Meetings

Zoonoses

The international symposium on Theoretical Questions of Natural Foci of Diseases, which was held in Prague, Czechoslovakia, 26–29 November 1963, was of prime importance in stimulating interchange of knowledge and cooperation between Soviet and Western scientists concerned with the transmission of human and animal diseases.

Research on the zoonoses in Russia developed more or less independently of that in the Western world, and this symposium was an important step in establishing communication between the two groups. All who attended were eager to exchange information on problems of disease transmission, and the research workers from the U.S.S.R. and Eastern Europe were especially anxious that Western scientists know what they were doing.

In order to understand the symposium's significance, some background information is necessary. We are well aware of the importance of the zoonoses—diseases transmissible between man and lower animals—in human welfare. The World Health Organization has listed over 100 zoonoses, some of which are more important than others. Plague, the great killer of past centuries, with its natural reservoir in rodents and its transmission by fleas, is a classic zoonosis. Rabies, transmitted by the bite of infected dogs, wolves, skunks, bats, and other animals, is another; even Pliny had what he thought was a cure for it. Tuberculosis, transmitted in part from man to man but also transmitted from cows to man in the milk, is a third.

Research on the epidemiology of the zoonoses in the U.S.S.R. was stimulated when the Russians encountered them in opening up new areas of the country. People who entered uninhabited regions for the first time often contracted new and unusual diseases or old ones not present in the places from which they had come.

In 1939 E. N. Pavlovsky brought out his "doctrine" of natural focality or natural nidality of disease. This crystallized the thinking of Russian workers. Prior to this time it was believed in Russia that most human diseases occurred only in man and were transmitted from man to man either directly or by vectors. Then it was discovered that many occurred naturally in wildlife, and Pavlovsky developed his theory that they were transmitted from wildlife to man by way of arthropod vectors when men invaded their territory.

For instance, a construction project was set up on the Murgab River in a desert region of Turkmenia. Many gerbils (*Rhombomys opimus*) were present in the area, and a high percentage of them had skin lesions caused by the protozoon, *Leishmania tropica*. Sandflies (*Phlebotomus*) bred in the gerbil burrows and transmitted the disease from one gerbil to another. The sandflies also bit man, and they were so abundant that the workers slept under nets. About 50 people a day came to the dispensary to have skin ulcers treated, and these were found to be caused by the *Leishmania*. The natural focus of infection was eliminated by poisoning with chloropicrin all the gerbil burrows within 1 to 2 km of the settlement and then blocking them with earth. About half a million burrows were so treated, and the infection disappeared from man.

Each terrain type or landscape has its own characteristic zoonoses. The Russian forest zone has tick-borne encephalitis and the steppes and grasslands have Asiatic tick-borne typhus; both have reservoirs in rodents and other small mammals and are transmitted to man by ixodid ticks. Moist meadows around large lakes and river floodlands have leptospirosis, transmitted directly from rodents by way of water. They also have virus encephalitides, transmitted from wild birds to man and horses by mosquitoes. Deserts and semi-deserts have Oriental sore, transmitted from gerbils to man by sandflies; they also have relapsing fever, transmitted from rodents to man by *Ornithodoros* ticks. We are well aware of similar zoonoses in the United States—tularemia and Rocky Mountain spotted fever are examples.

Pavlovsky's theory paved the way for a great surge of investigation. A large number of workers at many institutions have done research on diseases with natural focality, both in the U.S.S.R. and in Eastern European countries. Among these institutes might be mentioned Pavlovsky's own Parasitological Laboratory of the Zoological Institute of the U.S.S.R. Academy of Sciences in Leningrad, the Gamaleya Institute of Epidemiology and Microbiology of the U.S.S.R. Academy of Medical Sciences in Moscow, and the Parasitology Laboratory at the Institute of Zoology of the Kazakh Academy of Sciences in Alma-Ata, Kazakhstan.

Many expeditions have been sent throughout the U.S.S.R. to investigate these diseases, a great number of papers have been published, and many conferences and symposiums have been held on the subject.

