effort to discover new deposits and help to increase the output from those already being exploited. The production of motor fuel from coal and shale of the Urals, Karaganda and the Far East occupies an important place in the plan of work.

Among eminent Soviet men of science who are engaged on the problem of mobilizing the country's natural resources, under the direction of Vladimir Komarov, president of the Academy of Sciences, are Alexander Fersman, Vladimir Obruchev, Alexander Skochinsky, Pavel Stepanov, Lev Shevyakov and Alexander Zavaritsky.

No less important a place in the Academy's plan is held by the problem of increasing the yield of cereal and industrial crops, such as rubber-bearing plants, cotton, sugarbeet, and potato; and also the manufacture of artificial fertilizers. The working out of new industrial processes and the intensification of existing processes constitute the central item in the plans of the Department of Technological Sciences of the Academy. Considerable attention will be devoted to the development of the power resources of the eastern regions of the country so as to ensure an adequate supply to the new industrial areas. Efforts will be made to improve industrial gas generating stations, and also to put the gasification of new forms of fuel on an industrial footing, utilizing sources available in various localities and thus obviating the necessity for long hauls of fuel. This will involve working out the principles of design of highly efficient gas-generating installations. The Department will also deal with problems connected with the economic restoration of the liberated regions.

In chemistry, work will be concentrated this year on industrial utilization of raw materials in the eastern regions, and the manufacture of synthetic rubber, plastics, pharmaceutical preparations, etc. The Institute of Chemical Physics will continue the study of the theory of combustion, which is of cardinal importance in the design of prime movers. Alexander Porai-Koshitz will direct researches into the utilization of the chemical products of coke in industrial plants of the eastern regions. Peter Kapitza will continue his work on the design of a powerful machine for making liquid oxygen.

The work of biologists will include investigations on the healing of wounds, and also on the prevention of infectious diseases. It is proposed to treat shock and tetanus on a wide scale by the method of Lina Stern, of the Academy of Sciences, which involves influencing nerve centres by spinal injections. Efforts will be made to discover more effective blood-clotting substances, stimulants, pain-relieving and fatigue-relieving substances.

Historians will engage on a number of interesting investigations, including the history of various nations—the Slavonic history of wars and international relations, the history of the second World War, the history of Russian culture and a chronicle of the present Soviet-German War will occupy chief place. The Department of Languages and Literature is compiling a work on language changes during the present War, a dictionary of modern Russian edited by Sergei Obnorsky, and a study of the mutual influence of Russian and English literature in the nineteenth and twentieth centuries.

The programme of work I have outlined was endorsed by the council of the Academy of Sciences at a meeting held in Moscow under the chairmanship of the president, Vladimir Komarov.

OBITUARIES

Prof. Arthur Willey, F.R.S.

DR. ARTHUR WILLEY, emeritus professor of zoology in McGill University, Montreal, died on December 26. He was the son of the Rev. William Willey, a leading minister of the west of England. After education at Kingswood School, Bath, he proceeded to University College, London, where in his second year he worked in Lankester's research laboratory. After taking his degree he was sent to the Stazione Zoologica, Naples, where he did research on Tunicates and Amphioxus, afterwards returning to the College as fellow.

Amphioxus was reinvestigated by Willey from every aspect, as it was a key animal in the controversies on the ancestry of vertebrates. In opposition to Cuvier's four types of structure, Saint-Hilaire sought a unity of plan homologizing insects and vertebrates, Leydig especially comparing their brains. Kowalevsky followed in 1866 with researches on Amphioxus, but in 1875 Semper and Dohrn independently maintained an annelid ancestry for vertebrates. In the early nineties most schools of zoology seriously discussed all these views, but in 1894 Willey's book, "Amphioxus and the Ancestry of the Vertebrates", caused almost a revolution. He had tried his matter out in a course of lectures at University College, when he had insisted on his practical work including every stage in the development and structure of Amphioxus in comparison with Ammocœtes.

At this time the leading zoologists of Great Britain became excited about the Pearly Nautilus. This "pre-tertiary creation" had been re-examined by Graham Kerr, following on work by Ihering and Ray Lankester, and a knowledge of its embryology was desired. To this end the managers of the Cambridge Balfour Fund elected Willey their student and continued him for five years. Nautilus had first been described by the great Dutch naturalist Rumphius, together with many Malayan 'plant animals'. Owen was excited by the anatomy of a later specimen, but Cuvier did not live to see it in the flesh. Its shell had been known from the time of Aristotle, but it was always compared with that of the argonaut, which floats on the sea-surface in connexion with the development of its eggs. It was supposed to be related to Spirula, the soft parts of which were equally scarce, although its shell is common on tropical beaches. This form, however, has a floating life with a shell that has been reduced to a minimal weight and size and has become almost internal, whereas Nautilus is a ground feeder in comparatively deep water with an immense shell, the animal being in a terminal chamber out of which its crawling and feeding tentacles protrude; its flattened shell is held upright on the ground. Specimens which had floated to the surface, on which the early anatomy had been studied, were mostly moribund. Willey trapped specimens in relatively deep water; the bait was mashed-up crayfish wrapped in coconut fibre so as to be invisible to the animal, which proved to be attracted by smell, its pinhole eye not being the efficient eye of most cuttle fish. The necessary breeding for the embryology did not succeed with the means at Willey's disposal, but the anatomical account published in the "Zoological Results" of his expedition is classical.

