward is the replacement of roentgeno-therapeutic apparatus with telegamma-equipment containing radioactive cobalt. Such instruments are less injurious to the skin and bone tissue in the zone of irradiation. However, for best results, apparatuses of high and low activity and of short and long focal length are required for the irradiation of deep-seated and superficial tumors. In addition, modern equipment which is supplied with rectifiers and scanning devices and telegamma-equipment for rotational and mobile therapy make it possible to irradiate any size or form of tumors at any depth.

New radiological departments must be constructed since the lack of specially equipped installations discourages the therapeutic use of isotopes and high energy radiations. Simultaneously, the production of modern sources of radiation and radiation monitors must be speeded.

112. Chinese Research in Radiobiology

"The Effect of a Lethal Dose of Whole Body X-Irradiation on the Permeability of Rat Blood Vessels," by Hua Kuang (華 光), Hsieh Ch'uan-fu (薛 全 福), and Yen I-chao (嚴 儀 昭), Department of Pathology, Chinese Academy of Medical Sciences; Peiping, Sheng-li Hsueh-pao (Acta Physiologica Sinica), Vol 22, No 4, Dec 58, pp 312-321

This paper reports experiments undertaken in an effort to explain the nature of vascular disturbance which gives rise to severe hemorrhage in radiation injury. Plasma proteins labeled with iodine 131 and sulfur 35 were used to observe the effects of ionizing radiation on the permeability of the blood vessels of small animals.

Eighty six albino rats were used in the controlled experiments. Acute radiation injury was induced by total body irradiation of 1,100 r. One to 8 days after exposure, the rats were given intravenous injections of plasma proteins which had been labeled by the authors. At scheduled intervals, blood was drawn to determine loss of plasma proteins from circulation. Necroscopy was performed to observe the distribution in the various organs.

It was found that in normal rats, the plasma proteins remained in the circulation 1.44-2.7 times as long as they did in the irradiated rats. Plasma protein distribution in the organs was also more pronounced in the irradiated than in normal rats. The authors consider these phenomena an indication that a lethal dose of ionizing radiation increases the permeability of the blood vessels to plasma proteins, at least in the rat.

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"The Effect of Whole Body Irradiation on the Phosphorus Uptake of Erythrocytes," by Li Chih-wang (李 志 旺) and Hua Kuang (華 光), Department of Pathology, Chinese Academy of Medical Sciences; Peiping, Sheng-li Hsueh-pao (Acta Physiologica Sinica), Vol 22, No 4, Dec 58, pp 305-310

Eighty-one albino rats were used in a series of controlled experiments which were conducted to observe phosphorus metabolism in the red blood cells during the course of radiation injury.

Di-sodium hydrogen phosphate labeled with phosphorus 32 was added to the citrated blood specimens of rats which had received 1,100, 800, or 600 r of ionizing radiation. The blood was then left at various temperatures for different intervals, after which the erythrocytes were eluted and measured for radioactivity.

From the results observed, the authors conclude that 1,100 and 800 roentgens of whole body X irradiation causes a decrease in the phosphorus uptake of the red blood cells of the rat and that such a decrease increases as the radiation sickness progresses and is in direct proportion to the dose of radiation received. They theorize that the phenomenon is caused by erythropoietic disturbance in the irradiated rat.

Surgery

113. Leukosis Treatment by Hemopoietic Tissue Transplantations

"Leukosis Will Be Conquered" (unsigned article); Moscow, Izvestiya, 5 Jul 59, p 6

An Izvestiya correspondent requested that the chief hematologist of the Ministry of Public Health USSR, Prof A. A. Bagdasarov (Active Member of the Academy of Medical Sciences USSR), explain to him in simple language any new medical information on the treatment of leukosis. The following is a summary of the professor's reply.

After a preliminary definition of leukosis, its different forms and physiological consequences, the more effective methods for treating leukosis are enumerated, and include a complex method of therapy together with the transfusion of whole blood and of blood fractions (erythrocytes and thrombocyte mass); the use of chemotherapeutics; and the use of hormonal preparations which suppress the excessive growth of hemopoietic tissue.

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Presently, it was stated, research is being conducted to find new methods of treating leukosis and other diseases in which blood formation is disturbed. This research includes the transplantation of hemopoietic tissue, especially of bone marrow. Such transplantations, when successful, transfer to the patient healthy hemopoietic cells which can function normally. Work on this subject is still in the experimental stage, and is performed primarily on animals. Isolated transplantation operations have been done on humans (for example in a recent case in France in which bone marrow was transplanted into a Yugoslav physicist who had received acute radiation injuries resulting from an atomic reactor accident.)

A number of isolated observations lead one to suppose that leukosis may be treated by this new method of transplanting hemopoietic tissue; however, it is difficult and premature to make any conclusions concerning the advantages of this method of treatment over existing ones since the transplanting of hemopoietic tissue has many unsolved and unexplained problems requiring the persistent and thorough study of a number of medical workers in various specialties.

Some of these difficulties include the following: In order that the transplanted tissue may take root and function, it is necessary to decrease the reactivity of the organism to the transplanted tissue. Various methods have been proposed to prepare the patient for this and recently use has been made of total irradiation by large X-ray doses. The transplanted tissue must be compatible with that of the recipient in all of its immunological factors.

Thorough research is being conducted at many scientific and medical institutes both in the Soviet Union and abroad, and Prof Bagdasarov is confident that this enemy of man will be conquered.

114. Chinese Investigate Effect of Acupuncture on Protein Fever in Rabbits

"Preliminary Observations on the Effect of Acupuncture on Protein Fever in the Rabbit," by Chu Tsung-hsiang (祝 總 驤), Ho Chin-hai (郝 金 凱), Tung Cheng (董 征), and Ts'ai T'ien-chiao (蔡 天 皎), Institute of Acupuncture and Moxibustion, Academy of Traditional Chinese Medicine, Peiping; Peiping, Sheng-li Hsueh-pao (Acta Physiologica Sinica), Vol 22, No 3, Sep 58, pp 219-223

The purpose of the controlled experiments was to investigate the effect of acupuncture, a procedure in Chinese traditional medicine, on the body temperatures of normal rabbits and rabbits with fever.

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Fifty-eight rabbits were used in the experiments. Protein fever was induced in the experimental group by injecting cow's milk into an aural vein. The acupuncture needle was applied at a site known in traditional medicine as the pai-hui depression (百會穴). In rabbits it is situated between the seventh lumbar and the first sacral vertebrae.

Results showed that acupuncture produces no appreciable change in the body temperature of normal rabbits but it can alter the fever curve of rabbits having experimental protein fever. Administered at the onset, it inhibits the elevation of body temperature. Administered at the peak of fever, it effects a rapid drop back to normal. Administered before the injection of milk, it produces no appreciable effect.

The nervous mechanism of fever is discussed.

115. New Soviet Antihemorrhagic

Prague, Ohrana Lidu, 21 Jul 59, p 2

Scientists at the Stalinabad Medical Institute in the USSR, under the leadership of Meritorious Scientist J. L. Kozov, have succeeded in transforming the deadly poison from the guersa snake into a drug which can halt the most severe hemorrhage. The capability of this drug to halt bleeding is ten times that of the drug thus far known, which is derived from the venom of the Indian viper doloya.

