MICROBIOLOGY

AND

EPIDEMIOLOGY

Being a volume in the Series

ACHIEVEMENTS OF SOVIET MEDICINE IN THE PATRIOTIC WAR

Edited by

Prof. E. B. BABSKY, Prof. I. G. KOCHERGIN,

and

Prof. V. V. PARIN

Translated from the Russian

by

Dr. H. P. FOX

MEDICAL PUBLICATIONS, LTD.

47 PRINCES GATE, S.W.7

Published in the U.S.S.R., 1943
First English Edition, November, 1945

To Soviet Medical Workers fighting heroically for the Honour, Freedom and Independence of Motherland.

MADE AND PRINTED IN GREAT BRITAIN AT
THE FLEET STREET PRESS
EAST HARDING STREET, E.C.4

CONTENTS.

MICROBIOLOGY
AND
EPIDEMIOLOGY

MICROBIOLOGY

AND

EPIDEMIOLOGY

Being a volume in the Series

ACHIEVEMENTS OF SOVIET MEDICINE IN THE PATRIOTIC WAR

Edited by

Prof. E. B. BABSKY, Prof. I. G. KOCHERGIN,

and

Prof. V. V. PARIN

Translated from the Russian

by

Dr. H. P. FOX

MEDICAL PUBLICATIONS, LTD.

47 PRINCES GATE, S.W.7

Published in the U.S.S.R., 1943
First English Edition, November, 1945

To Soviet Medical Workers fighting heroically for the Honour, Freedom and Independence of Motherland.

MADE AND PRINTED IN GREAT BRITAIN AT
THE FLEET STREET PRESS
EAST HARDING STREET, E.C.4

CONTENTS.

CHAPTER I

PROBLEMS OF EPIDEMIOLOGY IN WAR-TIME

by

Major-General of Medical Services, Professor
T. E. Boldyrev

The great patriotic war conducted by the Soviet peoples against the Fascist invaders has confronted the epidemiologists of our country with a number of new problems pertaining to the protection of the Army and civil population against the outbreak and spread of epidemics.

Owing to the conditions created by the war, some of our traditional notions on the reservoirs of viruses of epidemic diseases, both in nature and in the human environment, on the paths followed by infections in their spread in human communities, and on the routes and mode of infection, have had to be re-checked and revised.

Simultaneously there has arisen a number of problems relating to effective prophylaxis against infectious diseases. War-time conditions, the scale of the measures that are being carried out against epidemics, and also the necessity of solving in the shortest possible time the acute problems that crop up in practical work—all these have given their specific imprint to the character of the investigations devoted to the effective prophylaxis of epidemic diseases.

In the war period we have again been confronted with the problems of natural *foci* and endemic *nidus* of some of the infectious diseases; of some of the endemic infections in those regions in which their *foci* (despite the absence of any connexion with human activity) have become established. The existence of natural *foci* of a number of infectious diseases has been demonstrated in practice in many districts that are otherwise healthy and relatively advanced culturally. The list of infections—the existence of the natural *foci* of which has been so brilliantly worked out by the school of Academician E. N. Pavlovsky in the case of tick encephalitis, recurrent tick typhus, and pappataci fever—should be supplemented with full justification by tularaemia, leptospiroses, and, possibly, by some of the intestinal infections as well.

In the course of war when enormous aggregates of troops have come into close contact with nature, when for many people the dug-outs, reinforced bomb-proof shelters, and light huts have become the only dwelling places, the effect of the latent natural *foci* of infection has become manifest in many new regions. *Foci* of such infections as tularaemia, infective jaundice, tick encephalitis have been found to exist in regions where no cases of those diseases had formerly been observed.

It is unnecessary to stress how important it is, for the organization

of rational and efficacious prophylaxis against such diseases, to have a previous knowledge of the existence of natural *foci* of infection; and how essential it is, likewise, to have accurate knowledge of how the causal agent of the disease persists in these *foci* and by which route it is likely to be transmitted to man.

The problem of the natural *foci* of a number of diseases, and, therefore, the problem of the study of regional epidemiology, of the possible natural carriers of the viruses and the manner of their transmission and spread in a human community now present themselves to us in a new light.

The successful solution of this problem makes special demands on science, and is also of much practical value. It acquires considerable significance, both as a part of the task of preserving the health of the army and of that of safeguarding the interests of the national economy. The rapid development of industrial centres in new regions, due to the opening up of new territories, makes the latter task particularly important.

As a result of the practical experience gained in war-time our attention has again become centred on the question of the limits of variability of some of the pathogenic micro-organisms. The available evidence leads to the supposition that the variability of some pathogenic micro-organisms might reach such a degree as to cause them to lose their pathogenicity. For this reason, one may be justified, in practice, in classifying such microbial forms with the non-pathogenic species.

