Programs for Medicine and National Health in the USSR

Stuart Mudd, *President of the American-Soviet Medical Society* and *Professor of Bacteriology, Medical School, University of Pennsylvania*

OBSERVATION OF SOVIET RESEARCH activities was recently made possible during a visit to the USSR organized by Robert L. Leslie through the American-Soviet Medical Society and the *American Review of Soviet Medicine*. The preceding issue of *Science* described some of the work being done in experimental laboratories on problems of mental health and communal hygiene. This installment reports further on work being done by leading Soviet institutions, especially in preventive medicine and rehabilitation of war wounded.

The Prevention of Specific Infectious Diseases

The Central Institute of Epidemiology and Microbiology of the Ministry of Public Health, with grounds and buildings in the outskirts of Moscow, plans a considerable extension of its facilities over a period of 5–10 years. Diphtheria and tetanus toxin, toxoid and antitoxin, smallpox vaccine, typhus vaccine, polyvalent dysentery bacteriophage, and BCG vaccine for tuberculosis are produced here on a large scale. During the war this Institute was evacuated to the Ural mountains, where production of the needed biologicals was carried on. Production methods are standard, but less well provided with mechanical appurtenances than in this country.

Smallpox and BCG vaccine for shipment to remote parts of the USSR are dried *in vacuo* from the frozen state, and, according to Academician Michal Morosow, the results are most satisfactory. Typhus vaccine is produced by the mouse-lung method under the direction of Maria Krontovskaya. BCG vaccine is produced by growing the Calmette strain on a synthetic medium containing glycocoll, asparagine, and salts. Polyvalent dysentery vaccine contains Shiga toxoid and the five classic Flexner strains. Polyvalent dysentery bacteriophage preparations were also prepared. These were scattered during the war in soil, sewage, and food as well as being given by mouth. The director, L. Jankelevich, said that statistics regarding bacteriophage were weak; he had observed its therapeutic use, however, and thought the results were good.

Polyvalent bacteriophage as a prophylactic against the diarrheal diseases is also produced in the All Union Institute of Biological Prophylaxis of Infections, of which Z. V. Ermolieva is the director. This is a highly polyvalent preparation containing phages against *Escherichia coli, Shigella dysenteriae* (Shiga), *S. paradysenteriae* (classic Flexner types), *Salmonella paratyphi* (A and B), *Proteus*, and *Pseudomonas pyocyanea*. The polyvalent phage is given children in children's gardens and summer camps every 10 days from May to October. Prof. Ermolieva cited experiments in which groups of children had received this phage and control groups physiological salt solution, with a lower rate of incidence in the protected than in the control groups. Statistical studies are promised for the *American Review of Soviet Medicine*.

Later, in the Institute of Microbiology, Epidemiology, and Bacteriophagy of the Ministry of Health of the Georgian Republic in Tbilisi, we observed the preparation of polyvalent dysentery bacteriophage both as broth filtrate and in dry tablets. V. S. Antadze, director of research there, stated that prejudice against bacteriophage in the USSR has been overcome by controlled experiments with human populations matched as to age, weight, etc. The main point, he said, is to use many types of phage active against Shiga, Flexner, Hiss, and Sonne types of dysentery bacilli. Phage is given by mouth. For treatment, administration must begin as early as possible in the disease. In early acute dysentery, Dr. Antadze stated, there is almost immediate cure; the patient feels better in two or three days if the phage types coincide with the types of the infecting organisms. Effectiveness is very low in chronic dysentery, however.

Favorable results were also being obtained at the Institute with polyvalent bacteriophage against *Eberthella typhosa*. Cases treated in the first days of clinical symptoms were believed to be shortened to 14 or 15 days duration. Polyvalent typhoid phage was used both for prevention and treatment. It had not been successful, however, in clearing up typhoid carriers.