The latest symposium was the one of most importance to Western workers. It was organized by Pavlovsky's disciple, Bohumir Rosický, director of the Institute of Parasitology of the Czechoslovak Academy of Sciences. Pavlovsky was honorary chairman, and he presented the opening address.

Not everyone who was scheduled to present a paper was able to attend and a few papers were presented without written abstracts. However, analysis of the 62 papers of which English copies or abstracts were available reveals the scope of the symposium. Almost half the papers (29) were from the U.S.S.R.; 14 were from Czechoslovakia; 4 from Poland; 3 each from Yugoslavia, Austria, and Great Britain; 2 from the United States; and 1 each from Finland, Italy, Netherlands, and Rumania. Thirteen papers were general in scope; 13 dealt with tick-borne encephalitis, 3 with other tick-borne virus diseases; 3 with ticks themselves; 7 with plague; 5 with tularemia; 4 each with leptospirosis and arboviruses; 3 with hemorrhagic fever; 2 each with Q fever and toxoplasmosis; and 1 each with mites, mycoses, and helminthoses.

One of the problems of communication between Soviet and Western scientists is that the definitions of the same words are not necessarily the same. What Soviet scientists call a disease with natural focality, Western scientists call a disease with a wildlife reservoir. To Soviet scientists, a zoonosis is a disease of lower animals alone, while to Western scientists it is a disease transmissible between these animals and man; the diseases which Western scientists call zoonoses, Soviet scientists call zooanthroponoses or anthropozoonoses. And when Soviet scientists say that a disease is transmissible, they mean the same thing that Western scientists do when they say that it is vector-borne.

(Left to right) Bohumir Rosický, director of the Institute of Parasitology, Czechoslovak Academy of Sciences; Evgenii N. Pavlovsky, Parasitological Laboratory of the Zoological Institute of the U.S.S.R. Academy of Sciences, Leningrad; and G. M. Maruashvili, director of the Virsaladze Institute of Medical Parasitology and Tropical Medicine, Ministry of Health of the Georgian S.S.R., Tbilisi. [Fotoreportáže, Prague]

Pavlovsky dealt with conditions under which natural foci of diseases may form in towns and then spread from them into the countryside. P. A. Petrishcheva (Gamaleya Institute, Moscow) discussed the influence of man on the existence and development of natural foci of diseases. Rosický's paper (delivered by Dr. B. Ryšavý), told how migratory mammals and birds may introduce diseases and infected vectors into areas where they had not previously existed or from which they had been eradicated. Migrating lemmings in Scandinavia, for instance, introduced tularemia into new areas, and birds may introduce ticks into areas where they have been eradicated by DDT.

V. V. Kucheruk (Gamaleya Institute) told how many types of wild rodents may be found in vacant lots, along canals, and in other places, even in relatively large cities. The numbers and species of their ectoparasites vary with the type of place—city, town, agricultural community, field, and so forth. Furthermore, the predominant parasites differ in host range in different regions; those in the country have a relatively broad host range.

C. E. Gordon Smith (London School of Hygiene and Tropical Medicine) contrasted the ecologies of mosquito- and tick-borne infections. The reproduction rate of an arthropod-borne virus in its maintenance hosts must be 1.0 for a stable infection to exist; if it is higher, an epidemic results, and if it is significantly lower, the infection will die out. Many factors are involved in the reproduction rate, including the duration of the infection in its vertebrate and arthropod hosts, the reproduction rates, population densities, and behavior of both hosts, and the climate and microclimate.

M. R. Honer (State Agricultural University, Wageningen, Netherlands) emphasized the importance of survival niches and of ecotones (contact zones between different habitats, "buffer layers," "edge phenomena," "tension belts," or "fringe habitats") in the epidemiology of zoonoses, and discussed the importance of the topological analysis of foci.

In discussing the microstructure and stability of natural foci of diseases, N. P. Naumov (Moscow University) made special reference to plague, tularemia, and leptospirosis. He classified elementary foci of diseases into three main types: (i) those in which ticks, mosquitoes, or other long-lived arthropods are the real reservoirs of the infectious agent in nature; (ii) those in which the causative agents are harbored by rodents and transmitted by short-lived ectoparasites, such as fleas and gamasoid mites; and (iii) those such as leptospirosis in which there is no vector.

