PARASITOLOGY IN THE MEDICAL CURRICULUM

BY

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The medical student of to-day suffers, as his predecessors did and as his successors probably will, from mental surfeit. Although a certain amount of pruning has been done in some of the older branches of his studies, in others—the more modern—the tendency is always to enlarge and amplify. The aim of those responsible for his education must appear to be to turn him out an expert in all subjects, many of which are destined to benefit him but little as a general practitioner. If the whole medical curriculum is to be regarded as a cultural exercise, then the vast accumulation of facts—jettisoned as no longer useful the moment the examinations are over—may be considered to have some effect in training the mind. It may also be upheld by some that the idea of immediate utility as an aim in training debases true educational values. In view, however, of the remarkable assortment of knowledge which medical students are called upon to incorporate and, if possible, to digest, it is debatable whether intelligence is not stultified and interest numbed by the process of memorizing, on such a large scale, quite superfluous facts. Past sufferers, and present inflictors of suffering in this direction, are in duty bound to consider these matters.

Having made these preliminary observations it may seem temerity to propose, as I am going to do, that the subject of human parasitology should receive attention early in the student's career. The temerity is, however, more apparent than real, because the proposal is not for an additional subject with an additional examination, but merely for the earlier introduction of human parasitology—that is, as a constituent part of the subject of zoology—without additional examination.

Parasitology includes the study of the agents of many diseases which will play an important part in the post-graduate experience of every medical student, and the sooner, in his career as a student, he obtains an insight into the realities of their existence, the better for him as a medical practitioner and for the public which he will be called upon to attend. The animal parasites which are pathogenic to man are by no means neglected in the zoology stage of the curriculum in some of the more up-to-date schools of medicine, and I am simply advancing here arguments which may perhaps contribute to an extension of what appears to be a very sound modern tendency.

In the first place consider briefly the impacts which the subjects of parasitology will make on the ordinary career of the medical man in practice, and it will be possible to estimate whether it is not well worth his while to have an early acquaintance with the subject.

PARASITES PATHOGENIC TO MAN

The animal parasites, which are pathogenic to man, are included in the phyla Protozoa, Platyhelminthes, and Nemathelminthes. Of the phylum Protozoa, the four classes, Rhizopoda, Mastigophora, Sporozoa, and Ciliata, each contains one or more species of pathogenic parasites of human importance. Thus, in the Rhizopoda there is one such parasite, *Endamoeba histolytica*, the cause of amoebic dysentery; in the Mastigophora there are three, *Trypanosoma gambiense*, the cause of human trypanosomiasis or sleeping sickness in Africa, *Trypanosoma cruzi*, the cause of trypanosomiasis in South America, and *Leishmania donovani*, which gives rise to kala-azar; in the Sporozoa we have the three species of malaria parasite of man, *Plasmodium falciparum*, *Plasmodium vivax*, and *Plasmodium malariae*; finally, in the Ciliata, there is *Balantidium coli*, which, though rare in man, when present produces balantidial dysentery.

Of the worm parasites which affect man, we find in the phylum Platyhelminthes two main groups—the tape-

worms and the flukes. To the tapeworms belong the species *Dibothriocephalus latus*, *Taenia solium*, *Taenia saginata*, *Taenia granulosa*, *Hymenolepis nana*, and *Dipylidium caninum*. The adult of each of these species, with the exception of *T. granulosa*, occurs as a parasite in the intestine of man (the adult of *T. granulosa* occurs in dogs). In addition, man is infected by the larval stages of three of these worms—namely, *T. solium* and *T. granulosa*, which give rise respectively to Cysticercus cellulosae and hydatid; and *Hymenolepis nana*, of which the larval form, the cysticercoid, develops in the villi of his small intestine. The trematodes or flukes contain the Bilharzia worms, *B. haematobia*, *B. mansoni*, and *B. japonica*, *Clonorchis sinensis*, and several other parasites.