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Veterinary Medicine

116. Chinese Isolate Hog Asthma Virus

"Initial Report on the Study of the Pathogen of Hog Asthma," by Kao Shang-yin (高 尚 荫), Liu Nien-ts'ui (刘 年 翠), Chang Li-jen (张 立 人), and Hsien T'ien-en (谢 天 恩), Wuhan Microbiological Laboratory of Academia Sinica and Department of Biology of Wuhan University; Peiping, K-o hsueh T'ung-pao (Scientia), No 10, 26 May 59, pp 332-333

The authors report experiments which culminated in the isolation of a virus which produced typical asthma in normal pigs. Under the electron microscope, the virus is elliptical with a major and minor axis of 100-140 millimicrons. In controlled experiments, the virus produced morbid changes in the chorio-allantois tissues of 10-day-old chick embryos. Further research on the properties and titration of the virus is indicated.

Miscellaneous

117. Statistics on Soviet Sanitary-Epidemiology Stations

"Statistical Data" (unsigned article); Moscow, Sovetskoye Zdravookhraneniya, No 6, Jun 59, pp 58-61

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The following charts indicate the number of Soviet Sanitary-Epidemiology Stations and Sanitary-Bacteriology Laboratories within the Sanitary-Epidemiology Stations for 1940, 1946, 1950, 1956, and 1957.

Sanitary-Epidemiology Stations
Under Ministries of Health USSR and the Union Republics
(including urban and rural areas)

	No of Stations			
	1940	1946	1950	1955
USSR total	1,958	3,972	5,357	5,452
RSFSR	591	1,991	3,070	3,008
Ukrainian SSR	826	945	962	966

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	No of Stations			
	1940	1946	1950	1955
Belorussian SSR	147	193	200	197
Uzbek SSR	30	174	175	195
Kazakh SSR	38	111	205	270
Georgian SSR	25	37	88	93
Azerbaydzhan SSR	28	44	93	91
Lithuanian SSR	--	30	46	91
Moldavian SSR	16	60	68	62
Latvian SSR	--	12	31	72
Kirgiz SSR	9	76	79	77
Tadzhik SSR	56	73	75	59
Armenian SSR	13	19	33	37
Turkmen SSR	26	45	57	59
Estonian SSR	8	15	20	45
Stations under USSR only	145	147	155	130

	1956		1957	
	No of Stations	No of Sanitary-Epidemiology Divisions of Rayon Hospitals	No of Stations	No of Sanitary-Epidemiology Divisions of Rayon Hospitals
USSR total	5,009	221	3,785	1,289
RSFSR	2,796	160	2,066	820
Ukrainian SSR	959	14	881	54

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	1956		1957	
	No of Stations	No of Sanitary-Epidemiology Divisions of Rayon Hospitals	No of Stations	No of Sanitary-Epidemiology Divisions of Rayon Hospitals
Belorussian SSR	191	7	181	2
Uzbek SSR	188	--	117	66
Kazakh SSR	271	--	168	88
Georgian SSR	93	--	90	3
Azerbaydzhan SSR	92	--	67	20
Lithuanian SSR	88	--	7	80
Moldavian SSR	38	10	8	36
Latvian SSR	57	2	57	2
Kirgiz SSR	68	--	53	14
Tadzhik SSR	58	--	49	9
Armenian SSR	37	--	7	31
Turkmen SSR	55	--	18	37
Estonian SSR	18	28	16	27
Stations under USSR only	--	--	--	--

The last four columns in the above chart (1956 and 1957) give the figures for the number of Sanitary-Epidemiology Stations after their reorganization, i.e., when a number of them were permanently attached to rayon hospitals and became Sanitary-Epidemiology Divisions of Rayon Hospitals.

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Sanitary-Bacteriology Laboratories
Within the System of Sanitary-Epidemiology Stations

	No of Sanitary-Bacteriology Laboratories Within System of Sanitary-Epidemiology Stations						Independent Sanitary-Bacteriology Laboratories	
	1940	1946	1950	1955	1956	1957	1940	1946
USSR total	1,150	1,182	2,838	4,557	4,604	4,585	439	213
RSFSR	323	586	1,570	2,377	2,528	2,532	298	179
Ukrainian SSR	525	263	663	951	960	925	11	10
Belorussian SSR	63	43	70	185	192	182	1	--
Uzbek SSR	18	38	74	150	160	170	13	--
Kazakh SSR	32	41	61	187	202	206	1	1
Georgian SSR	25	37	55	93	93	93	3	13
Azerbaydzhan SSR	28	17	34	42	45	56	--	1
Lithuanian SSR	--	3	32	86	88	87	2	6
Moldavian SSR	8	17	68	62	48	48	3	2
Latvian SSR	--	6	22	70	59	58	--	--
Kirgiz SSR	6	6	13	66	64	66	7	7
Tadzhik SSR	6	9	5	38	35	34	--	--
Armenian SSR	13	15	30	37	37	36	1	--
Turkmen SSR	12	17	14	44	47	54	1	--
Estonian SSR	8	14	18	45	46	38	1	--
Laboratories under USSR subordination only	83	70	109	124	--	--	7	--

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118. Public Health in Poland

"Fifteen Years of People's Rule in Poland," by Dr. B. Kozusnik, Deputy Minister of Health, Polish People's Republic; Moscow, Meditsinskiy Rabotnik, 21 Jul 59

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"During the occupation of Poland by Germany, almost 80% of the existing hospitals were destroyed. Of the 16,503 Polish physicians only 9,313 survived the occupation. Despite these difficulties, Polish public health for the past 15 years has advanced considerably. The number of hospital beds has increased from 69,400 in 1938 to 153,544 toward the end of 1958. Toward the end of that year, 3,844 medical personnel were employed in Polish polyclinics. Of this figure, 2,026 worked in plants and establishments. In addition, 1,535 medical stations and 2,488 treatment cabinets were established.

"The Ministry of Health has concentrated its efforts in making excellent medical care available to workers in plants and factories. In 1958, some 3,160 physicians and more than 5,800 medical personnel were employed in various plants and factories.

"Considerable efforts are being made to improve the qualifications of the cadre. In the prewar period, physicians were trained in five medical faculties, and now there are already 10 medical faculties. In addition, there are 7 pharmaceutical faculties, 7 stomatological faculties, and 15 scientific research institutes.

"At the close of 1958, Poland had nearly 28,400 physicians in various specialties, 8,375 dentists, and nearly 7,500 pharmacists. In 1938, there were fewer than 10,000 nurses, while in 1958, there are over 55,000.

"Poland exerts considerable effort in protecting the mother and child. All hospitals have maternity wards, and numerous lying-in homes are in operation. Because of this 85% of all children are born under the observation of medical personnel. For children, the government has established permanent and seasonal nurseries, kindergartens, milk kitchens, sanitoriums, and resorts.

"Considerable attention is given to the health of rural inhabitants. Prior to the war, there were only 68 medical stations in villages, while at present there are more than 1,800. In the postwar period, some 813 lying-in homes have been built in the rural areas, which gives a total hospital bed capacity of 6,000.

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"The State Sanitary Inspectorate has under its jurisdiction 477 well-equipped sanitary-epidemiological stations. The State Sanitary Inspectorate also controls a number of scientific research institutes. Among them, the institutes of labor hygiene located in Lovzi, Rokitnits, and Warsaw.

