Edward Alfred Minchin, M.A., F.R.S.

BORN 1866—DIED 1915.

(PLATE XXVI.)

It was with deep regret that we heard of the death, on 30th September last, of Professor E. A. Minchin, Professor of Protozoology in the University of London.

Minchin was born in 1866. From his birth a constitutional weakness imposed on him physical disabilities, which, however, as he grew up he faced with rare determination and courage, and he permitted them to interfere as little as possible with his many activities. His earlier education was received privately; later he was for a short time at the United Services College, Westward Ho! and at the Bishop Cotton School at Bangalore, having gone out, when about fourteen years of age, to join his parents in India. Debarred from participation in field sports (he was, however, an expert swimmer), Minchin found his recreation and pleasure as a boy in the observation of animal life both in this country and in India, and he continued to the end of his days a keen naturalist.

After some years spent in India, Minchin proceeded to Oxford, took his degree in 1890 with first-class honours in Zoology, and three years later was elected Fellow of Merton College. He was Assistant to Sir Ray Lankester and Demonstrator in Comparative Anatomy at Oxford from 1890 to 1899, and during the years 1898–1899 he was also Lecturer in Biology at Guy's Hospital. In 1899 he was appointed Professor of Zoology in University College, London, and held this post until 1906, when he was elected to the newly established Chair of Protozoology in the University of London, which he held up to the time of his death. This chair was associated with the Lister Institute of Preventive Medicine, where Minchin organised the new department which he directed with conspicuous ability and success. He was elected a Fellow of the Royal Society in 1911.

Minchin had considerable experience of work in laboratories abroad; for instance, in those of Professor O. Bütschli in Heidelberg and of Professor R. Hertwig in Munich, in both of which Institutes the atmosphere was congenial for one interested in cell structure and in the Protozoa. He had also carried out researches in the marine

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zoological stations at Naples, Rovigno, Banyulis-sur-Mer, Roscoff, and Plymouth.

Minchin's contributions to zoological literature, about forty in number, show a thorough grasp of the matters dealt with, for he was a keen observer and critical of his own and of previous work. His published papers bear ample evidence of his infinite patience and of manipulative skill of the highest order, and are models of clear and accurate presentation of results, not only as regards the text, but also in the accompanying illustrations. In all his researches Minchin strove for the highest accuracy possible, and worked with extraordinary skill and patience to secure his object.

His first two papers were published while he was still an undergraduate; the first (1888) was on a new organ in the cockroach (*Periplaneta*); the second (1889) was a note on the embryos of *Aurelia*. In 1892 he published notes on the Cuvierian organs of *Holothuria*, in which he gave the first satisfactory account of the morphology and working of these extraordinary organs. In the same year were issued the first of a long series of papers on sponges—three papers dealing with the histology of *Leucosolenia*. While working at *Holothuria* he had observed certain gregarine parasites therein, and his account of these (1893) was the forerunner of many notable contributions to protozoology. From 1892 to 1898 Minchin wrote eight papers on the anatomy, histology, development, and classification of calcareous sponges, the chief of these being his masterly treatise on the origin and growth of the triradiate and quadriradiate spicules.¹ In 1900 appeared his admirable account of the sponges in Lankester's "Treatise of Zoology." The results of his later researches on sponges formed the subject of eight papers issued from 1905 to 1910.

As already stated, Minchin's first paper on Protozoa—on the Gregarines of Holothurians—appeared in 1893.² In the following year was published his translation of Bütschli's "Untersuchungen über mikroskopische Schäume im Protoplasma," giving an account of Bütschli's investigations on foams and of his theory of the alveolar structure of protoplasm. For the next few years Minchin's energies were devoted chiefly to the study of sponges, but in the later part of this period he worked assiduously on his memoir on the Sporozoa, which was published as part of Lankester's "Treatise of Zoology" in 1903. This was at once recognised as a masterly work, admirable alike in its method and presentation, showing the author's grasp of the subject and his critical and detailed knowledge of the literature. This treatise on the Sporozoa was for some years the best account extant, and was of the greatest service to all workers on this class of organisms.

In 1905 Minchin went to Uganda as a member of the Special

¹ *Quart. Journ. Micr. Sc.*, London, 1898, vol. xl.

² *Ibid.*, vol. xxxiv.