The phylum Nemathelminthes is remarkable for the number of human pathogenic parasites it embraces. *Ascaris lumbricoides*, the round worm, *Enterobius vermicularis*, the threadworm, *Trichuris trichiura*, the whipworm, *Trichinella spiralis*, the larva of which produces trichinosis, *Ancylostoma duodenale*, and *Necator americanus*, the hookworms, and *Strongyloides stercoralis*, are all pathogenic species which inhabit the intestine of man. Besides these, there are the tissue parasites belonging to the Filarioidea, which have complicated life-histories, involving an insect vector in the case of *Wuchereria bancrofti*, *Loa loa*, *Onchocerca volvulus* and *Dipetalonema perstans*, or a crustacean vector in the case of *Dracunculus medinensis*, the guinea-worm.

From the foregoing it can be seen that no medical practitioner can avoid, at some time in his experience, having to deal with the diagnosis and treatment of disease due to one or other of the animal parasites. It has long been accepted that for anyone proposing to practise in the tropics and subtropics a very considerable knowledge of parasitology is essential. The naval and military services—especially the latter—have from necessity been very progressive in the study of parasitology; the liaison service between this country and the Empire—that is the merchant service—is beginning somewhat belatedly to try to attain an equal standard of efficiency, but a great deal remains to be done. It is not yet sufficiently appreciated, however, that large numbers of cases of serious disease produced by such animal parasites are constantly coming under the observation of medical practitioners in temperate climates. A knowledge of the morphology and life-history of these parasitic organisms is thus essential for all medical men, and the elementary tuition in their structure and habits could usefully be imparted to the student quite early in his career.

THE PLACE OF PARASITOLOGY IN THE CURRICULUM

It may appear unkind to introduce a student in his first year to a subject which bristles with such names as those mentioned above, but it should be borne in mind that names like *Taenia solium* and *Bilharzia mansoni* are not a whit more difficult for him to master than are such names as *Amphioxus lanceolatus* or *Petromyzon fluviatilis*, names which the student may be required to learn by the dozen. Further, it is not going to be a difficult matter for the student to grasp the main points of the life-history of the dysentery parasites or of the parasitic worms, and he will value this knowledge increasingly towards the end of his curriculum. When he reaches his final year the amphistylis arrangement in the Elasmobranchs may well have faded from his consciousness, but if its place has been taken by a definite and less ephemeral knowledge of parasites and parasitic worms which is of practical value to him, he, as a medical graduate, will be the last to complain. The essential methods required for the examination of the pathogenic parasites are not complicated, and the young medical student will find no difficulty in acquiring the technique of preparing films of blood and faeces and the use of Leishman's stain and iodine. The parasites which are found in the blood, intestinal contents, and tissues of the wild rat would serve as a very useful introduction to the pathogenic parasites of man.

Reverting to the subject of utility as an end in education, I would submit that, while utility may be condemned

in the pre-medical career, from the first moment when the career of medicine has been chosen, utility should be the chief and almost the sole criterion of the value of the education given. The real question a teacher of medical students in any branch should ask himself would appear to be "How much of my subject will prove of real practical value to the student at any time?" not "How much of my particular subject can I cram into this fellow in a given time?" Regarded from this point of view I believe that the introduction of elementary parasitology at an early stage in the student's curriculum would prove of the greatest ultimate service to him; the knowledge that he was studying something useful for his after life would be a distinct attraction, while the diverse life-histories of the human parasites would stimulate his imagination, and develop his powers of observation and reasoning in such a way as to give him a vital interest in his studies in the subject of zoology.

CORRECTION OF HEARING DEFECTS

A SURVEY OF TWO YEARS' RESEARCH

We have received the following brief survey of two years of research by the National Institute for the Deaf and the Department of Industrial Physiology of the London School of Hygiene and Tropical Medicine.

The problem of deafness is one which has two aspects—namely, the diagnosis and treatment of the pathological conditions which may be the underlying cause of impaired hearing function, and the correction of the defects in hearing themselves.

