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A NEW STAGE IN THE DEVELOPMENT OF MICROBIOLOGY AND IMMUNOLOGY

Prof N. I. Leonov

[A digest]

Although some viruses (those causing epidemic pneumonia of horned cattle, agalactia of goats, and psittacosis) could not only be seen under an ordinary microscope, but could be grown in the usual nutritive media for microbes, contemporary microbiology rigidly distinguished between viruses and microbes. Only a comparatively small number of investigators, among them the prominent microbiologist, Academician N. F. Gamaleya, assumed that viruses do not comprise a special class of organisms, but may be bacteria which have become microscopically invisible.

This tentative conclusion was reached recently by Prof V. A. Krestovnikova and her collaborators, Fal'kovich, Zhrubina, et. al., concerning the viruses of typhus, scarlet fever, influenza, and the bacteriophage. At the same time, many Soviet investigators, Suknev, Timakov, Zhukov-Verezhnikov, Kalina, Utenkov, Novogrudskiy, and others, succeeded in proving definitely that many pathogenic bacteria, in addition to the usual, microscopically visible form, also exist in an invisible form corresponding to viruses.

All this forms the background for G. M. Bosh'yan's work on the interconversion of viruses and microbes carried out by him and his collaborators at the All-Union Institute of Experimental Veterinary Medicine, where he is director of the Department of Biochemistry. The results of this work have been summarized in Bosh'yan's book On the Nature of Viruses and Microbes, which was published in 1949. Now that Bosh'yan's experimental data and theoretical deductions have been published, the microbes which are known to accompany many virus diseases must be regarded in a new light. The ordinary intestinal microbe *Proteus X¹⁹* always accompanies typhus; paratyphoid bacteria, spirochetes, and pasteurillae are always present in swine plague; staphylococci in smallpox; streptococci in

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scarlet fever; etc. There is hardly a disease caused by a virus in which such accompanying microbes have not been found. Phenomena which other investigators regarded as accidental have been systematically unified and explained by Bosh'yan on the basis of his own work demonstrating the transformation into microbes of the following viruses: equine infectious anemia, swine plague, bird plague (Newcastle disease), foot and mouth disease, typhus, smallpox of sheep, and equine encephalomyelitis. All the viruses mentioned above and a number of others have also been transformed into protein crystals, showing that they are capable of undergoing this type of transformation which hitherto was only known to occur in the case of viruses producing diseases of plants. The protein crystals obtained from viruses of human and animal diseases could be transmuted into viruses and microbes, and several scores of pathogenic and nonpathogenic microbes were shown to be capable of transmutation into viruses.

In connection with this work, it was established that microorganisms exhibit a much higher resistance to powerful chemical and physical influences than that which was ascribed to them hitherto. Thus, Bosh'yan was able to isolate living cultures from nutritive media which had been boiled and autoclaved repeatedly. Having this high resistance, microorganisms do not perish either in the host organism or outside of it as easily as had been assumed. Notwithstanding the prevalent view that a sterile vaccine contains only dead microorganisms, cultures of living microbes could be successfully grown from many formalized vaccines and also some so-called chemical vaccines (polyvaccine NIISI -- Scientific Research and Experimental Medical Institute of the Red Army). This phase of Bosh'yan's work checks with the results obtained by Leonov, Terent'ev, Strogov, and Miroz'yan in other laboratories of the All-Union Institute of Experimental Veterinary Medicine (cf Sovetskaya Zootekhnika, No 6, 1949, and Veterinariya, No 10, 1949). Numerous investigations of immune antitetanus serum which had been treated with phenol revealed that a culture of tetanus microbes could be invariably isolated from it. The initial live microbe culture could also be isolated from immune antianthrax serum and the active swine plague virus from the immune serum used against that disease. The identification of the microbes and viruses in question was quite certain. Microbe cultures were also obtained from many other sera used for medical and veterinary purposes. The conclusion is that immune sera of animal origin do not contain substances which kill microorganisms, but the microorganisms themselves in their invisible and nonpathogenic development stage. Similarly, microbe cultures were grown from toxins, antitoxins, and a number of bacteriophage varieties.

Thus, the living nature of all biological preparations, without exception, used in medical and veterinary practice for prophylactic vaccinations, therapy, and diagnosis was established. The experimental data in question form an adequate basis for rejecting the outlived concept of sterile immunity.

It was assumed hitherto that after recover from an infectious disease or vaccination the microbes introduced into a human or animal organism ultimately perish. It has been shown by Bosh'yan that the causative factor of disease is retained in the organism for a long time in its unusual, filterable form, and that it is precisely this presence of the microbes in their filterable form which confers immunity against repeated infection. In the light of Bosh'yan's data, immunity to bacterial and virus infections is no more sterile than immunity to malaria, haemosporidia, helminths, and other parasites of animal origin.

Assuming the virus origin of malignant growths, Bosh'yan applied his investigative methods to the study of filtrated blood serum and tumor serum of human patients suffering from cancer of varying localization. In these studies an identical microbe culture was isolated in all cases. This microbe culture may be regarded as the visible phase of development of the cancer virus. If these results are confirmed, the present views on the cancer problem and cancer therapy must be revised.

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From the general biological standpoint, Bosh'yan's work has an important bearing on the formation of new species of bacteria. Furthermore, this work proves that microbe cells are formed from the smallest constituent parts of these cells rather than other cells, as postulated by Virchow's cell theory. This ties up with the results obtained by the Soviet biologist O. B. Lepeshinskaya.

This paper is illustrated with a series of five photomicrographs purporting to show, in a magnification factor of 1,100, successive stages of the transformation of a virus into microbe cells. The captions under the pictures representing these stages read as follows: "Stage 1. Primary Granularity from Structureless Dendrite," "Stage 2. Accumulation of Granular Matter," "Stage 3. Formation of Large Structures from Granular Matter," "Stage 4. Formation of Threads," "Stage 5. Further Differentiation of Threads. Formation of Separate Rods" These illustrations are omitted



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