



PROFESSOR J. S. ALEXANDROWICZ

(Facing p. 1007)

OBITUARY

PROFESSOR J. S. ALEXANDROWICZ

Prof. Jerzy Stanislaw Alexandrowicz, who died at Plymouth on 28 October 1970, was one of the most distinguished histologists of the nervous system, whose series of memoirs upon invertebrate peripheral nervous systems stimulated much physiological and histological research. He was born at Stoczki, in Poland, on 2 August 1886, and after matriculating in Warsaw studied medicine and natural science at the universities of Warsaw, Zurich, Munich, Heidelberg, Paris and Jena. He took his Ph.D. at Zurich under Lang, and his M.D. at Jena, under Biedermann, serving for a short period as a surgeon in the Military hospital at Belgrade, before being appointed to the department of descriptive anatomy at Wilno. He remained here during the war, and in 1918 served with the field hospitals coping with epidemic diseases brought to Poland from the East. He himself survived an attack of typhus. In 1919 he was appointed to organize and direct the department of descriptive anatomy at Wilno, and the next year rejoined the army to serve as the chief medical officer of a cavalry regiment in the fighting against Russia.

In 1920 he returned to Wilno, as head of the department of histology, and remained there until 1929, when he moved to Lwow, again as director of the department of histology, in the Academy of Veterinary medicine. In 1933 he became Pro-Rector of the Academy, and in 1936 Rector, finally leaving the university in 1937 to head the scientific and university department of the Ministry of Education. He quickly became Under-secretary of State for Education, and in 1938 relinquished this post to spend six months at the Stazione Zoologica, Naples, where he had previously worked on three occasions.

He was mobilized on 1 September 1939 and joined his regiment whilst Warsaw was under German bombardment; by the end of the month he had fallen into Russian hands and been sent to a concentration camp. In later years his only reference to this experience was to aver that his freedom from rheumatism was probably due to having slept in a bed by a glassless window, awakening each morning to find his bed covered in snow. In 1941 the Russians released most of their Polish prisoners who were still alive and Alexandrowicz joined the Polish army units organized in Russia under General Anders. Eventually this army moved to Persia. He served throughout the Middle East and Italy, becoming chief education officer of the 2nd Polish Corps with the rank of Colonel.

In 1946 the Corps came to England and in 1948 he left the Army and took a job as a farm labourer in Hertfordshire. He wrote to his friends the Dohrns at Naples and this led to Rheinhardt Dohrn contacting Munro Fox and Pantin at Cambridge to let them know Alexandrowicz's situation. He was employed for a short time at the zoology department at Cambridge as a gardener (a device to enable him to begin scientific work again). In 1949 Munro Fox brought these facts to the notice of Sir Frederick S. Russell, then Director of the Plymouth Laboratory, who was able to appoint Alexandrowicz in a temporary technician's post to look after the laboratory's microscopes and histological

material. This gave time for arrangements to be made with the Treasury to create a special post on the research staff. Thus began his long and remarkable sojourn at Plymouth, during which he 'retired' from the staff in 1957 and was then supported until his death by grants from the Royal Society. During his scientific career, which was interrupted by two world wars, he had worked outside Poland at Villefranche, Roscoff, Plymouth (in 1930 as well as later) and at Naples. He published 39 papers, no less than 25 of these after reaching the age of 65, and at the time of his death was working on two further papers, one of which will appear in a future number of this Journal.

His work was concerned almost entirely with the organization of the nervous system in Crustacea and Mollusca, which he investigated with simple techniques employed with unrivalled skill. Unlike Ramon y Cajal (with whom he corresponded) or Golgi, Alexandrowicz did not originate any new neurological methods. Instead, like Retzius, he applied and modified those devised by others, in particular the supravital methylene blue stain of Ehrlich, a method with which his skill was legendary. Many histologists and physiologists visited him at Plymouth to examine his extraordinarily beautiful mounted preparations and to learn from him his technique with methylene blue.