New trends in studies of natural disease foci were noted by I. G. Galuzo (Institute of Zoology, Alma-Ata, Kazakhstan). He emphasized the fact that parasites, pathogenic microorganisms, and viruses are as much components of biocenoses as vertebrates and other animals and plants. The natural disease foci of farm animals are especially important for the national economy. Examples include foot and mouth disease, rabies, anthrax, Q fever, brucellosis, leptospirosis, trypanosomosis, toxoplasmosis, and many helminth infections.

Many papers were devoted to specific diseases. B. K. Fenyuk (All-Union Anti-Plague Research Institute, Saratov, U.S.S.R.) described plague foci around the Caspian Sea and elsewhere and emphasized how susliks maintain the disease and the effects of human activities upon the boundaries of the foci. V. V. Kucheruk (Gamaleya Institute) told about the paleogenesis of plague and related it to the phylogeny of the various rodent families.

In discussing paleogenesis and epidemiology of tularemia, N. G. Olsufiev (Gamaleya Institute) related the phylogenies of the bacterial families Enterobacteriaceae and Brucellaceae to those of the lagomorphs and rodents. He recognized two subspecies of *Francisella tularensis; F. t. tularensis* is associated primarily with rabbits of the genus *Sylvilagus* in North America, while *F. t. palaearctica* is associated primarily with hares of the genus *Lepus* in Asia. However, both subspecies occur on both continents. He considered that *F. tularensis* exists in two principal ecologic forms: the original, "land" form is associated with hares, rabbits, and some rodents and is transmitted primarily by ticks; a secondary "water" form is associated with amphibious rodents and is transmitted chiefly through the water. Both subspecies of *F. tularensis* exist in the land form, but the water form is present mainly in *F. t. palaearctica.*

F. Przesmycki, Z. Wróblewska-Mularczykowa, and Z. Zoltowski (State Institute of Hygiene, Warsaw, Poland) discussed new arboviruses in Poland. In serologic studies in Warsaw province, antibodies against group A arboviruses were found mostly in bovine serums, whereas antibodies against group B arboviruses were found mostly in human serums. Two strains of group A arboviruses were isolated from *Culex pipiens* mosquitoes from one state farm in this region.

The geographic distribution of toxoplasmosis was noted by D. N. Zasukhin (Gamaleya Institute). This protozoan disease occurs not only in wildlife but also in farm animals, pets, and man. It has been found in the U.S.S.R. in various species of suslik, rat, mouse, vole, jird, hare, and shrew, and in the polecat, wildcat, and korsak.

Some papers dealt with the different zoonoses which occur in specific regions. G. M. Maruashvili (Virsaladze Institute of Medical Parasitology and Tropical Medicine, Tbilisi, Georgia) discussed the most important ones in Georgia, U.S.S.R. Among these are visceral and cutaneous leishmaniosis (to which the major part of his paper was devoted), tick-borne spirochetosis, toxoplasmosis, leptospirosis, trichinellosis, ornithosis, brucellosis, and Q fever.

P. C. C. Garnham (London School of Hygiene and Tropical Medicine) described six natural foci of human infection which succeed each other along the course of the Kuja River, which arises in the Kisii Highlands of Kenya and empties into Lake Victoria on the Tanganyika border. Man-made malaria, transmitted by *Anopheles gambiae* and *A. funestus*, occurs in the highlands. Rhodesian sleeping sickness, caused by *Trypanosoma rhodesiense* and transmitted by the savannah tsetse flies *Glossina swynnertoni* and *G. pallidipes* with a reservoir in the bushbuck, occurs in the game country of the Transmara at an altitude of 1800 meters. The Kuja river then drops through deep clefts and runs rapidly through the well wooded, hilly terrain of the Bassi and Riana regions. Here onchocercosis is transmitted by the blackfly *Simulium neavei*; the chimpanzee, now extinct in the area, was probably the original reservoir of this disease. Plague used to exist where the country flattens out below this region, but it disappeared spontaneously. From 1300 to 1100 meters, the Kuja flows slowly, and a narrow strip of vegetation on its banks provides a habitat for the riverine tsetse fly *Glossina palpalis*, which transmits Gambian sleeping sickness due to *Trypanosoma gambiense*, a disease which does not have a wildlife reservoir. At the mouth of the river and along the nearby lake shore, the snails *Biomphalaria pfeifferi* and *B. sudanica* breed. These are vectors of the blood fluke *Schistosoma mansoni*; its wildlife reservoir is the baboon, more than half of which are infected in this region.