Commission of the Tropical Diseases Committee of the Royal Society, which was sent out in order to investigate the relation of the tsetse-fly (*Glossina palpalis*) to the trypanosome (*T. gambiense*) of sleeping sickness. With characteristic thoroughness he set himself at once to investigate the anatomy of the tsetse-fly, and an account, with useful figures, of its alimentary canal, its specialised reproductive organs, and its nervous and vascular systems was published the same year.¹ The Commission demonstrated the important fact that the tsetse-fly was also the host of certain "wild" trypanosomes which had nothing to do with *T. gambiense*,—having an entirely different origin. Soon after his return from Uganda, Minchin became Professor of Protozoology, and on settling down at the Lister Institute he commenced to work out the material he had brought back from Uganda, and from this time his researches were almost entirely upon the structure and life history of trypanosomes. He discovered and described² all the stages in the encystation of *Trypanosoma grayi*, the principal "wild-fly" trypanosome. These observations suggested the likelihood of the occurrence, in some cases, of a contaminative method of infection of a new vertebrate host, as contrasted with the inoculative method found to take place in the case of *T. gambiense* carried by the tsetse-fly. In 1908 Minchin published a full account³ of the results of his observations in Uganda on the forms of *T. gambiense* and the changes exhibited by this trypanosome in the gut of the tsetse-fly up to the end of the fourth day, by which time the trypanosomes had disappeared in all his flies. (It was during the following year that the discovery was made that the trypanosomes become established and are able to complete their cycle of changes in only a small percentage of the tsetse-flies which have fed on an infected host.) His next studies were on the flagellates in the blood of fresh-water fishes,⁴ in which he gave an account of several species of *Trypanosoma* and *Trypanoplasma*, and pointed out the advantages of a more careful technique in the study of these organisms. In a well-known memoir⁵ published later in the same year, on the structure of *Trypanosoma lewisi* in relation to microscopic technique, Minchin summarised in a most useful manner his wide experience in the technique of hæmoflagellates. Up to this time blood smears had almost invariably been made on glass slides, dried in air, and stained. He pointed out the deformation produced by drying, and that such deformation could be avoided if the smear be fixed, before it has time to become dry, in the vapour of osmic acid. He found that the best results were obtained by making the smears on cover-glasses, followed immediately by fixation in the vapour of osmic acid, placing in absolute

¹ *Proc. Roy. Soc. London*, (B), vol. lxxvi.

² *Ibid.*, (B), 1907, vol. lxxix.

³ *Quart. Journ. Micr. Sc.*, London, vol. lii.

⁴ *Proc. Zool. Soc. London*, 1909.

⁵ *Quart. Journ. Micr. Sc.*, London, vol. lii.

alcohol and subsequently staining by Giemsa's stain or by iron-hæmatoxylin. The various effects of different stains on the trypanosome were described, *e.g.*, the tendency to deposition of the red constituent of Romanowsky not only in but around certain structures, for instance, the nucleus, kinetonucleus, and flagellum, causing them to appear larger or thicker than they actually are.

Minchin's *magnum opus*, carried out in collaboration with Dr. J. D. Thomson, was the study of *Trypanosoma lewisi* of the rat in its relation to the rat-flea. This work (230 pp. 10 plates),¹ the investigations in connection with which extended over five years, was published in January 1915, and it may be safely said that it will rank as the classical study of the life-cycle of a trypanosome in its invertebrate host. The authors dissected more than 1600 fleas, and the drawings of the stages of development of the trypanosome, given on the ten double plates illustrating the memoir, were selected from 700 drawings made during the progress of the work. The most striking feature of the history of *T. lewisi* in the flea is the intracellular phase, *i.e.*, the entry of a trypanosome into an epithelial cell of the stomach and its division into eight daughter trypanosomes, which eventually lie free in the exhausted cell from which they subsequently escape and either penetrate another cell, repeating the multiplicative phase, or pass through the pylorus and down the intestine to the rectum to give rise there to the crithidial phase from which the final trypanosome form is produced. Arising out of this research was an interesting paper² on certain points in the anatomy of the rat-flea, based on what Minchin termed his "needle-work"—the numerous dissections of the flea done with the aid of fine needles.

In the intervals of his investigations on trypanosomes, Minchin found time to write his "Introduction to the Study of the Protozoa" (1912). This book, written with special reference to the parasitic forms and with the needs of medical men in view, contains a critical and well-balanced account of what is at present known about the structure and biology of the Protozoa, especially parasitic forms, and its method and philosophical character aptly illustrate the author's comprehensive grasp of the whole subject and its connections.

Minchin's last contribution to the literature of Protozoa is a short paper on the much discussed subject of the nature and significance of the "infective granules" of Protozoa.³ He compared the formation of "granules" in trypanosomes and hæmogregarines with the endogenous budding which occurs in a species of amœba, and concluded that the two phenomena present essential similarity and homology.

During the last four or five years Minchin's interest had been particularly drawn to one of the fundamental problems of biology—

¹ *Quart. Journ. Micr. Sc.*, London, vol. lx.

² *Journ. Quekett Micr. Club*, April 1915.

³ *Ann. de l'Inst. Pasteur*, Paris, 1915, tome xxix. p. 537.

the earliest form and constitution of living matter. He gave an account of his views in an address delivered to the Quekett Microscopical Club in 1911, and in a discussion in which he took part at the meeting of the British Association in 1912, and his last work—his presidential address to Section D of the meeting of the British Association held in Manchester in September 1915—was devoted entirely to this subject. This address is, in especial measure, an example of Minchin's lucidity and grace of treatment of his subject. Although he was far from well when he was engaged upon the preparation of the address, he nevertheless hoped to be able to deliver it, and it was a keen disappointment to him that he could not be present at the meeting, owing to the rapid development of the illness which so soon afterwards brought his brilliant career to an end.

Minchin was a man of cultured intellect and had a keen and scholarly appreciation of literature both ancient and modern. The charm of his personal character and his innate modesty and gentleness won for him the deep regard of his friends, while his helpfulness in criticism and his readiness in placing his wide knowledge of literature and technique at the service of his fellow-workers have made many his debtors.

J. H. ASHWORTH.