BCG vaccine, we were assured in the Institutes in Moscow and also in Tbilisi, where it is prepared for the Georgian Republic, is now given to every newborn child in the USSR. In Georgia, for the past two years, BCG has been administered by mouth to all newborns within the first week of life. It is also administered to populations under special risk, such as nurses in tuberculosis hospitals.

Another interesting class of anti-infective agents has been developed in the Institute of Biological Prophylaxis of Infections. According to Prof. Ermolieva, lysozyme from the horse-radish has been used since 1934 in otolaryngology and ophthalmology. Egg-white lysozyme prepared according to Bordet is used as a spray in laryngitis. According to Prof. Ermolieva, "All the best singers insist on it."

Another anti-infective called "erythrin" is extracted from erythrocytes. This is said to be bactericidal against

Corynebacterium diphtheriae, staphylococci, and streptococci. When sprayed into the nose and throat four times per day for four days in one to three courses, it is reported to clear up the chronic diphtheria carrier.

Preventive measures against rabies were touched upon by V. Ushakov, of the Institute of Experimental Medicine in Leningrad. Dr. Ushakov began work on hydrophobia in the first Pasteur Institute in Russia, organized in 1886. He joined the staff of the Institute of Experimental Medicine in 1890, where he is still working at 81 years of age.

Rehabilitation of the War Wounded

The Soviet Union has established some 300 hospitals for war veterans. Special schools for injured veterans are maintained by the Department of Public Welfare. There are some 17 institutes for special surgical rehabilitation of the war wounded and victims of industrial and other accidents. The largest of these is the Central Institute of Traumatology in Moscow. N. N. Priorov, Vice-Minister of Public Health of the USSR and director of this Central Institute, personally conducted us through this splendid hospital.

During the war special workshops were organized in the hospitals. In these an effort was made to learn the experience and training of each man and to plan his rehabilitation accordingly. At the present time special schools for injured veterans are maintained under the Ministry of Social Welfare. Invalids are divided into three groups: (1) people unable to work or to take care of themselves, (2) people unable to work but who can take care of themselves, and (3) people who can work, even though their kind of work may need to be changed. The main source of psychological disturbances is in those who do not know what work to do; when work is found for them, as a rule they become mentally sound.

Cases were described and shown to us of veterans who had lost both hands; the bones of the forearm were separated by the Krukenberg operation. These men seemed quite unself-conscious about using their arms for greeting and other purposes. Veterans who had lost both hands had entered law school and a school of economics. Those blind or without both legs were seen, as were others with spinal and facial injuries in various stages of plastic and restorative surgery. Their spirit and the relationships between staff and patients impressed us as strikingly fine. The injured veterans included women as well as men.

An interesting accessory to surgery was shown us in the case of hyaluronic acid prepared from bovine vitreous humor. This was injected intragluteally for softening scars and to facilitate healing.

Special workshops and factories are devoted to the manufacture of prosthetics. These are being revised with the aid of prosthetic devices purchased in America.

Poliomyelitis is treated in acute stages by neurologists; in late stages, by orthopedic surgeons. Transplantation of muscles is sometimes resorted to. The Kenny method is not used.

The Institute of Biological and Medical Chemistry

The 20 medical institutes visited included some of those described in the report by A. B. Hastings and M. B. Shimkin (*Science*, May 17 and 24, 1946). So manifold are the scientific activities in Moscow and Leningrad and to a less extent in other cities of the USSR, however, that our experiences only partly paralleled those of Hastings and Shimkin and included very few, indeed, of the institutions visited by Selman A. Waksman as a guest of the Academy of Sciences of the USSR (*Sci. Mon.*, April 1947) and Edward L. Young with a party from Russian Relief (*Soviet Russia Today*, 1946, **15**, 12).