"Infectious diseases, so disastrous in the immediate postwar period, have now been considerably reduced. In the immediate future, it is planned to vaccinate all children and adolescents up to the 18th year against polio.

"Concerted effort is being made in Poland today in combating tuberculosis. From 1947 to 1958, nearly 21 million children and adolescents have been examined; 5,800 persons have received vaccinations.

"The number of tuberculosis dispensaries has increased from 65 to nearly 450 and the bed capacity in sanitoriums from 5,637 to 20,700 and the number of beds in hospitals from 2,454 to 8,700. In addition a special antituberculosis institute, ten physiotherapy clinics, special departments in hospitals and Voyevod dispensaries, etc. have been established.

"Likewise, considerable efforts are being made in the liquidation of cancer for this purpose, oncological scientific research institutes and oncological stations have been established.

"The Polish pharmaceutical industry has grown considerably and 80% of the country's needs are currently being satisfied. Poland is now producing some of its own preparations such as Isoniazid, Dextran, gamma globulins, antibiotics, and polio and antituberculosis vaccines.

"The amount of funds allocated for the public health budget is increasing annually. The budget for the Ministry of Health in 1955 was 5,880,000 zloty; in 1958 it has increased to nearly 10,032,000 zloty.

"The mortality rate in Poland has also decreased proportionately. For example, in 1938, 139 persons died for every 1,000 people in the population while in 1958 it was only 72.3. The average life span during the past 15 years has increased among women by 24.9% and among men by 21.6%.

"Considerable medical research is now being conducted in Poland. Fifteen scientific research institutes have been established, while in the prewar period only two were established. The greatest number of new institutes are institutes of hygiene. The Polish Academy of Sciences has its own scientific research establishments. Of considerable importance in medical research has been the work done in the chairs of medical, pharmaceutical, and stomatological faculties."

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119. Estimates for Public Health Expenditures in USSR During Seven-Year Plan

"The Perspectives for the Development of Material Bases of Public Health in 1959-1965," by V. M. Shustov; Moscow, Sovetskoye Zdravookhraneniye, No 1, Jan 59, pp 3-11

By 1965 the over-all number of hospital beds in the USSR will be some 2 million. This will be equivalent to approximately nine beds for each 1,000 persons. By 1965 the total number of spaces in nurseries and kindergartens will be approximately 6.1 million, which is an increase of 8.1 percent over 1958.

The cost of the production of medicines, medical instruments, apparatus, and other medical products is estimated to reach 16 billion rubles, which would be an increase of nearly three times the amount for 1958. The amount estimated for the construction of public health establishments, for social security, physical culture and sport, and for the medical industry during the Seven-Year Plan will be some 25.4 billion rubles.

120. Future Public Health Developments in Leningrad Oblast (1959-1965)

"On the Perspectives of the Development of Public Health in Leningrad Oblast in 1959-1965," by N. V. Borisov; Moscow, Zdravookhraneniye Rossiyskoy Federatsii, No 2, Feb 59, pp 10-14

In the perspective plan for the development of public health in Leningrad Oblast, the main emphasis is placed on the improvement of therapeutic, pediatric, obstetrical-gynecological, and stomatological services. The plan calls for the organization of new and remodeling of the old medical establishments. The number of hospital beds should total 12,165 by January 1966 (an increase of 39.6 percent over January 1959). The plan calls for the availability of 9.1 hospital beds per 1,000 persons. During the same period, 68 new hospitals are to be built, plus 11 polyclinics, 31 nurseries, 5 sanitary-epidemiological stations, and one blood transfusion station. The number of physicians should reach 21.6 per 10,000 population by January 1966.

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121. Mathematics in Biological Sciences

"Mathematics Helps Physicians," by D. Mamleyev, Izvestiya, 4 Jun 59, p 1

In his remarks to a correspondent of Izvestiya, Prof P. V. Terent'yev said that all branches of natural science are becoming quantitative in their methods of analyzing phenomena. He pointed out that the history of various branches of natural science shows that their earliest development was purely qualitative; only after each one of these branches reached a certain degree of maturity did they emerge from this state and pass into the quantitative state, thereby entering into an alliance with mathematics. Since biology endeavors to investigate life, which is the most complicated phenomenon encountered by the human mind, it is natural that it formed that alliance later than many other sciences.

The main difficulty involved in the application of mathematical methods in biology lies in the indefinitness of values which are strange to an exact science, he continued. In biology, almost all ratings fall within limits of "from" and "to." However, the arsenal of mathematical science is rich and cogent: this arsenal, explained Terent'yev, consists of the theory of probability, statistics, cybernetics, and other divisions of the science of mathematics which can overcome the main difficulty.

The professor further observed that mathematics can be used to determine the absolute number of work animals in a herd, to predict changes in the development of shoals of fish in a reservoir, to aid in the control of agricultural pests, and to analyze phenological observations. It is obvious that projected fruitful cooperation between biology and mathematics will produce tangible results in the near future. The joint conference held by representatives of both these sciences testifies to that, he went on.

An epidemic of influenza which raged during the winter in many countries of the world made its appearance in the form of waves, the professor said. It contained periods of abatement. It is evident that a prediction can be made, more or less exactly, by mathematical computations, concerning the approach of the next "wave" of influenza, Terent'yev asserted. The so-called patterns of epidemics can be developed by the use of mathematics. The best results at present are obtained in formulating the patterns for some children's diseases, malaria, and a number of other diseases.

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Scientists propose to develop statistical methods of diagnosing heart diseases, the professor disclosed. A machine can analyze a multitude of histories of the disease: information is converted to punched cards, from which answers can be obtained concerning experiences of predecessors. A physician is able to come to a more correct decision on the basis of such an answer.

In conclusion, Prof P. V. Terent'yev said that the immediate introduction of some instruction in mathematics into faculties of biology and agricultural vuzes is essential. It is also necessary to create openings for specialists in mathematical biology in the system of scientific establishments of the country, he maintained. It is expedient that the Ministry of Higher Education, Presidiums of the Academy of Sciences USSR and of the Academy of Medical Sciences seriously consider this very important question, the professor concluded.

122. Prof V. A. Gilyarovskiy, Soviet Psychiatrist, Dies

"Vasiliy Alekseyevich Gilyarovskiy (1875-1959)" (unsigned article); Moscow, Vestnik Akademii Meditsinskikh Nauk SSSR, No 6, Jun 59, pp 94-95

Prof Vasiliy Alekseyevich Gilyarovskiy, Active Member of the Academy of Medical Sciences USSR, Honored Worker of Science, and one of the old-time Soviet psychiatrists, died in his 84th year.

Gilyarovskiy graduated from the Medical Faculty of Moscow University in 1899. From 1919 to 1952 he continuously held the position of head of the Chair of Pyschiatry, Second Moscow Medical Institute. He was the founder and director of the Institute of Psychiatry, Academy of Medical Sciences USSR, for many years. He was also the founder of the Soviet school of psychiatry, and the author of over 200 scientific works. His awards include three Orders of Lenin, the Order of Labor Red Banner, and medals.