The most important problem to be considered in this respect is the possibility of the occurrence, in certain conditions, of a reversal of the process, i.e., of the restoration of all the pathogenic properties of those micro-organisms which had formerly lost their pathogenicity.

The existence of outbreaks of some epidemic diseases, the causes and the onset of which cannot be explained by the known epidemiological laws, furnishes us with valid grounds for reopening and revising the whole problem.

On the strength of the available evidence we are able to assume that those pathogenic possibilities existing potentially in a microbial cell, which had temporarily lost its pathogenicity, might again become evident in insanitary conditions, or as a result of a sharp alteration in the habitual nutritional regimen and in the quality of drinking water. This also might occur when people have become exhausted, and when meteorological conditions favour a sharp lowering of general immunological resistance of men. At the same time, the question naturally arises as to the possibility of a pathogenic micro-organism acquiring the properties of a saprophyte; in other words, of the acquisition by a micro-organism of an ability to persist indefinitely—parallel with its loss of pathogenicity—outside the human or animal body.

No less important, from the practical point of view, is the problem of a gradual change of the microbial flora in the dysenteric group of diseases; this is one which demands urgent solution. Thus for instance, in the course of this war, we have observed a considerable increase of infections caused by the Sonne strain of *Shigella dysenteriae*.

A similar phenomenon has been noted during the last two years by English authors, and the same holds good with regard to the German troops. For this reason, practical epidemiology is sometimes confronted with great difficulties, because the biological products and methods

of active anti-dysentery immunization—and the available 'phages—might not furnish an appropriate specific immunizing and bacteriophage component.

One should note here that exhausted subjects, in the first place, fell victims to this type of dysentery; it is mostly persons suffering from chronic intestinal aberrations who—after a change of their customary diet, drinking water and environmental conditions—develop the disease.

The liquidation of these outbreaks is at times an extremely difficult task, and particularly so in those cases where it is impossible to eliminate completely the insanitary and unfavourable environmental conditions.

We should also deal here, among many other problems of epidemiology which have arisen in time of war, with the problem of *per os* immunization against intestinal infections. It has been shown by practical experience that peror alimmunization according to Besredka's method, with vaccines in the form of tablets prepared according to the methods generally accepted to-day, possesses rather low efficacy. For this reason one is necessarily led to making use of subcutaneous immunization against dysentery with the anavaccine. Yet the subcutaneous method of immunization, and particularly that involving several injections, is unsuitable, despite all its advantages, for employment in war conditions, especially among troops in the field. Apart from a greater degree of post-vaccination reaction in comparison with the peroral method of immunization, it cannot be practically carried out among troops owing to the mobility of field units and the consequent greater or lesser fluidity of their personnel.

Therefore, both the maintenance in the armoury of war-epidemiologists of the peroral method of immunization, and the enhancement of the efficacy of peroral vaccines present a problem which merits considerable attention.

The importance of peroral vaccines acquires an even greater significance when one bears in mind that the immunity they produce develops much more quickly than that induced after subcutaneous immunization. This circumstance assumes very great practical value in the control of outbreaks when the personnel within the spreading focus of an epidemic has to be rapidly immunized.

The paths to be followed in the solution of the problem of peroral immunization have already been mapped out. In considering the problem one has to remember the following facts: (1) Peroral immunization produces an immunity which is not confined to the mucous membrane and the lymphatic apparatus of the intestinal tract alone; and (2) The organism of an inoculated person, owing to contemporary methods of preparation of vaccines in the form of tablets, receives more "slags" (useless ballast) than potent specific antigens. It follows from the foregoing that an alteration of the methods of preparation of tablet-vaccines, ensuring, in full measure, the preservation of the antigenic properties of the initial material, would also enable one to obtain a highly effective vaccine for the purpose of active prophylaxis.

No less important and, for this reason, meriting great attention, is the question of 'phages and the methods of their employment both for prophylactic and therapeutic purposes. Up to the present a great mass of facts has been gathered which has failed, however, to provide a

logical explanation, in the light of existing theories, of the nature of the agent which produces the lysis and of the mechanism of its prophylactic and therapeutic action.

The concepts, according to which a 'phage is regarded as a live active principle, have fully explained, for example, the fact that its lytic power is preserved in very high dilutions of a 'phage preparation; but only as long as this faculty of producing lysis in high dilutions is the "property" of that particular strain of 'phage. On the other hand, these very concepts have failed to explain the sharp decline in the prophylactic and therapeutic effect when diluted 'phages are used.

These concepts have likewise failed to furnish an explanation of the efficacy of large doses of 'phage preparations; a practice which has become widely established, contrary to the small dosage recommended before. It has been shown by practical experience that the dosage of the 'phage introduced into the body exerts an important influence on its efficacy or otherwise, and particularly so in case of phagotherapy. It would seem, if one accepts the above point of view, that the multiplication of 'phage *in vivo* on the corresponding live microbial cells should proceed with great intensity, and that in order to obtain a rapid therapeutic effect, there is no need to introduce large quantities of the lytic principle. Yet this reasoning is not borne out by facts encountered in practice.