His method of work was very characteristic. Whatever the object of his study, his first concern was to amass preparations. Great pains were taken to vary the method of staining with methylene blue, for example, staining sometimes in a damp chamber at other times injecting the dye, fixing in different ways, and so on. This resulted in a great accumulation of preparations, over a long period, until he was satisfied that the outlines, at least, of the problem had been clarified. Resort was then sometimes had to sections, usually stained with Azan or Bodian's silver, and to Bodian, Cajal, and Cajal-Schultze silver whole mounts. The very large Cajal-Schultze whole mounts of cephalopod material were amongst the most remarkable silver preparations ever made, astonishing in their transparency and fineness of impregnation.

Many hundreds of preparations, each involving hours of dissection of the stained preparations, in addition to the time spent in the initial staining, formed the basis for each of Alexandrowicz's papers. It is not surprising that the process might take years, and that he disliked preliminary communications, only publishing when he felt that he had made a reasonable contribution to a problem.

Sometimes, during the course of work on a particular problem, a novel structure would be observed, and put aside until the original work was finished. Thus, the muscle receptor organs of arthropods, the MRO's, were first observed in 1930, during the course of work at Naples on the heart of *Squilla*. They were studied at Naples in 1939, but the material and notes were lost during the war, and they were not described until 1951, after Alexandrowicz had returned to the problem at Plymouth in 1949. This long delay was in part due to the war, but a similar period of collecting preparations characterized his final work, which he had almost finished when he died. He had observed novel structures in the legs of hermit crabs in 1930, and mentioned them in a work on another receptor in decapods in 1957. He returned to the problem in 1966 and was writing up in 1970.

Such a slow meticulous approach gave any statement made in his papers unusual authority, and set an exceptionally high standard in the field of invertebrate neuro-

anatomy. It also had the consequence that many workers before publishing their own papers or texts would send drafts to Alexandrowicz, who spent much time in detailed criticism. His own papers were written most painstakingly; for example, he read anatomy texts in order to ensure that his own descriptions of muscles and their insertions were clear and unambiguous. He collected note-books full of happy phrases and examples of style which he had admired in scientific writings, and as a result his papers exhibit a vocabulary unusual even for a scientist writing in his native tongue.

His first paper appeared in 1909 and dealt with the innervation of the crustacean gut; this was followed by a series of papers dealing mainly with the innervation of the heart in arthropods, and with the wonderfully complex peripheral nervous system of cephalopods. After the second war, at Plymouth, he returned on occasion to the innervation of the crustacean heart (he was at work on the heart of *Leander* at his death), but he devoted his main efforts to the study of crustacean proprioceptors and to different aspects of the cephalopod nervous system. The first paper after the war, in which the muscle receptor organs of decapods were described, was at once recognized to reveal neurons of a size and accessibility to make them peculiarly suitable for physiological investigation, and they were intensively studied. These investigations supplied much information on neuron function, in particular upon receptor mechanisms, impulse generation, and synaptic inhibition, and upon the role of proprioceptors in the control of posture. Since then numerous papers have been published dealing with these organs. In the same way, publication of work (with M. Whitear) on receptors in the coxal region of decapods (in 1957) led to the interesting discovery that their large sensory fibres do not propagate action potentials. Curiously enough, this investigation was undertaken at the instance of a physiologist who wrote to Alexandrowicz pointing out that his experimental results implied the presence of proprioceptors at the coxal joints, and that the anatomy of the region would be worth investigation. As a rule, histology came first, and the publication of a paper by Alexandrowicz led to a series of physiological investigations by others of the organs which he had revealed.

Alexandrowicz himself was most satisfied with his 1927 memoir on the cephalopod eye, but he was very self-critical and always conscious of defects in what to others was work of great originality and merit. He had received the medal of the Polish Academy of Science before the war; and in later years he was fortunate in being given in full measure what he valued most, assurances of the respect and admiration of histologists and physiologists working on the nervous system. His work was especially admired in America, and he was particularly touched when, in 1961, many American physiologists joined to send him a number of books on his 75th birthday, as a token of their regard and of the debt that they owed to his histological work.

In later years at Plymouth, Alexandrowicz was a most stimulating and entertaining companion, retaining much of the stamina and zest for life which had always characterized him. Like Peacock, he taught himself Spanish in old age; he already was fluent in six other European languages, and read very widely. Outside scientific work, his interests were catholic: music, comparative religion, driving and maintaining his car, and feminine company. Even in his last years, when his research time had become most precious to him, he spent much time with visitors to the Laboratory, taking them for

trips in his car to show them something of Dartmoor, as well as helping them in the laboratory.