123. Prof M. M. Kuznets, Soviet Dermatologist, Dies

"In Memory of Prof M. M. Kuznets" (unsigned article); Kiev, Vrachebnoye Delo, No 4, Apr 59

Prof Mikhail Mefodiyevich Kuznets, Doctor of Medical Sciences and head of the Chair of Dermatology of the Kiev Medical Institute, died in his 59th year after a long illness. Kuznets graduated from the Medical Faculty of the Kiev University in 1927 and because of his outstanding work on syphilis as a student he was retained at the Medical Faculty in

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the Chair of Dermatology. He obtained his degree of Doctor of Medical Sciences in 1937 while at the Medical Faculty. Subsequently, he taught in Leningrad and at the Kuybyshev Military Medical Academy. During World War II he served as chief specialist on one of the fronts.

In 1947 Kuznets became head of the Chair of Dermatology, Bashkir Medical Institute; in 1952, head of the Chair of Dermatology, Kiev Institute for the Advanced Training of Physicians, and finally in 1954 he was elected to his last position. He was the author of over 70 scientific works on various aspects of venereal diseases. His awards include the Order of Lenin, the Order of the Patriotic War 1st Class, and medals. He was also associated with the Ministry of Health Ukrainian SSR as its chief venerealogist.

124. Prof A. Ye. Mangeym, Soviet Surgeon, Dies

"In Memory of A. Ye. Mangeym" (unsigned article); Moscow, Meditsinskiy Rabotnik, 28 Jul 59

Prof Aleksandr Yefimovich Mangeym, Honored Worker of Science and an outstanding Soviet surgeon, died in his 67th year after a long and serious illness. Mangeym graduated from a medical faculty in 1915 and served in the armed forces until 1921. From 1921 to 1941 he was associated with the Belorussian State Medical Institute, then from 1945 to 1955 he headed the Chair of Hospital Surgery of the Chernovtsy Medical Institute. He was the author of over 50 scientific works on surgery and was awarded the Order of Labor Red Banner and two medals.

125. Prof B. S. Sigal, Soviet Public Health Specialist, Dies

"In Memory of Prof Boris Samoylovich Sigal" (unsigned article); Moscow, Sovetskoye Zdravookhraneniye, No 5, May 59, pp 52-53

Prof Boris Samoylovich Sigal, Doctor of Medical Sciences and head of the Chair of the Organization of Public Health and the History of Medicine, Leningrad Sanitary-Hygiene Medical Institute, died in his 66th year after a long illness.

Sigal graduated from the Medical Faculty of the Kiev University in 1916 and served in the armed forces until 1925 when he became an instructor at the First Leningrad Medical Institute imeni I. P. Pavlov. He obtained his degree of Doctor of Medical Sciences in 1939 and in 1949 became head of the Chair of the Organization of Public Health and the History of Medicine. During World War II he headed the Statistical Bureau of the Sanitation Administration of the Karel'skiy Front.

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Sigal was the author of over 150 scientific works on the problems of the organization of public health and the history of medicine. He was awarded three orders and medals of the USSR.

126. New Children's Hygiene Institute Established in USSR

"New Scientific Institute" (unsigned article); Moscow, Meditsinskiy Rabotnik, 10 Jul 59

A new Scientific Research Institute of the Hygiene of Children and Adolescents (Nauchno-Issledovatel'skiy Institut Gigiyeny Detey i Podrostkov) has been organized under the Academy of Medical Sciences USSR. The institute is to have a Clinical Division with a clinic of 50 beds, and polyclinical and clinico-diagnostic laboratories.

The new institute will study hygienic requirements necessary for the personal relaxation of children, the problem of the physiology of growth, the principals and norms of occupational orientation of adolescents and children, and adolescent pathology, etc.

127. Soviet Medical Literature During 1958-1965 To Be Greatly Increased

"On the Development of Medical Literature in 1958-1965," by V. I. Mayevskiy; Moscow, Zdravookhtaneniye Rossiyskoy Federatsii, No 2, Feb 59, pp 15-18

The State Publishing House for Medical Literature intends, during 1958-1965, to increase the number of books and periodicals published by approximately 2.5 times the number published in 1958.

In addition to existing establishments, two Moscow printing shops will be enlarged and a new printing and publishing combine will be built in Ryazan'. It is estimated that the annual number of quires will reach 25,000 by 1965.

Special attention will be given to the publication of medical literature for the practicing physician. This type of literature will increase from 3,800 quires in 1958 to 11,800 quires in 1965. The amount of material published by the Academy of Medical Sciences USSR will increase from 1,200 to 5,000 quires. The publication of scientific-practical literature will increase from 300 to 1,300 quires, and the publication of medical periodicals from 4,500 to 8,000 quires.

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128. Rotor Forgings From Steel EI756 for Operation at 600°C

"Structure and Properties of the Metal of An Experimental Rotor Forging Made of Steel EI756," by G. P. Fedortsov-Lutikov, Candidate of Technical Sciences, and Engrs M. F. Sheshenev, N. I. Butko, R. S. Kaplan, and L. S. Marinenko; Leningrad, Energomashinostroyeniye, No 6, Jun 59, pp 31-35

Mechanical and structural tests were conducted on experimental steel EI756 for application in forgings of turbine rotors operating at steam temperatures of 600°C. Steel EI756 was developed by the Branch of High-Temperature Alloys of the Central Scientific Research Institute of Technology and Machine Building on a 12% chromium steel base alloyed with 2% tungsten, 0.7% molybdenum and 0.3% vanadium. Testing of the experimental forging was conducted jointly with the Kharkov Turbine Plant.

Preliminary annealing consisted of heating to 850°-870°C and furnace cooling. Heat treatment was as follows: normalization at 1,070° to 1,050°C; cooling in air; quenching in oil from 1,020° to 1,050°C; tempering at 660° to 680°C followed by furnace cooling. Macrostructural examination of surfaces of the axial channel, exterior and cross section disks of the rotor disclosed no defects. Measurements of hardness along the radii of cross section disks indicated uniform metal structure. No significant increase of free ferrite was observed in central zones of the rotor. Stipulated yield points for tangential specimens were 44.5 kg/mm^2 at the central portion and 47 kg/mm^2 at the periphery. Impact strength after 3,000 hours at 575°C remained at the level of 3 $kg\ m/cm^2$. Creep strength at 575°C was 8 kg/mm^2 at a rate of 1×10^{-5}%/hr. Fatigue strengths were calculated to be 16 kg/mm^2 at 550°C, 13 kg/mm^2 at 575°C and 10 kg/mm^2 at 600°C. Steel EI756 is considered to have sufficiently high mechanical and heat resistance properties to be a prospective material for the manufacture of rotors of stationary steam turbines with steam temperatures at 600°C. Cost of the new steel is approximately one-half that of austenitic steels.

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X. PHYSICS

Atomic and Molecular Physics

129. Intermolecular Effect

"The Effect of Intermolecular Interactions on Molecular Spectra," by S. I. Kubarev, Moscow State University imeni Lomonosov; Moscow, Doklady Akademii Nauk SSSR, Vol 126, No 5, Jun 59, pp 971-974

The author attempts to explain spectroscopic phenomena such as broadening or shifts of lines, by intermolecular interactions. A general case, adaptable to any arbitrary state of the substance, is analyzed. The method developed by M. Lax (J. Chem. Phys., 20, 1752 (1952)) is chosen in connection with the Frank-Condon principle for crystals. This method may be applied to analysis of luminescence of complex molecules, but this last problem requires departure from the semiclassical approach.