A high point scientifically was the Institute of Biological and Medical Chemistry of the Academy of Medical Sciences of the USSR. This splendidly organized Institute, under the direction of J. O. Parnas, comprises five principal Divisions: (1) Intermediate Nitrogen Metabolism, (2) Protein Biochemistry, (3) Chemistry of Tissues (4) Enzymology, and (5) Biochemistry of Carbohydrates. There are also Laboratories of Physical Chemistry, Analytical Chemistry, Organic Chemistry, and Physiology, each of which has the dual function of supplying needed materials and methods to the principal biochemical divisions and pursuing its own special problems. The several subdivisions in general collaborate and supplement each other in addition to carrying on their own investigations. Each laboratory has its own responsible head. There is an institute library with an especially fine reprint collection. Scientific direction and administration, supplies, and equipment are, of course, centralized under Dr. Parnas.

The following written statement concerning the current work of the Laboratory of Intermediate Nitrogen Metabolism, headed by A. E. Braunstein, a member of the Academy of Medical Sciences, and the Laboratory of Enzymology, under M. G. Kritzmann, may be of interest:

> Braunstein and his colleagues continue the study of the enzyme system and biological significance of the enzymatic transamination of amino acids, discovered in this laboratory. A review of transamination, including a new theory of the integrative functions of dicarboxylic acids in nitrogen metabolism, by Braunstein, will appear in Vol. 3 of *Advances in protein chemistry*. The mechanism of hydrogen translocation in the course of transamination is being studied in isotopic experiments with deuterio-amino acids (Konikova and Braunstein), showing that the labilization and dissociation of α-hydrogen (hydrogen on the α-carbon) is a preliminary and independent enzymatic preliminary step of the reaction. In a cross-assay of the coenzymes of amino acid decarboxylases and transaminating enzymes, made in cooperation with Dr. Gale (Cambridge), the identity of phosphopyridoxal with the prosthetic group of glutamic aminopherase, recently an-

nounced by American authors, has been corroborated, and its non-identity with the "coenzyme" of aspartic aminopherase has been proved (Braunstein and Kritzmann).

A specific enzymatic manometric micromethod for the determination of aspartic acid has been worked out by Braunstein, Nemchinskaya, and Wilenkina. A. S. Konikova made an extensive study of the amino acid metabolism of *Bac. brevis*. An important finding of hers is that *B. brevis* contains large amounts of d-amino acids in the cell proteins as well as in gramicidin and tyrocidine.

The mechanism of the stimulatory effect of ascorbic acid on the metabolism of tyrosine has been investigated in tissue slices by R. Azarkh. The effect is positive in ascorbic acid-deficient and normal guinea pigs and in rats. It is associated with a reaction preceding deamination. Work is in progress on the mechanism of enzymatic synthesis of peptides in animal tissues.

Braunstein is preparing a comprehensive monograph on the biochemistry of amino acid metabolism for publication in Russian and English.

M. Kritzmann has proved that the Wood-Werkman reaction of CO_2-fixation and the transamination reaction are intermediary stages of the synthesis of alanine from NH_3 and pyruvate in liver slices. Phosphate is also involved in this synthesis, which has been effected, for the first time, in cell-free enzyme systems by Kritzmann and Melik-Sarkyssian. Kritzmann has succeeded in the reversible splitting of glutamic aminopherase. The nature of liver aspartic dehydrogenase is being investigated in her laboratory.

The following notes on the functional significance of adenosine triphosphate for the muscular and nervous systems were furnished by Eugene B. Babsky, head of the Physiological Laboratory:

The work of the laboratory has established the fact that small quantities of adenosine triphosphate heighten the excitability of the muscles and increase muscular contraction. Large quantities of adenosine triphosphate lower the excitability of the muscles and decrease muscular contraction. In small quantities (1×10^{-7}–5×10^{-8}) this substance stimulates tetanic contractions.

The laboratory's experimental data lead us to the conclusion that the release of adenosine triphosphate which occurs with every individual muscular contraction heightens the excitability of the muscles (researches of E. B. Babsky and F. D. Sheikhon).