The above considerations lead one to the supposition that the active prophylactic and therapeutic principle in the preparations of 'phage is not a live agent ('phage) but some substance, possibly the products of 'phage metabolism, the potency of which decreases in proportion to the degree of dilution of the preparation. It is probable that the lysates of the micro-organisms, containing substances similar to the specific antigen, might be the source of that very principle.

The complete antigens (in particular that of typhoid infection) have been applied in therapeutic practice in the enemy armies. In pre-war Soviet practice there were cases of experimental use of complete antigens.

Another important problem of epidemiology is that relating to the migrations of field rodents, those carriers of many pathogenic microbes and viruses.

If the vast, unprecedented multiplication of rodents, such as rats and mice, in regions adjacent to the front line and in its immediate rear can be explained by the abundance of food in unharvested fields, by the presence of abandoned unthreshed corn stacks, and by the cessation of planned measures for rodent destruction, those mysterious mass migrations of rodents sometimes occurring over large distances still await explanation. Many aspects of this problem have yet to be clarified by epidemiologists; their successful solution would enable us to foresee such mass movements of rodents and to organize in good time suitable prophylactic measures by which the spread and the transmission of a number of epidemic diseases could be prevented.

Many of the epidemiological problems that arise in war-time have already received full scientific and practical solution owing to the concerted efforts of our scientists.

One of the most vital problems in the prophylaxis of typhus is that of active mass-immunization against the disease. This has already been solved, as witnessed by the work of Professor M. K. Krontovskaya, which is included elsewhere in this volume. It has been demonstrated in

practice that vaccination according to Krontovskaya's method prevents the onset of the disease; and that in the case of an infection which has already taken hold of the patient, it considerably diminishes the severity of attack. Inoculated patients who subsequently develop the disease usually pass through an attack without going to bed; complications are extremely infrequent, and mortality becomes reduced to an insignificant level. Extremely important, in this connexion, is the fact that persons who have had an attack of the infection, after being vaccinated with Krontovskaya's vaccine, usually recover without needing the usual lengthy period of convalescence; in the case of an unimmunized person, however, a long period of incapacity for work is entailed.

The inoculated persons, after a short period of fever, are usually able to carry out their ordinary duties almost at once. Yet one should not think that, in this particular field, the goal has already been reached. Numerous observations are still required in order finally to solve a number of problems relating to this new method of active prophylaxis against typhus.

The circumstance that inoculated persons may pass through an attack of the infection without being confined to bed, developing the so-called "walking" type of the disease, possesses an extremely important epidemiological interest; it is obvious that patients suffering from an atypical form of the disease are carriers of the typhus virus.

The availability of a requisite stock of the effective range of insecticides plays an extremely important part in the prophylaxis and control of typhus. During the period of the patriotic war a number of new insecticides has been elaborated and introduced into practice. These include the "albichtol" preparations, new kinds of insecticidal dusting powders, and preparations for the impregnation of underwear. We should note here, in this connexion, the achievements of the Central Disinfection Institute of the Peoples' Commissariat of Health of the U.S.S.R. (the works of F. S. Hanenya and S. V. Zhuravlev) and of the Research Sanitary Institute of the Red Army.

In war conditions circumstances may arise when the prophylaxis of pediculosis by ordinary means such as regular washing, haircutting, and change of underwear becomes almost impossible. On the other hand, if one considers that the territories temporarily occupied by the German-Fascist invaders have been converted into *foci* of various infectious diseases, including typhus, it is clear that the continued offensive of our troops in these regions is fraught with a great danger of outbreaks of infection.

The appearance, in our armoury of weapons for active prophylaxis, of the antiparasitic preparations efficacious in antiepidemic defence is one of our greatest achievements. The Red Army soldier, provided with underwear impregnated with substances precluding the development of pediculosis, is protected to a great extent against possible typhus infection.

It may be fitting to mention here, in passing, that the enemy have no similar individual means for combating pediculosis, and, up till now, they have made no organized attempt to use those means which are at their disposal for such purpose. This is one of the causes of that universal lice infestation from which the Hitlerite army suffers, and which brings in its train a wide dissemination of typhus among their troops.

During the war there has arisen, on an unprecedented scale, the necessity of the mass sanitary treatment of men, of their clothing and their various possessions. An enormous number of disinfecting chambers and laundries has become necessary.

The conditions of the war have at the same time demanded the design and manufacture of new models of such sanitary equipment as could be easily transported over any kind of roads or over a roadless countryside; of equipment which should be light, cheap, constructed from materials which are not in short supply, reliable and easy to operate.