130. Photochemical Sensitivity of Silver Chloride Crystals at Lower Temperatures

"Photochemical Phenomena in Sensitized AgCl Crystals at a Temperature of Minus 253°C," by A. Scholz, Institute of the Physics of Crystals, German Academy of Sciences, Berlin; Leipzig, Annalen der Physik, Vol 3, No 5/6, 1959, pp 298-315

Even though photochemical sensitivity decreases with decreasing temperature, sensitized AgCl crystals can still be colored photochemically at the temperature of liquid hydrogen and below. The photochemical sensitivity at minus 253° C is increased considerably by a previous irradiation at minus 185° C.

Photochemical coloration of doped AgCl crystals at minus 253° C is interpreted as an indication that a sufficient number of $Ag_0^{\cdot}$ ions have established themselves in the immediate vicinity of the sites of electron capture. On the other hand, at temperatures above minus 235° C, the movement of silver ions to the $Ag_0^{\cdot}$ interstice must also contribute to the photochemical processes.

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131. Magnetic Powder Patterns at Higher Temperatures

"Magnetic Powder Patterns at Higher Temperatures," by W. Andrae, Institute of Magnetic Materials, German Academy of Sciences in Berlin, Jena; Leipzig, Annalen der Physik, Vol 3, No 5/6, 1959, pp 334-339

A description is given of a modified powder pattern technique for which a suspension was produced by the introduction of smoke from burned $Fe(CO)_5$ in paraffin oil. Acceptable powder patterns were obtained on cobalt up to a temperature of 400° C, at which point the oil began to boil. The resolution of the usual suspensions was not equaled, even when an emulsifier (Ca-soap) was added and a slight breakdown of particle agglomerates was produced by ultrasonic treatment (at 800 kc).

Mechanics

132. Boundary of a Gas Mixture

"Slipping and Temperature Discontinuity at the Boundary of a Gas Mixture," by R. Ya. Kucherov and L. E. Rikenglaz; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 36, No 6, Jun 59, pp 1758-1761

Boundary conditions have been obtained for the hydrodynamical transfer equations for a gas mixture. The conditions take into account slipping and the temperature jump at the boundary with a solid surface.

133. Diffusion Equation for Non-Linear Systems

"Phase-Space Diffusion Equation for Nonlinear Systems," by V. B. Magalinskiy and Ya. P. Terletskiy, Moscow State University, Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 36, No 6, Jun 59, pp 1731-1735

The technique developed by the authors (ZhETF, 34, 729 (1958); ibid, 36, 1942 (1959)) on basis of Gibb's method is extended to the case of diffusion in phase space.

The general space-velocity equation of motion for the probability density is derived on the basis of only the general principles of statistical mechanics and an assumption regarding the form of the averaged equation of motion of the system. In the particular case of a linear friction law this equation coincides with the familiar space-velocity Einstein-Fokker-Planck equation.

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A general solution of the diffusion equation thus obtained is derived for a system in a uniform external field which possesses a nonlinear force of friction independent of the coordinates.

134. On the Schuster Theory of the Origin of Turbulence

"Investigations on a New Theory of the Origin of Turbulence," by D. Ullmann, Institute of Theoretical Physics, University of Jena; Leipzig, Annalen der Physik, Vol 3, No 5/6, 1959, pp 316-322

In 1957, K. Schuster introduced a theory (Annalen der Physik, Vol 20, 1957, p 381) which revealed an instability of the parabolic profile of a two-dimensional Hagen-Poiseuill flow. He employed the method of small oscillations in his research and introduced an acoustic wave with a longitudinal and transverse velocity component as the interference motion. He broke with tradition by computing with a spatial damping or undamping of the interference waves, rather than with a damping or undamping dependent on time. In all earlier works, the continuity equation was used in the form of the imcompressibility condition; with Schuster the fundamental flow itself is incompressible, but the velocity components of the wave satisfy the complete continuity equation.

In this article, the Schuster theory, which was limited to the special case of the first harmonic of the transverse oscillation, is generalized to include the fundamental plus any number of harmonics. It is shown that the algebraic equations of the fifth degree for the dimensionless propagation constant, in the supercritical case, permit the existence of only one undamped wave.

135. Argon Plasma Jet of 15,000° K

"Description of an Arrangement for the Production of an Argon Plasma Jet with Stable Electrodes and the Measurement of the Temperature Distribution Within the Plasma Jet," by W. Neumann, A. Peters, K. Rademacher, and R. Rompe, Physical-Technical Institute, Radiation Sources Area, German Academy of Sciences in Berlin; Berlin, Experimentelle Technik der Physik, Vol 7, No 2, 1959, pp 77-84

A description is given of an arrangement for the production of an argon plasma jet. The plasma is produced in a high-current arc between a cylindrical tungsten cathode and a water-cooled copper ring anode and then blown by a gas flow out of the ignition chamber through the ring anode.

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The hotter part of the plasma jet, over 9,000° K, reached a length of about 15 millimeters with a current of 500 amperes and a gas flow of about 500 liters of argon per hour. The maximum temperature during this time amounted to about 15,000°K. The temperature distribution of the plasma jet was determined photometrically, using a monochromatic photograph taken with the jet at a wavelength of 5,560 angstroms, with the computation based on the theory of the electron-ion-collision continuum. Several melting experiments with tungsten were conducted; no continuous melts were obtained, rather only molten spheres about 3 millimeters in diameter, characterized by considerable porosity.

Nuclear Physics

136. Fission of Th-232 Nuclei

"Fission of Th-232 Nuclei by Negative μ - and π - Mesons," by M. G. Petrashku and A. K. Mikul, Joint Institute for Nuclear Research; Moscow, Doklady Akademii Nauk SSSR, Vol 126, No 4, Jun 59, pp 752-754

Simultaneously with the study of Th fission by μ - mesons the fission at π - meson capture is studied, because the evaluation of the first process requires the knowledge of the π -meson capture effect, the μ - meson beam being not pure. By comparing the obtained results for Th an U it is found that the ratio of cross section for Th and U equals the ratio of cross sections of photofissions.

137. Scattering of U and Th Gamma-Rays

"Computation of Multiple Gamma Ray Scattering of Uranium and Thorium Families," by A. N. Orlov, V. S. Galishev, and G. G. Taluts, Institute of Physics of Metals, Academy of Sciences USSR, Moscow, Doklady Akademii Nauk SSSR, Vol 126, No 5, Jun 59, pp 975-978

Some new methods and results of computation of multiple gamma-ray scattering of U and Th and their decay products in equilibrium with the mother elements in most simple geometric conditions are described. They are of special interest in ionization methods of geophysical prospecting. The most intensive spectral lines of U and Th at equilibrium at $E > 0.5$ Mev are tabulated. The absorption coefficients of gamma rays are taken from a table by C. M. Davisson and R. D. Evans (Rev. Mod. Phys., 24, 79 (1952)).

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138. Measurements of Star-Producing Cosmic Radiation in Lead Agree with Theory

"On the Transition Effect of the Star-Producing Component of Cosmic Radiation in Lead," by I. Hauser, P. Landrock, and K. Lanius, Institute of Nuclear Physics, [East] German Academy of Sciences in Berlin, and L. Mitrani and A. Peeva, Physics Institute of the Bulgarian Academy of Sciences, Sofia; Berlin, Monatsberichte der Deutschen Akademie der Wissenschaften zu Berlin, Vol 1, No 1, 1959, pp 5-8

In recording the frequency of nuclear disintegrations (stars) in nuclear emulsions under lead absorbers exposed to cosmic radiation at an altitude of 3,000 meters, many authors have found, contrary to theory, a maximum, supposedly caused by neutrally produced stars with a low number of rays.