The laboratory's investigations have also shown that adenosine triphosphate sensitizes muscles to acetylcholine and choline. The interaction of these substances is of importance in the transmission of an impulse from the nerve to the muscle, since when the nervous impulse reaches the muscle acetylcholine is released in the neuro-muscular synapse, and adenosine triphosphate in the muscle.

The substance described by numerous investigators as contained in the tissues of the brain and as acting as a sensitizer to acetylcholine is, according to the data obtained in this laboratory, adenosine triphosphate (researches of E. B. Babsky and P. F. Minayev).

In investigating the influence of adenosine triphosphate taken from the muscles or from the brain, upon electroencephalograms, it has been shown that this substance markedly affects the amplitude and frequency of cerebral potentials. This is a direct indication of the physiologic significance of adenosine triphosphate in the functions of the brain (researches of E. B. Babsky, A. E. Gurvich, and M. N. Livanov).

A third program of special interest was described by S. O. Kaplainsky, head of the Laboratory of Chemistry of Tissues. Studies in this laboratory are concerned with the effects of protein deprivation and wound dystrophy. These have shown that in conditions of extreme deprivation of protein essential enzymes of the tissues may become deficient. The proteins of the deamidizing and decarboxylating systems are thus partially lost. In consequence, nonoxidized keto-acids and nondecarboxylated amino acids are eliminated in the urine. The excretion of amino acids in the urine may be increased three to four times in wound dystrophy. There is decrease in urea excretion due to lack of function of an enzyme in the liver; enzymes in the kidney are less impaired. Changes in the enzyme systems of the brain are also involved; respiration of brain tissue may be decreased two- to threefold. Metabolic detoxification processes may be stopped almost entirely.

The consequences of loss of the proteins of the fermentative systems resemble in some features the avitaminoses due to lack of enzymes for which the deficient vitamins are coenzymes. Some of the observed changes in man seem to be irreversible, even after restoration of normal protein intake, if protein deprivation has been too long continued. The best restorative measures, in the experience of these investigators, are intravenous administration of fresh human plasma and the feeding of liver proteins.

The State Central Medical Library

The State Central Medical Library of the Ministry of Health of the USSR, of which L. Bassias is the director, must be mentioned because of its importance as an agency for exchange of literature in the medical sciences between the United States and the USSR. The staff comprises some 140 persons, 138 of whom are women.

Here we found a fine collection of foreign journals, including the best English and American psychiatric and mental hygiene journals, as well as the *Journal of Bacteriology*, *Journal of Immunology*, *Journal of Biological Chemistry*, etc. We were informed that the *Journal of Biological Chemistry* was the most used journal in English. Many books in English were on display, and a whole room was devoted to catalogues of American medical and scientific supply firms. We were told that money to buy books (in English) was now in hand and that their immediate need was for catalogues. Everywhere in stacks and reading rooms there was evidence of intensive use of the facilities available. Both Dr. Bassias and her assistant librarian, Mrs. Maisil, showed great enthusiasm for, and devotion to, their work. They in turn spoke of the heroic girls who had worked in the dark and cold of

the library every day during the war, even though a bomb fell through the stacks. In a recent letter to Mrs. Mudd, Dr. Bassias writes:

> We have only just summed up the results of our work for the three quarters of the first postwar year which appear to have surpassed our expectations. They showed that we have outdistanced the achievements of the last prewar year. In 1940, our reading rooms have been visited 60,476 times and 237,884 books have been borrowed from the stacks, while throughout the period from January 1st to October 10th, 1946, 68,371 visits to the reading rooms and 235,914 loans from stacks were already registered. The same increase can be seen in all the branches of our work and not only in our Library but also in other medical libraries of our country.
>
> These figures reflect as in a mirror the intensive, creative work of our medical workers, who strive, as well as all the other people here, to cure as soon as possible the wounds inflicted by war. Nobody in our country derives profit of war. On the contrary, war brings only suffering to all the people and demands heavy sacrifices. It would be so nice if all could understand, as you do, how much happiness we gain from our peaceful work, the results of which we feel so vividly. Work really has become in our country a "matter of honour, valour and heroism," and I suppose this to be the main characteristic feature of Soviet people.