Of the 147 registrants attending the symposium, 57 were from outside Czechoslovakia. They included 17 from the U.S.S.R., 8 each from Poland and Yugoslavia, 4 each from Great Britain and Austria, 3 each from Bulgaria and Hungary, 2 each from France, East Germany, and Rumania, and 1 each from Finland and the United States.

Mimeographed abstracts or full papers in English were sent to all participants ahead of time, and a few more were distributed at Prague. Simultaneous translations of all talks and discussions were provided in English, German, and Russian by means of individual transistor radios and earphones. The entire proceedings are to be printed in English and published as a book by Academic Press. Since the symposium provided a good picture of Russian and Eastern European research to date, its proceedings can serve as an invaluable source of information for western scientists and as a foundation for further research by all.

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Neutron Irradiations: Biological Effects

Because of their unique physical characteristics, neutrons form a special type of radiation hazard on the one hand and a potential tool for applied radiobiology on the other. Compared to x- and γ-irradiation there is less known about, or long-range experience with, neutron irradiation. A symposium to bring together existing knowledge on the biological effects of neutron irradiations was held at the Brookhaven National Laboratory, 7–11 October 1963. This was the first scientific symposium to be held in the United States under the sponsorship of the International Atomic Energy Agency (IAEA), a United Nations–affiliated organization with headquarters in Vienna, Austria. Approximately 150 scientists from 17 nations and four international organizations attended.

In addition to 50 research papers, the program featured an informal panel of eight scientists, moderated by H. H. Rossi (Columbia University). They discussed biophysical principles underlying experiments with neutrons. Survey papers were presented in three areas of general interest: (i) health and safety aspects of the use of neutrons (Y. I. Moskalev, Institute of Biophysics, Moscow), (ii) uses of neutron irradiation in agriculture and applied genetics (A. R. Gopal-Ayengar and M. S. Swaminathan, India), and (iii) the potential of thermal neutrons, fast neutrons, and other heavy particles in radiotherapy (J. F. Fowler, Hammersmith Hospital, London). An informal lecture on the international aspects of science was presented by Glenn T. Seaborg (chairman, U.S. Atomic Energy Commission).

High-energy protons are of interest in connection with the development of aerospace medicine because the Van Allen belt and protons from solar radiation constitute a hazard to man in space. P. Bonet-Maury and coworkers (Radium Institute, University of Paris) described results of experiments in which mice were exposed in the 157-Mev proton beam of the Orsay synchrocyclotron, in the 600-Mev proton beam of the CERN synchrocyclotron, and in the 950-Mev electron beam of the Orsay linear accelerator. The overall results of exposure to these beams indicated a biological effectiveness of the same order as that produced by x- or γ-rays and did not reveal any particular phenomenon that could be considered characteristic of these high energies. C. A. Tobias summarized observations made at the Donner Laboratory and the Lawrence Radiation Laboratory of the University of California on the effects of 730-Mev protons on mammalian systems. In proton-irradiated mice gastrointestinal death predominated, whereas after exposures to x-rays hematopoietic death predominated. It was suggested that the difference in cause of death may be the result of differences in tissue dose distribution. Experiments have been carried out on monkeys by the U.S. Air Force School of Aerospace Medicine in an effort to assess the likely hazards to man from protons during near- and deep-space penetration. Energies of 14-, 40-, 187-, and