This article describes briefly a repetition of the measurements made by Schopper and associates (Phys. Rev., Vol 82, 1951, p 444; Z. Naturf., 6a, 1951, p 603.) The results found here are in agreement with theory, indicating no maximum for stars with three or more rays under 1-2 centimeters of lead.

"On the Transition Effect of the Neutron-Producing Component of Cosmic Radiation in Lead," by I. Hauser, Institute of Nuclear Physics, [East] German Academy of Sciences in Berlin; Berlin, Monatsberichte der Deutschen Akademie der Wissenschaften zu Berlin, Vol 1, No 2, 1959, pp 95-100

In studies of the transition effect of the neutron-producing component of cosmic radiation, based on measurements of the neutron intensity of solid absorbers (lead, aluminum, and carbon), several authors point to an occurrence of a first maximum in the transition curve at 0.5-2 cm of lead, whereas other authors have not observed any such maximum. Since no satisfactory interpretation has been given of the occurrence of maxima in the transition curves of star-producing and neutron-producing components, a special absorber design was used for the investigation of the first maximum of the transition curve of neutron-producing radiation in lead. In contrast to earlier works in which BF_3 counter tubes were used as the indicating instrument, the neutron measurements here were confirmed with boron-doped Agfa K3 emulsions, containing 0.063 g/cm3 of boron, on the basis of the reaction $B^{10}(n, \alpha)Li^7$. The emulsions were exposed for 38 days at an altitude of 2,630 meters above sea level on Lomnicky Stit in Czechoslovakia.

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Measurements were made in lead up to 2.4 centimeters thick. The results showed a smooth curve for the integral neutron production corresponding to an exponential decrease of the neutron-producing radiation. In keeping with theoretical expectations, no indication of a maximum was found in up to two centimeters of lead.

139. Repulsive Many-Body Forces Not Required for Stabilization of Nuclei at Normal Densities

"On the Saturation of Nuclear Forces," by W. Brunner, Institute of Nuclear Physics, German Academy of Sciences in Berlin, Zeuthen; Leipzig, Annalen der Physik, Vol 3, No 5/6, 1959, pp 233-240

This article discusses the question of whether repulsive many-body forces are necessary for the stabilization of atomic nuclei at normal densities, or whether the saturation character of nuclear forces can be explained solely on the basis of hard cores for the nucleons. It is shown that an approximation representation given by W. Macke (Ann. Physik, Vol 19, 1956, p 89(for the calculation of the total energy of a nucleus leads to an underestimation of the kinetic energy, and thus gives nucleas densities which are too high. An improved representation of the kinetic energy is obtained if the density is reduced by a factor of ten. Consequently, the introduction of repulsive many-body forces for the stabilization of nuclear material at normal densities is not as compelling as Macke supposes.

140. Production of Hyperons in Lead and Aluminum Studied

"A Study of Λ^0 and θ^0 Particles Produced in Pb and Al," by Lu Min (呂 敏), Cheng Jen-ch'i (郑 仁 圻), and Li Hao-nien (李 鶴 年), Institute of Atomic Energy, Academia Sinica; Peiping, Wu-li Hsueh-pao (Acta Physica Sinica), Vol 15, No 5, May 59, pp 230-245

In two experiments undertaken at the Lo-hsueh Mountain Laboratory during April-November 1955 and August 1956-June 1957, 75,000 pairs of stereoscopic pictures were made with a 50 x 50 x 28 cm^3 multiplate cloud chamber. Among a total of 550 V^0 events, 113 were found to be measureable and classifiable on the basis of the $\alpha - \epsilon$ method. These were analyzed to obtain data concerning correlation angle distributions of production plane and decay plane as well as production efficiencies in light versus heavy elements, and to compare different properties of V^0 particles produced in lead and in aluminum.

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Of the 113 classifiable V^0 particles, there were 58 Λ° and 38 Θ° produced in lead and 9 Λ° and 6 Θ° produced in aluminum. A summary of the authors' analysis follows:

1. The decay angle in the center of mass system of Λ° or Θ° is uniformly distributed. The correlation angle between the production plane and the decay plane is also uniformly distributed. No information was obtained on whether the spins of the V° particles are larger than 1/2.

2. No asymmetry of angular distribution, indicating nonconservation of parity is evident in the decays of the Λ° particles produced in Pb. For Λ° produced in Al some indications of asymmetry are noted.

3. The hyperon tends to go backward in the associated production process as indicated by the momentum spectrum and production angle distribution.

4. The following lifetimes are obtained:

$$\tau_{\Lambda^\circ} = (3.39^{+0.63}_{-0.44}) \times 10^{-10} \text{ sec}$$

$$\tau_{\theta^\circ} = (0.86^{+0.26}_{-0.16}) \times 10^{-10} \text{ sec}$$

5. $N_{(\Lambda^\circ)} : N_{(\theta^\circ)} \sim 1.4$

6. The total cross section for strange particle production is estimated to be of the order of 0.8 mb/nucleon, both for Pb and Al.

7. The Pb nucleus is more effective than the Al nucleus for producing a V^0 particle, when we consider the percentage of the V^0 with respect to the total number of secondary particles.

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141. Chinese Research on Strange Particles

"The Properties, Production, and Decay of Strange Particles," by Ho An-hsiang (霍安祥), Institute of Atomic Energy, Academia Sinica; Peiping, Wu-li Hsueh-pao (Acta Physica Sinica), Vol 15, No 5, May 59, pp 219-239

This paper reports details of an experiment undertaken to study the properties of Λ° and θ° particles, their momentum distributions, and the angular distributions of their decay products in a system at rest.

As reported, for this experiment a 30 x 30 x 10 cubic centimeter cloud chamber in a magnetic field of 6,200 gauss was set up at the Lo-hsueh [26°16' E, 102°52' N] Mountain Laboratory, Yunnan Province (雲南落雪高山实驗室). The laboratory is situated 3,185 meters above sea level. During the period December 1956-December 1957, a group of 30,000 pairs of photographs was taken. Among 105 events of V particle decay observed, 43 could be classified as: 16 Λ° particles, 26 θ_1° particles, and 1 θ_2° particle.

A summary of the results of a study of their properties follows:

1. Q values : $Q = (36.2 \pm 2.5)$ Mev,

$$Q = (233 \pm 11) \text{ Mev};$$

2. Mean lifetime $\tau_{\Lambda^\circ} = (3.19 \pm \frac{2.42}{0.92}) \times 10^{-10}$ sec;

$$\tau_{\theta_1^\circ} = (1.14 \pm \frac{0.49}{0.27}) \times 10^{-10} \text{ sec};$$

3. The momentum distributions found for Λ° and θ° particles did not differ appreciably from earlier results reported in the literature. Mean momenta ($\bar{P}$) were found to be 1,059 Mev/c and 1,374 Mev/c for Λ° and θ_1° particles, respectively.

4. The production ratio of Λ° to θ° in a cloud chamber was estimated to be $N(\Lambda^\circ) / N(\theta_1^\circ) = 1/2$ (in lead).