It was typical of him that he once remarked to a colleague sitting beside him in his car 'Do you know why I don't drive this car any faster?', supplying the answer 'Because it won't go any faster' with some regret. But his most remarkable characteristic was his readiness to accept new ideas, try new techniques, and the ability to abandon long-held hypotheses. He began electron microscopy at the age of 78 and only stopped work on the ultrastructure of cephalopods when he found that a younger worker had independently chosen the same problem.

He lived simply, latterly cooking for himself in the laboratory, and living in digs close by. Until his final illness he was very rarely away from the laboratory, and usually worked until 11.30 or so each evening. This simple way of life enabled him to give monies to individuals and charities, and to assist his remaining relatives in Poland. As F. S. Russell has said, Alexandrowicz was a man of high scientific distinction who had a nobility of character that gave inspiration to many; he set himself, and judged others by, very high standards. In his life, Alexandrowicz had suffered much - his wife, who had nursed him through an attack of typhus, was killed in the bombing of Warsaw; he lost all his possessions and his scientific notes and preparations, he endured the rigours of a Russian concentration camp, and felt he could not return to his native land after the war. Yet he was always cheerful in adversity and never grumbled. He strove to finish his final contribution on crustacean proprioceptors during his short final illness, and was working on the day of his death. He was cremated at Plymouth and his ashes taken back to Poland, after a memorial service at the Brompton oratory.

Q. BONE

COLLECTED PAPERS BY DR J. S. ALEXANDROWICZ

1. Zur Kenntnis des Sympathischen Nervensystems der Crustaceen. *Jena. Z. Naturw.*, Bd. 45, pp. 1-50, 1909.
2. O autonomicznych aparatach nerwowych. (Polish.) *Wszechswiat*, 1910.
3. Beiträge zur vergleichenden Physiologie der Verdauung. VI. Zur Kenntnis der Cellulose und des celluloselösenden Fermentes im Hepatopankreassaft der Schnecke (*Helix pomatia*). *Arch. ges. Physiol.*, Bd. 150, pp. 57-86, 1913.
4. Zur Kenntnis des sympathischen Nervensystems einiger Wirbellosen. *Z. allg. Physiol.* Bd. 14, pp. 358-76, 1913.
5. The innervation of the heart of the cockroach (*Periplaneta orientalis*). *J. comp. Neurol.*, Vol. 41, pp. 291-309, 1926.
6. Contribution à l'étude des muscles, des nerfs et du mécanisme de l'accommodation de l'œil des Céphalopodes. *Archs Zool. exp. gén.*, T. 66, pp. 71-134, 1927.
7. Sur l'innervation des vaisseaux sanguins des Céphalopodes. *C. r. Séanc. Soc. Biol.*, T. 99, pp. 1015-16, 1928.
8. Sur la fonction des muscles intrinsèques de l'œil des Céphalopodes. *C. r. Séanc. Soc. Biol.*, T. 99, pp. 1161-3, 1928.
9. Notes sur l'innervation du tube digestif des Céphalopodes. *Archs Zool. exp. gén.*, T. 67, pp. 69-90, 1928.
10. Badania nad unerwieniem serca raka (*Potamobius astacus*). [Recherches sur l'innervation du cœur de l'Écrevisse (*Potamobius astacus*).] *Folia morph.*, Vol. 1, pp. 37-68, 1929.
11. Quelques expériences sur le fonctionnement du système nerveux du cœur des Crustacés Isopodes. *C. r. Séanc. Soc. Biol.*, T. 108, pp. 1270-2, 1931.
12. The innervation of the heart of the Crustacea. I. Decapoda. *Q. Jl microsc. Sci.*, Vol. 75, pp. 181-249, 1932.

