flora. Sterilization by chemicals has not been found to be effective on a field scale, as a good penetration into the soil is generally not obtained. Biological control offers a good means of preventing soil-borne diseases. Starving out the pathogen or eliminating it altogether by enhancing the antagonistic activities of the non-pathogenic micro-organisms has been found to be possible by modifications of cultural practices or addition of certain manures as in the case of "Take-all" of wheat and potato scab. Field sanitation is another control measure which is often neglected to the detriment of the cultivator. Certain diseases like wilts are known to render fields unfit for cultivation and others like gram-blight perennate on crop refuse in the field. Debris from an infected crop should, therefore, be destroyed and not allowed to disperse. Rogueing diseased plants in the case of annual crops has not always been found to be beneficial, but has given good results in Plantations. Keeping the land fallow has also given good results in certain cases.

Amendment of soil conditions with a view to exeate unfavourable conditions for the pathogens has been tried with considerable success. Two striking examples are afforded by "Take-all" disease of cereals and root-rot of cotton. In the former case trefoil and Italian rye-grass are intercropped with barley. After barley is harvested in autumn the seeds-mixture grows actively and it is harvested in early winter and ploughed in. During its period of growth the mixture utilizes nitrogen essential for the "Take-all" organism and thus virtually starves it out. If the mixture is ploughed in, it gradually decomposes and liberates nitrogen for the next crop of barley. In the case of root-rot of cotton in the Punjab reduction in field temperature has been obtained by intercropping cotton with *moth* to control the disease. Changing the date of sowing has also proved very effective in controlling this disease. Adjustment of soil reaction by using such chemical substances as sulphur and lime has given successful results as in the case of potato-scab and club-root of clovers, but such methods are generally not practicable on account of the cost involved. Adjusting the soil moisture by giving proper attention to drainage and changing the depth of sowing has in some cases yielded good results, but cannot always be relied upon.

From what has been said about the behaviour of pathogens and control measures it is obvious that, while investigations carried out have cleared many obscure features, there are still more complex ones that require to be elucidated by intensive research involving radical changes in technique and methods of approach. It will be noticed that every one of the farm or garden crops is exposed to attack of some one or other types of soil fungi. The subject of soil pathology has gained importance during recent years. Having attracted the attention of pathologists it offers hopeful signs of solving the diverse pathological problems. For a proper study of these problems, team work of pathologists, soil-chemists, crop-physiologists, geneticists, and agronomists is what is imperatively needed.

SOME ASPECTS OF TUBERCULOSIS IN INDIA AND MEASURES FOR ITS CONTROL*

THE question of Tuberculosis is of vital importance to India at the moment; the defences of the cities against a disease like tuberculosis are yet weak and poor and the author insists that everything should be done to strengthen the defences.

In his Presidential Address, Dr. Soparkar, who has spent more than twenty-five years in the study of the various aspects of the disease both in man and animals, firstly deals with those aspects of tuberculosis which affect animals particularly cattle, because of its intrinsic importance from the agricultural and veterinary standpoint. The second part deals with the disease in relation to its control and eradication in India as it affects human beings.

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* Abstract of Presidential Address delivered by Dr. M. B. Soparkar, before the Section of Medical and Veterinary Sciences, 36th Indian Science Congress, Allahabad, 1949.

Dealing with the tuberculosis among cattle, the author says that as a result of extensive survey it is found that the incidence of infection detected in India is about equal to that found in European countries where bovine tuberculosis is known to be prevalent and even exceeds those in some parts of Europe and America. The author says that if the incidence is based upon results of tuberculin test, it would probably reveal still higher incidence. The strains of tubercle bacilli isolated from cattle in India were found to be as virulent as those of European origin. The Indian cattle as a rule are not known to be infected under natural condition with tubercle bacilli of human type. The characters of the strains isolated were found to be of bovine type except in some isolated cases where the organisms isolated were found to be a mixture of bovine and avian types.

Although cattle are not as susceptible to infection with human type as they are with bovine type, yet they are known to be capable of harbouring this infection and of excreting these bacilli in milk without any gross lesion in the udder. This infection, therefore, if found on investigation to be prevalent among Indian cattle would constitute another source of danger to public health.

Besides cattle, several other species of animals suffer from natural tuberculosis. In the Zoological Gardens in Bombay the author found a large number of animals of different species including Llama, spotted deer, Nilgai, Sambar, antelope, Arabian gazelle, Malayan tapir, suffering from tuberculosis. In view of these findings and chronic course of the disease there is an obvious danger of infection to those who visit the gardens.

Taking up next the subject of the surgical form of tuberculosis the address refers to the meeting of the Second All-India Veterinary Conference held at Calcutta (1923). Major-General (then Colonel) Hutchison stated at the Conference that the so-called surgical form of tuberculosis such as bone and joint tuberculosis, glandular tuberculosis and other closed type of tuberculosis occur in India in the same proportion as in Western Countries and he laid stress upon the necessity of investigating the organism responsible for this form of human tuberculosis in India. The investigations carried out by Dr. Soparkar and others have shown that this type of disease is caused in India except in rare instances—mainly by the human type of tubercle bacilli. These and similar findings would appear to show that the bovine bacillus does not play an important role in the causation of human tuberculosis in India in spite of the high incidence now recorded of the disease among cattle. This is mainly perhaps because of the almost universal practice of boiling milk. Nevertheless a potential danger would remain.