5. The angular distributions of the decay products of the Λ° and θ° particles in a rest system showed no marked asymmetry.

6. The lifetime of the θ_2° particle is estimated to be 10^{-9} second in the rest system. The decay mode of this particle is probably

$$\theta_2^\circ \longrightarrow \pi^- + \pi^+ + \pi^\circ \quad \text{or} \quad \theta \longrightarrow \pi^\pm + \mu^\pm + \nu .$$

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Plasma Physics

142. Temperature of High-Current Spark Plasma

"Oscillographic Measurements of High-Current Sparks," by B. Kuehn, Institute of Technical Physics, Jena, and the Joint Institute of Nuclear Research, Dubna/Moscow; Leipzig, Annalen der Physik, Vol 3, No 5/6, 1959, pp 241-259

A description is given of equipment and results of precise measurements of voltage, current, resistance, and power of high-current sparks. The energy balance of the sparks is also discussed, and an estimation of the temperature in the spark plasma is attempted. In a re-examination of the relationship $\sigma = u \cdot a/p$ (linear dependence of conductivity σ on the internal energy u, where a is a constant which is relatively independent of temperature, and p is the pressure) from the theory of Weizel and Rompe (Ann. Physik, Vol 1, 1957, p 285 and Theorie der Elektrischen Lichtboegen und Funken (Theory of Electrical Arcs and Sparks), Leipzig, 1949), the possibility is considered of computing the value of a directly from the resistance and the energy E, which is converted up to a particular time t. The expansion of the spark channel begins at a radius not more than 0.1 millimeter; nevertheless, the lower limit of energy density is still sufficient to bring the gas to a temperature of 10,000°-20,000°K and to ionize it extensively.

Solid State Physics

143. Magnetic Properties of Thin Films of Nickel

"Thin Nickel Films with Very High Coercivity and High Energy Product," by W. Ruske, Institute of Magnetic Materials of the German Academy of Sciences in Berlin, Jena; Leipzig, Annalen der Physik, Vol 3, No 5/6, 1959, pp 323-326

Since thin films of ferromagnetic materials generally have higher coercivity forces than the solid materials, attempts were made to obtain a maximum coercivity and energy product on the basis of a selection of optimal configurations of the specimens. Nickel films, as multiple-film

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systems, were deposited electrolytically on perforated cylindrical copper rods with inside diameters of 4.7 millimeters and outside diameters of 6 millimeters, and subjected to pressures in the axial direction. The magnetic characteristics were measured in the range of "low" coercive forces ($H_c \leq$ 350 Oe) with a fluxmeter capable of recording a static hysteresis loop within a few minutes. Higher coercive forces ($H_c \geq$ 350 Oe) were measured by means of a sensitive coercimeter (with oscillating coil).

It was found that with selective specimen treatment coercive forces of 1,000 oersted and over, and maximum energy products (in relation to Ni-volumes) of $3.5 \cdot 10^6$ oersted can occur. Heretofore, these very high values have been found only in thin tempered films ($d_{Ni} \approx$ 150-700 angstroms, tempered for 1 1/2 hrs at 200° C in vacuum). Since multiple-film systems with thin copper interlays ($d_{Cu} \leq d_{Ni}$) also attain coercive forces of nearly 1,000 oersted, the cooperative influence of the nickel films on the value of the coercive force, when external force is applied, is not clearly established.

144. Improved Method of Producing High Pressures at Low Temperatures

"Production of High Pressures at Temperatures Below Minus 25°C," by L. Bewilogua and R. Knoener, Workshop for Low Temperature Physics, Dresden; Berlin, Monatsberichte der Deutschen Akademie der Wissenschaften zu Berlin, Vol 1, No 2, 1959, pp 85-93

A description is given of an improvement on a method first suggested by Lazarev and Kan (ZhETF, Vol 14, 1944, p 439) of producing high pressures at low temperatures by increasing the volume of the water during the transition from the liquid to the solid phase. The pressure is measured and tested for homogeneity down to 20°K by means of two Manganin manometers frozen into the ice. It is shown that a homogeneous pressure distribution can be attained only if the cooling is uniform and controlled with respect to time in such a way that the ice can be converted. It is further shown that inhomogeneities of the pressure distribution which occur during the cooling are not compensated at nitrogen temperatures. The pressure depends also on the coefficient of expansion of the material used for the pressure vessel. With the St-37 steel used here, a pressure of 1,550 (plus-minus 100) atmospheres can be attained at 78°K, which drops to about 1,400 atmospheres during cooling to 20°K.

Any pressure from one to about 1,500 atmospheres can be reached by filling the pressure vessel with water-dioxane mixtures.

[For additional information on solid state physics see also under Electronics, Materials.]

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145. Pressure-Density Relationship of Matter Needs Revision

"On the Theory of Matter Under High Pressure," by P. Gombas, Budapest; Max Planck Festschrift 1958, VEB Deutscher Verlag der Wissenschaften, Berlin 1959, pp 237-242

It is shown that an extension by means of the Weizsaecker correction considerably changes the statistical theory of compressed atoms by comparison with the Thomas-Fermi and Thomas-Fermi-Dirac models. If, starting with the free atom, the atomic volume is diminished, the energy first decreases, reaches a minimum, and then increases very abruptly. Accordingly, as the atomic volume decreases (once more from that of the free atom), negative pressure values are obtained at first; the pressure disappears at the energy minimum, then becomes positive and likewise increases very rapidly.

The pressure-density relationship of matter, derived on the basis of the Thomas-Fermi and Thomas-Fermi-Dirac model and specifying that energy and pressure increase monotonically with a reduction of atomic volume, must be revised.

146. Elementary Particle Structure

"On the Structure of Elementary Particles," by D. I. Blokhintsev, Joint Institute of Nuclear Research, Dubna; Max Planck Festschrift 1958, VEB Deutscher Verlag der Wissenschaften, Berlin 1959, pp 291-296

The determination of the structure of an elementary particle by means of the elastic scattering of arbitrary rays is discussed. "Nonlocal" theories are subjected to critical analysis, and it is shown that the introduction of one "universal length," supposedly determinative for nonlocality, is unfounded.

The concept "black sphere" is defined in a relativistically invariant way as that region in which the rays are completely absorbed. By means of the propagation function of photons, it is shown that the form factor of optical mapping at high energies does not occur as a result of a weak, but rather as a result of a strong interaction between elementary particles and rays.

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147. New Formulation of Causality Principle of Quantum Mechanics Called For

"On the Interpretation of Quantum Mechanics," by V. Fok Academy of Sciences USSR, Leningrad; Max Planck Festschrift 1958, VEB Deutscher Verlag der Wissenschaften, Berlin 1959, pp 177-195

The necessity of referring to the means of observation employed in establishing and describing quantum physical processes precludes the application of classical mechanical determinism and necessitates a new formulation of the principle of causality. Quantum theory is shown to be a fundamental extension of materialistic philosophy. For this reason, all attempts at a new formulation of quantum theory based on a classical deterministic method, which are often undertaken as a reaction to the idealistic interpretation of quantum theory, are destined to failure.