13. Innervation des branchies de *Squilla mantis*. *Archs Zool. exp. gén.*, T. 75, pp. 21-34, 1933.
14. The innervation of the heart of Crustacea. II. Stomatopoda. *Q. Jl microsc. Sci.*, Vol. 76, pp. 511-48, 1934.
15. Anomalie podziału komórek i ich możliwy wpływ na rozwój pennych cech indywidualnych. 9 pp. *Polska Gaz. lek.*, No. 44, Rok. 15, 1936.
16. Muscle receptor organs in the abdomen of *Homarus vulgaris* and *Palinurus vulgaris*. *Q. Jl microsc. Sci.*, Vol. 92, pp. 163-99, 1951.
17. Lymphocystis tumours in the red mullet (*Mullus surmuletus* L.). *J. mar. biol. Ass. U.K.*, Vol. 30, pp. 315-32, 1951.
18. Receptor elements in the thoracic muscles of *Homarus vulgaris* and *Palinurus vulgaris*. *Q. Jl microsc. Sci.*, Vol. 93, pp. 315-46, 1952.
19. Innervation of the heart of *Ligia oceanica*. *J. mar. biol. Ass. U.K.*, Vol. 31, pp. 85-96, 1952.
20. Muscle receptor organs in the Paguridae. *J. mar. biol. Ass. U.K.*, Vol. 31, pp. 277-86, 1952.
21. Notes on the nervous system in the Stomatopoda. I. The system of median connectives. *Pubbl. Staz. zool. Napoli*, Vol. 23, pp. 201-14, 1952.
22. Nervous organs in the pericardial cavity of the decapod Crustacea. *J. mar. biol. Ass. U.K.*, Vol. 31, pp. 563-80, 1953.
23. Notes on the nervous system in the Stomatopoda. II: The system of dorsal trunks. III: Small nerve cells in motor nerves. *Pubbl. Staz. zool. Napoli*, Vol. 24, pp. 29-45, 1953.
24. Some experiments on the function of the pericardial organs in Crustacea. *J. mar. biol. Ass. U.K.*, Vol. 32, pp. 175-92, 1953.
25. Innervation of an amphipod heart. *J. mar. biol. Ass. U.K.*, Vol. 33, pp. 709-19, 1954.
26. Notes on the nervous system in the Stomatopoda. IV. Muscle receptor organs. *Pubbl. Staz. zool. Napoli*, Vol. 25, pp. 94-111, 1953.
27. Innervation of the heart of *Praunus flexuosus* (Mysidacea). *J. mar. biol. Ass. U.K.*, Vol. 34, pp. 47-53, 1955.
28. Receptor elements in the muscles of *Leander serratus*. *J. mar. biol. Ass. U.K.*, Vol. 35, pp. 129-44, 1956.
29. Notes on the nervous system in the Stomatopoda. V. The various types of sensory nerve cells. *Pubbl. Staz. zool. Napoli*, Vol. 29, pp. 213-25, 1957.
30. Receptor elements in the coxal region of Decapoda Crustacea. *J. mar. biol. Ass. U.K.*, Vol. 36, pp. 603-28, 1957. (With M. Whitear.)
31. Further observations on proprioceptors in Crustacea and a hypothesis about their function. *J. mar. biol. Ass. U.K.*, Vol. 37, pp. 379-96, 1958.
32. Innervation of the heart of *Sepia officinalis*. *Acta zool., Stockh.*, Vol. 41, pp. 65-100, 1960.
33. A muscle receptor organ in *Eledone cirrhosa*. *J. mar. biol. Ass. U.K.*, Vol. 39, pp. 419-31, 1960.
34. An accessory organ of the circulatory system in *Sepia* and *Loligo*. *J. mar. biol. Ass. U.K.*, Vol. 42, pp. 405-18, 1962.
35. A pulsating ganglion in the Octopoda. *Proc. R. Soc. B*, Vol. 157, pp. 562-73, 1963.
36. The neurosecretory system of the vena cava in Cephalopoda. I. *Eledone cirrosa*. *J. mar. biol. Ass. U.K.*, Vol. 44, pp. 111-32, 1964.
37. The neurosecretory system of the vena cava in Cephalopoda. II. *Sepia officinalis* and *Octopus vulgaris*. *J. mar. biol. Ass. U.K.*, Vol. 45, pp. 209-28, 1965.
38. Receptor organs in thoracic and abdominal muscles of Crustacea. *Biol. Rev.*, Vol. 42, pp. 288-326, 1967.
39. Receptor organs in the coxal region of *Palinurus vulgaris*. *J. mar. biol. Ass. U.K.*, Vol. 47, pp. 415-32, 1967.
40. The comparative anatomy of leg proprioceptors in some decapod Crustacea. *J. mar. biol. Ass. U.K.*, Vol. 52 (in press).