While otological science has achieved notable success in dealing with certain diseased conditions of the auditory apparatus, the same cannot be said of the progress made in the correction of functional defects which persist after the signs and symptoms of active disease have disappeared. Deafness following disease, whether it be obstructive deafness or what is known as nerve deafness, is a very real hardship to a patient, and the proper assessment and correction of such defects deserves far more attention from medical men and scientists than has as yet been given. The magnitude and seriousness of the problem facing the medical profession is apparent if we pause and consider the widespread incidence of deafness. According to estimates made by the National Institute for the Deaf, based upon available statistics, there are approximately 3,000,000 people in Great Britain who suffer from some hearing defect in one or both ears. This figure, however, gives an exaggerated idea of how many are incapacitated by deafness to such a degree that they are unable to follow their occupations or partake of the usual amenities of life. Suffice it to say that the number of these is very great, and that most are in need of artificial aids to hearing.

INSTITUTION OF RESEARCH

Early in 1930 a meeting of the medical committee of the National Institute for the Deaf appointed a small subcommittee to inquire into the existing types of electric hearing aids, and ascertain the possibilities of improving them. This subcommittee soon found that nothing could be done without some technical and mechanical methods of assessing the reproducing powers of these instruments, and accordingly appealed to the Ministry of Health, who put the subcommittee in touch with Dr. G. P. Crowden of the Department of Applied Physiology of the London School of Hygiene and Tropical Medicine, who was already conducting research in the detection of deafness in school children.

A research team was formed as a result of this introduction, and care was taken to ensure that due considera-

tion would be given to the teachings of physiology, phonetics, clinical otology, and modern telephone and radio engineering. It was realized from the outset that only by the combined efforts of individuals possessing these special interests could a satisfactory solution of the problem of the correction of defects of hearing be hoped for. The technical part of the research was carried out to a large extent in the Department of Industrial Physiology at the London School of Hygiene and Tropical Medicine.

PROBLEMS INVOLVED

The problems which had to be faced were, in brief, the magnification of sound waves in such a way as to enable deaf or partially deaf persons to hear (a) ordinary sounds, and (b) human speech. The magnification of ordinary sounds has never presented any special difficulties, and need not be considered in a very special way in this short summary. On the other hand, the magnification of human speech is a problem which presents special difficulties when it has to be brought within the hearing capacity of the hard of hearing. Deaf patients desire most of all to hear the speech of others, so as to enter into communication with them, and avoid the isolation which deafness brings.

It was therefore necessary to investigate the following questions:

1. *The Analysis of Speech Sounds.*—In this inquiry the committee owes a debt of gratitude to Harvey Fletcher of the Bell Telephone Research Laboratories of New York, whose book, *Speech and Hearing*, is a recognized standard work on this subject. The committee also received the expert advice of one of its own members, Mr. Stephen Jones, B.Sc., of the Phonetics Department of University College.

2. *A Satisfactory Means of Standardizing Speech Sounds.*—In this field of the work expert help was received from the Western Electric Company, and also from the scientific departments of the Columbia and His Master's Voice Companies. After exploring all avenues on this side of the question, the committee decided to use the 4A audiometer of the Western Electric Company, a decision which was endorsed by all who were called in consultation. By means of this audiometer, gramophone records of speech could be delivered to the microphone of an electric hearing aid—a method first used by Dr. Crowden.

3. *The Reproduction of Notes of Known Frequency and Constant Intensity.*—The necessity for this arises because the analysis of speech sounds by Harvey Fletcher and others shows that fundamental vowel sounds are of low frequency and high intensity, while the overtones which distinguish one vowel sound from another, and the different combinations of frequencies and intensities which distinguish the consonant sounds, are of higher frequency but lower intensity than fundamental vowel sounds; so that it is necessary to know in what way a specified hearing aid magnifies the different frequencies involved, or whether a hearing aid even picks up such frequencies. This investigation was carried out using the "constant note" scientific records of the Parlophone and His Master's Voice Companies played on the Western Electric 4A audiometer, the results being occasionally checked by comparison with the notes and intensities of the Western Electric 2B audiometer.

4. *The Reproduction of Speech Sounds of Varying Measured Intensities.*—This was done by using specially graduated records made by the Western Electric and Columbia Companies for use with the 4A audiometer. These had already been used in this country for detecting early deafness in school children by Dr. Crowden. This work was described in the *Medical Officer* (September 13th, 1930).