This problem has been attacked by a very large number of workers of the army sanitary services. We may say that we possess at present a great number of different models, both of complicated and of simple sanitary equipment, with the aid of which the important problem of keeping the army in good hygienic condition is easily solved.

We may mention here the "bath-laundry-disinfecting" plant on the Volkhov front; the portable disinfecting installations on the North Western and the Leningrad fronts; the tents—disinfestation chambers on the Western front; the water-heating apparatus on the Kalinin and Southern fronts; the disinfestation furnace of Safonov's system; the water-heating apparatus of the DIOF-18 system; and many others.

We are in a position to record here considerable achievements during the war in the realm of prophylaxis of gastro-intestinal epidemic diseases.

In war conditions troops and population have to be immunized against a number of such infections as typhoid, paratyphoid, dysentery, tetanus, and others. The principle of multiple vaccination, which had been widely used before the war, cannot be applied satisfactorily in war-time. The limited period allowed for the carrying out of vaccination, the mobility of military units, and the fluidity of different groups of population quite often prevent the completion of vaccination that has already been commenced.

Moreover, the number of infections against which persons should be vaccinated is so enormous that, if one were to make use of the ordinary mono- di- and triple-vaccines, the immunized groups of persons would have to be constantly kept under immunization.

The problem of rapid immunization against many infections has received its successful solution in a new polyvalent preparation for mass immunization—the polyvaccine of the Research Institute of Immunology and Serology, which has been called the Risi polyvaccine. This preparation enables one, by means of a single injection, to achieve rapid immunization against many infections of different military formations and groups of population living among widely divergent conditions. According to the available evidence, this method of immunization possesses sufficient efficacy.

Yet even this problem, the problem of active prophylaxis against the gastro-intestinal epidemic diseases, cannot be regarded as completely solved. The polyvalent preparation mentioned above should still be tested to the widest possible extent, and especially in the case of those infections with which we have hitherto had no occasion to deal.

In this field there exists an important problem, both from the scientific and practical viewpoint, which is capable of solution by a concerted effort on the part of our research institutes working jointly with the bacteriological institutes engaged in the manufacture of biological

products and with the laboratories attached to the Red Army. This problem will be made clear if we consider below two well-known facts.

The first fact is the considerable incidence of acute gastro-intestinal diseases, and particularly of dysentery, among the armies of the German-Fascist invaders. The second fact is that this army consists of the troops that saw service in France, Belgium, Holland, Norway, Greece, Poland, Czechoslovakia and Africa. The army consists of German, Italian, Hungarian, Austrian, Rumanian, Spanish, Finnish and other contingents. All this variegated and multi-national mass of troops represents a very large body of carriers with rich dysenteric flora having a variety of local peculiarities; these numerous carriers infect occupied territories of our country, furnishing it with new types of dysentery organisms.

It is probable that those anti-dysentery vaccines and the polyvalent dysentery 'phages prepared from our local strains of the causal agent of dysentery, may, in a number of cases, fail to produce the desired effect—especially in liberated territories. We should, forthwith, begin the study of these new imported strains of dysentery and endeavour gradually to introduce some of the more widely spread strains into the production of polyvalent vaccines and 'phages.

The fate of an infected patient, and of one suffering from dysentery in particular, as well as the character of the epidemic outbreaks of the gastro-intestinal epidemic diseases depend to a great extent on the nutritional condition of troops and population. It cannot be disputed that nutritional disturbances due to deficient and insufficient diets (alimentary dystrophy and avitaminoses) reduce sharply the resistance of the body; and groups of persons so affected furnish a particularly favourable opportunity for the spread of various infections including those involving the intestinal tract.

It is owing to the appearance of the above nutritional disturbances that the dormant chronic tuberculous, dysenteric, and other processes become reactivated. Persons who develop in that condition acute intestinal infections easily become chronic cases increasing thereby the numbers of chronic carriers of infection. The diseases themselves take a grave protracted course and result in a high mortality rate. The suppression of outbreaks of diseases occurring in the above conditions is slow. The use of active 'phages in these conditions produces a most spectacular effect. The latter fact furnishes additional evidence, and this again leads one to the supposition, that their therapeutic effect depends on the nature of the active reaction set up in the infected organism after the administration of 'phage.

In the light of these considerations the problem of a fully balanced diet becomes one of epidemiology; and the discovery of new sources of easily assimilable protein, of new food products rich in vitamins attains additional importance.

The work of our scientists in this field has already yielded important results. Foodstuffs rich in additional proteins and vitamins such as lucerne flour, yeast, wheat germs; vitamin preparations from the needles of coniferous trees, leaves of different plants, and mountain ash berries are being used in ever increasing quantities in daily practice in our country.

Considerable success has been achieved, during the war, in the treatment of dysentery with sulphonamide preparations. This method