Referring to experiments on immunisation against Johne's disease caused by an acid-fast bacillus closely allied to tubercle bacillus, the address says that intravenous inoculation of cattle with living avian tubercle bacilli has been used for the purpose of prevention. The results of Dr. Soparkar's experiments in this connection suggest the possibility of averting the fatal effects in cattle following upon intravenous inoculation of avian tubercle bacilli, by previous treatment of the animals by subcutaneous method, thus rendering safe the method of preventive inoculation of cattle against Johne's disease by the application of living avain tubercle bacilli.

Discussing the nature of allergic reaction in tuberculosis the paper states that results of experiments have demonstrated the presence of a toxic product and afford a direct experimental proof in support of the hypothesis that in apparently normal skin of tuberculous animals certain substances are present which, when brought in contact with tuberculin, render it toxic so that an inflammatory reaction is produced.

As regards the existence of a filterable form of tubercle bacillus, the author carried out several experiments, and obtained evidence of the existence of a filterable form, probably representing a stage in the evolutionary cycle of the organism.

Turning to the immediate practical problem of the control of tuberculosis in man, the author first deals with the available data regarding the prevalence of tuberculosis in India. He then goes on to discuss the expenditure involved in providing adequate number of beds for the isolation and treatment and after-care of cases, a means adopted in Western countries where the control measure has made good progress. Such measure in India would involve an enormous sum of money which the country under the present circum-

stances can hardly afford. The whole scheme cannot be implemented at once even if funds are available and it will take time before the disease can be controlled to any appreciable degree by adopting this measure. In the meanwhile something must be done and the author suggests that the only solution to the problem appears to be mass immunisation. The method which has been of late widely adopted is preventive vaccination with B.C.G. Experience of over ten million vaccination with B.C.G. has demonstrated the safety and harmlessness of the measure and the protection it affords. After discussing protective value of B.C.G. vaccination and the effect of this vaccination on general infant mortality, the author points out that the Ministry of Health, Government of India, after careful consideration, have come to the conclusion that mass vaccination with B.C.G. will be a cheap and effective method of control. It has been decided to introduce this method at first on a limited scale in a few large centres in the country under the supervision and control of the Central Government.

In conclusion, the author stresses upon the need for further research in this direction and urges the authorities to launch a campaign for the mass vaccination with B.C.G. Given the will and the drive, it will be possible, with proper organisation, the author remarks, to give protection to millions of the population and thus bring this disease under control. N. N. De.

THE PLACE OF PHYSIOLOGY AMONGST THE MODERN SCIENCES AND THE IMPORTANCE OF ITS STUDY TO THE NATION*

Dr. SARKAR in his Presidential Address has described Physiology as the study of the normal working of the delicately adjusted systems and of the various factors belonging both to the internal and the external environments, which influence and modify their activities. The importance of physiological knowledge for the health and welfare of individuals and the nation as a whole is universally recognised. Physiology therefore should be a special subject of study and research. Dr. Sarkar has indicated a few lines along which we should proceed to improve and develop the study of physiology and intensify research in the subject.

Discussing the claim of physiology for being considered as an independent science, the author says that as an independent subject of study, it rests on the tripod, Morphology, Physics and Chemistry. He emphasised that in our country Physiology has to be viewed and fostered as a fundamental subject of importance. It should be developed on proper lines like other important science subjects. It is true that the growth of physiology is inseparably connected with that of medicine. But physiology is not a branch of medicine though it forms one of its principal basic subjects. And as such it forms the solid foundation on which the clinical knowledge is built up. Therefore, the systematic study of physiology should be continued with advantage during the subsequent years in the clinical classes and post-graduate studies in medicine.

Dr. Sarkar suggests that when there are plans for improvement of education for the proper training of high class scientists and technicians in this country, immediate steps should be taken for carefully preparing plans for the improvement of medical curriculum. All the outstanding results of modern progress should be included in the study and it is not a bad idea as Dr. Sarkar points out to provide additional course of study in physiology of a higher standard.

Acknowledging the importance of the study of physiology as advancing our knowledge regarding the working capacity of man under various conditions of stress and strain imposed by modern civilisation, the author says that proper arrangements should be made for training scientists in the theory and practice of some of the highly specialised technical branches of physiology. With this object in view it has to be decided whether physiology should find a place in School and College curriculum. The author sees no reason why elementary physiology should not be introduced in schools as a compulsory subject of study. It should also be included

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* Abstract of Presidential Address delivered by Dr. B. B. Sarkar before the Section of Physiology, 36th Indian Science Congress, Allah abad, 1949.