The Five-Year Plan of the Academy of Medical Sciences

A comprehensive five-year plan of medical research and its applications was adopted in preliminary form by the Academy of Medical Sciences of the USSR early in September 1946 and was formally adopted in November. This plan, covering 200 mimeographed pages, will appear, when translated, in the *American Review of Soviet Medicine*. The areas of research covered are thus listed in the Table of Contents:

I. Main Problems of Public Health in the Postwar Period: Scientific principles of Soviet public health protection; Medicosanitary consequences of the war and measures for overcoming them; hygienic standards and sanitation of external environment; protection of the health of mother and infant; child health protection; protection of the health of industrial workers; problems of nutrition.

II. Medical Problems Arising From War Traumas: Restoration of functions after war traumas; clinical and pathophysiologic study of traumas of the nervous system and their restorative therapy; biology of infected wounds; traumatic shock; the problems of pain.

III. Problems of Infection in Theory and Practice: Infection and immunity; epidemiology and pathology of infection; malaria, helminthiasis and other problems of medical parasitology; ultraviruses and ultravirus diseases; tuberculosis; problems of scarlatina in child health protection; the problem of sepsis; etiotropic therapy of infectious diseases.

IV. Urgent Problems of Clinical Medicine: The problem of malignant growths; hypertonia; gastric and intestinal ulcers; problems of modern hematology and blood transfusion.

V. Physiologic Regulation and Means of Actively Influencing It: Reactivity of the organism; correlative processes in the organism; regulation of the composition and properties of the internal medium of the organism; pharmacological regulation of functions; the influence of physical factors on the human organism; capacity for work, fatigue and rest.

VI. Physiology and Pathology of Nervous Activity: Factors of integration in the nervous system; the higher nervous activity; psychoses (pathogenesis and therapy).

VII. Certain Problems of Theoretical Medicine: General physiology and pathology of the cell; growth and development of the normal and pathological organism; metabolism and energy; the physiology of digestion; history of medicine.

The secretary of the Academy states that the proposals incorporated in this plan originated with the staffs of the 25 component institutes of the Academy. They were then subject to discussion between the presidium of the Academy and the component institutes. The plan, as finally agreed upon, was adopted by the Academy and returned to the institutes as a recommended but not obligatory program. The emphasis of the plan on fundamental theoretical problems is noteworthy.

Academician A. I. Abrikosov, first vice-president of the Academy of Medical Sciences, in comment upon this five-year plan, has written in part:

> It is to be pointed out that the five-year plan of the USSR Academy of Medical Sciences insures the genuinely scientific synthesis of the various scattered factual findings obtained by scientists, institutes and laboratories in the course of their work on one or another phenomenon. . . .
>
> The essence of our method does not consist in mere registration of phenomena. The task of the Soviet scientist is to explain phenomena and their causal interdependence, to combine theory with practice in relation to man not only as a biological unit but as a social being whose normal and pathological development is affected first and foremost by the social conditions prevailing in his environment (*Moscow News*, November 16, 1946).

Interchange of scientific literature between the United States and the USSR is already established and is growing; the science of both countries is enriched thereby. The sending of reprints, monographs, foundation reports, and book catalogues relating to the medical sciences is one easy and concrete way of promoting intercultural understanding. These may advantageously be mailed to the State Central Medical Library of the Ministry of Health, Sadovo-Kudrinskaja, 1, Moscow, USSR. Good will exists between those scientists of the two countries who have had the opportunity for personal acquaintance. It is the author's earnest belief that the good of both countries demands the future broadening of the basis of mutual understanding and good will.