The scene of Willey's first labours was in Blanche Bay, New Britain, now known as Rabaul. It is a

circular rocky bay open to the east; a camp was pitched on an island erupted in 1878. The floor at 50 fm. and deeper was ridged by lava lines with deep chasms between, the feeding ground of Nautilus. A coconut plantation covered the low ground and was an oasis of civilization due to Parkinson, almost a 'king'. The island had been partially subdued by that warlike missionary, George Brown, but conditions were primitive in the extreme, the natives still in the stone age, and Willey was in constant danger, but at all times quite imperturbable. Here in the primitive native canoes with a 'boy' or two, he went out day by day, laying his baskets, hand trawling and sweeping his surface nets, returning to an open shelter and cooking his taro, breadfruit or yam with an occasional fish, a tunicate flavour often added from his experimental colonies. New Guinea, to which he went next, was even worse, the natives being flesh rather than fish eaters. It was alleviated by the purchase of a small sailing cutter. The D'Entrecasteau and Conflict Groups were visited and Willey was anchored off Buna for some time.

When sailing, one of the boys jumped overboard to secure a floating cuttle bone and off this, when placed in a pan of water, were secured quite a number of organisms, including some which could both crawl and swim. These proved to be Ctenoplana, a single specimen of which had been described in 1886. As it crawls it is a flatworm, and as it swims a ctenophore, transparent and provided with swimming plates. This important intermediate form, later worked out in Haswell's laboratory at Sydney, made up for many disappointments. There was also a lancelet, Asymmetron, previously caught only in the Bahamas but now known to be cosmopolitan.

New Guinea proving unsuitable for Nautilus, a move was made via New Caledonia to the Loyalty Islands in the New Hebrides, even then governed by a condominium between France and England. Off Noumea, an enteropneust, Ptycodera, was found; this with later specimens was the subject of a long memoir, a comparison with West Indian forms and Amphioxus. A settlement was finally made at Sandal Bay, Lifu, and here for eight months Willey tried to make his Nautilus breed, but its heavily yoked eggs were always infertile. The island population (7,000) were enjoying the everlasting Catholic v. Protestant fights, and so far as the French authorities were concerned there was, as usual, little generosity. Land as well as marine animals were collected and on these more than thirty memoirs were published in the "Zoological Results". Willey's special contribution among these was on a primitive beast from Rabaul, *Peripatus novæ-britanniæ*; this gave him great pleasure as he had an unbounded admiration for F. M. Balfour, whose classical memoir on *Peripatus capensis* he greatly admired. A further visit to New Britain terminated two years of field research.

On his return, Willey became lecturer in biology at Guy's Hospital, London, and he was shortly after elected to the Royal Society. He did not like this soul-killing job, and social conditions in England were to him unpleasant, while the climate was anathema. He was hence glad to go to Colombo as director of its Museum, a post he held from 1902 until 1910. Here in Ceylon he found a fauna little known except for Kelaart's Prodromus, 1892. He supposed he would find many animals peculiar to the island and a fauna comparable to the flora as described by Tennant and Trimen. He set out to examine the mammals but found no important forms not already known from southern India. The phenomena of endemicity were best represented in the reptiles, now being monographed by Deraniyagala. The fauna is analogous with those of Great Britain and Tasmania in relation to their neighbouring continents, but there proved to be relationship to the East Indies. Educational requirements were the subject of several reports, as also the sea and freshwater fisheries and various molluscs. The Museum began to take a scientific shape, no longer merely a collection of curiosities. It was an uphill job at first, the attitude of the ruling authorities being deplorable, while collectors seldom appreciated the necessity of accurate data. The *Spolia Zeylanica* was founded as a quarterly journal, since when zoology in Ceylon has never looked back. Willey's own researches wandered into the marine worms connected with the pearl banks. As an amusement he was collecting data for a book, "Convergence in Evolution", which at the time created great interest among students, stimulating the closer study of the living forms.

In 1911 Willey commenced his courses at the McGill University, where he remained for the rest of his life. From here he always wrote happily of his teaching and life in the University—and as an adopted son of Canada. He had a research interest which wandered into every side of animal life, plankton, placentation in the beaver, Branchioderma and Branchiotrema, general marine conditions, Arctic Copepoda and even a research on "Reductions and Reversions in the Wing Venation of the Stoneflies". He was called upon to advise on many economic sides, and Macallum paid high tribute to the value of his opinion. The University Club especially interested him, and with age he became less sensitive and retiring, while preserving a pleasant liveliness in disposition. He acquired a solid popularity, for he was always dependable. J. S. GARDINER.

Prof. F. M. Cornford, F.B.A.

PROF. F. M. CORNFORD, who died at Cambridge on January 2, at the age of sixty-eight, was the first occupant of the chair of ancient philosophy established there in 1931. He became a fellow of Trinity in 1899, and was a lecturer in classics until his election to a readership in 1927.

His published work was abundant and falls naturally into two periods, divided by the War of 1914–18 during which he served in the Ministry of Munitions. The earlier period is especially marked by an interest in the origins of Greek philosophy, and in the religious conceptions from which it developed. Thus the leading principle in "From Religion to Philosophy" (1912) is a distinction between the 'mystical' school, represented by Heraclitus, Pythagoras, Empedocles and Plato, a school which seeks primarily to preserve what the religious consciousness values, and a scientific school, including Anaxagoras, the Atomists and others, which tends to discard religion for rationalism. In "The Origin of Attic Comedy" (1914) he sought to explain the structure of the extant plays by examining the ritual forms which lie behind them; here he was influenced by the work of Jane Harrison and Frazer. An earlier work, "Thucydides Mythistoricus" (1907), was a daring re-interpretation of the historian's mental background and of the religious framework which governed the selection and presentation of his material.