Classical mechanical determinism is not logically binding. Its predominance can be explained by the peculiarities of the historical development of the natural sciences. The "probability-theory" expressions used in quantum theory are in complete accord with the experiences of our practical life, wherein we are accustomed to differentiate strictly between what is merely possible and what has actually happened. The causality principle of quantum mechanics, which represents a natural generalization of the classical principle of causality, refers directly to that which is potentially possible and to the wave function associated with it, and not to actual events.

The solutions which already have been realized in quantum mechanics (with regard to contradictions between the wave-character and corpuscular nature of the electron, between probability and causality, between the quantum-mechanical description of an atomic object and the classical description of the test instruments, between individual properties of atomic objects and the statistical form in which these properties appear) all represent striking examples of a practical application of dialectic methods to problems of natural science, and the successes of quantum mechanics will, without doubt, essentially further the development of dialectic materialism.

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148. New Method of Deriving Planck's Radiation Law

"Radiation Statistics and Gas Statistics," by K. F. Novobatzky, Budapest; Max Planck Festschrift 1958, VEB Deutscher Verlag der Wissenschaften, Berlin 1959, pp 213-224

After the assumption of the corpuscular nature of the photon is shown to be invalid, a method of deriving Planck's radiation law is given, which is based on no previous assumptions whatsoever. (It is not assumed that the radiation energy is quantized, and the special form of the quantum $\epsilon = h\nu$ is considered unknown; nor is the procedure based on any model. All of this, as well as the radiation formula itself, is given as a result of the derivation.) The method is then applied to gases, leads to a new quantum, and gives an explanation of suprafluidity in the sense of the Tisza theory.

149. Some Properties of Nonlocalizable Field

"Some Physical and Mathematical Properties of a Nonlocalizable Field," by G. Heber, Institute of Theoretical Physics, Friedrich Schiller University, Jena; Max Planck Festschrift 1958, VEB Deutscher Verlag der Wissenschaften, Berlin 1959, pp 345-352

This article is a continuation of an earlier attempt by the author (Nuovo Cim. VII, 1958, p 677; Nuovo Cim. VIII, 1958, p 327) to construct a model of a nonclassical field theory. The earlier works established new rules of translation for such a field theory, i.e., for translations between the place where the field value is supposed to be measured and the field value itself. This present article discusses the directions in which simple solutions of classical field equations must be changed on the basis of these rules. Even though the field equations, or their equivalent, have not yet been derived, this article discusses several qualitative properties which solutions of these still lacking field equations must possess.

150. Nonconservation of Parity in Weak Interactions

"Longitudinal Polarization of Dirac Particles and the Nonconservation of Parity," by A. Sokolov, Physics Faculty, Moscow State University; Max Planck Festschrift 1958, VEB Deutscher Verlag der Wissenschaften, Berlin 1959, pp 309-320

After a survey of the invariance properties of the Dirac equation under three-dimensional reflection, time reversal and charge conjugation, a brief representation is given of the theory of Dirac particles with

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oriented spin. The theory of the neutrino with oriented spin is then developed in some detail, and the invariance properties of the equations are considered. The theory of the neutrino with oriented spin affords the possibility of explaining, from a more general point of view, the Lee-Yang Theory of nonconservation of parity for the case of interactions, as well as the possibility of setting up different variations of theories of this type, which is of considerable importance in view of the dearth of experimental data on weak interactions.

151. Nonlinear Theory of Matter

"Remarks On a Uniform Nonlinear Theory of Matter," by D. Ivanenko, Moscow State University; Max Planck Festschrift 1958, VEB Deutscher Verlag der Wissenschaften, Berlin 1959, pp 353-369

Current attempts to provide a uniform description of all elementary particles within the framework of nonlinear spinor theory began from three different points: from the nonlinear generalizations of electrodynamics by Mie, Born, and Infeld together with an analogous extension of mesodynamics; from the fusion theory of DeBroglie; and from the theory of composite particles of Fermi-Yang, Goldhaber, Sakata, and others. After discussing various possibilities of a nonlinear extension of the Dirac equation, this article gives a brief survey of the furtherance of nonlinear theory by the works of Heisenberg and his associates. The induced vacuum-nonlinearities of the meso-theory and theory of gravitation are considered, and several simple solutions of the nonlinear field equations are discussed.

152. Multimoments in Lagrange Formalism

"Note On the Nonrigorous Affinitive Conservation Theorems of Multimoments Within the Framework of a General-Relativistically Covariant Lagrange Formalism," by G. Knapecz, Budapest; Leipzig, Annalen der Physik, Vol 3, No 5/6, 1959, pp 340-344

Mizkjewitsch (Annalen der Physik, Vol 7, No 1, 1958, p 319) investigated multimoments and their rigorous theorems of conservation in a general-relativistically covariant wave field; this article gives the common expression of all multimoments and the nonrigorous affinitive theorems of conservation of the same. As with Mizkjewitsch, a multimoment is understood here as comprising those variables which result as sums of products of coordinates and energy-type variables (The energy moment is of the zero order, the momentum moment of the first order, the inertia moment of the second order, etc.).

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Wave fields investigated by W. R. Davis (Z. Naturforschg., 12a, 1957, p 658), i.e., those with a rather general transformation character, were considered here; the common affinitive continuity equation obtained here thus represents a rather general result.

From a general-relativistically invariant Lagrange function, a general and common expression is derived for all multimoments (studied by Mizkjewitsch), and the affinitive continuity equation is proved.

153. Reappraisal of Relativity Theory Suggested

"On the Classic-Relativistic Treatment of the Spin Problem," by J. Weyssenhoff, Jagiellonski University, Krakow, Poland; Max-Planck-Festschrift 1958, VEB Deutscher Verlag der Wissenschaften, Berlin, 1959, pp 155-168.

In view of the difficulties still encountered in attempts to bring the principles of quantum theory and the theory of relativity into complete agreement, the view is expressed here that it is worth while to reappraise the still little investigated areas of the theory of relativity. Particular emphasis is put on Einstein-Mathisson relativistic point mechanics, which is understood as Mathisson's extension of the Einstein-Grommer method of treating singularities in the gravitational field as a model of mass points without assuming a statically central-symmetrical character for these singularities (in three-dimensional hyperplanes which are pseudoothogonal to the world line of the singularity).

If the eigenfield of the particle in its immediate surroundings, in each of the above-mentioned hyperplanes, is developed into a series of gravitational multipoles, and if, initially, only the first term is considered, the result is the Einstein-Grommer "unipole particle." Even with the addition of only the second term of the multipole series, equations of motion of greater than second order are obtained, and the forms of motion obtained exhibit many properties which are, for example, remarkably similar to the behavior of the Dirac electron. It is emphasized here that these equations of motion must be supplemented by additional conditions, if the motion (with corresponding initial conditions) is to be established completely.

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Since the theory of relativity arose as a macrophysical theory and was experimentally confirmed as such, the requirement of unconditional validity in all of physics, down to the smallest dimensions, must be considered an enormous extrapolation of experimental finding. The author suggests the name "picophysics" for that branch of physics of the interiors of nuclei and of the structure of elementary particles where the orthodox quantum theory of fields has run into insuperable difficulties, and that picophysics can most likely be considered that field of physics in which the role of the "universal elementary length" is determinative. "Microphysics," on the other hand, might remain the general designation of the physics of the interiors of atoms, where present-day quantum theory agrees so well with the results of experiments and so well explains the structure of atoms out of electrons and nuclei.

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