for certain firms. One collateral development has been the setting up of systematic courses at the London School of Economics for postgraduates drawn from industry. It is by now quite plain that this side of the Division's work will expand substantially in the years to come.

Research on Statistical Method

A great many problems coming to the Division's attention are necessarily of a statistical character, and attempts are made to solve such theoretical statistical problems as arise. The work covers a very large field. At the mathematical end, for example, it has included the tabulation of the distribution of the characteristic roots of a random-dispersion matrix. A considerable number of studies have been published on distribution theory, estimation and inference, the theory of statistical relationship, time-series and stochastic processes. Such work, though in the main theoretical in character, usually stems from problems of analysing complicated and imperfect data such as arise in multivariate systems.

Bibliographical Work

A great deal of work within the Division's sphere of interest, as in scientific fields generally, is concerned with ascertaining what is being done elsewhere. A number of individual bibliographies have been published, for example, on queueing theory and on the life testing of industrial equipment. Some special studies have also been undertaken. For example, a "Dictionary of Statistical Terms" has been prepared on behalf of the International Institute of Statistics and Unesco; a new *Journal of Statistical Abstracts* has been founded; and the Division is on the point of going to press with the first volume of a comprehensive bibliography of papers on statistical method and probability from the sixteenth century up to the end of 1958 which will ultimately comprise about 25,000 titles.

Team Work

It is a characteristic feature of much of the Division's work that its problems require collaboration between workers in several different fields. Problems of survey research, for example, need mathematicians and statisticians at the sampling stage; psychologists at the interview stage; numerical analysts and statisticians at the summarizing stage; and sociologists or economists at the interpretative stage. Dynamic economics requires—in addition to economists—electrical engineers, numerical analysts and mathematicians. The members of the Division are, in consequence, drawn from all sorts of disciplines, and it frequently calls on the wide resources of the teaching staff at the London School of Economics as well as on those who are formally attached to it. The consequent interactions have done much to contribute to the Division's development and, I hope I may say, to its successes.

OBITUARIES

Sir Henry Tizard, G.C.B., A.F.C., F.R.S.

IT is often said that you cannot keep a good man down, but you only have to look at the early history of many eminent people to realize how much they owe to chance. Tizard was thirty-five before he took the step which enabled him to develop his powers to the full. I believe that it was then that he took the quite conscious decision to become a V.I.P. He certainly achieved his greatness by his own efforts.

Tizard's forebears were all connected with the sea in some way or another and he, himself, was destined for the Navy, but failed because of eyesight. His mathematics gained him an exhibition at Westminster School, and at the outbreak of the First World War he was a Fellow of Oriel College, Oxford, having got there by way of a first-class degree in natural sciences at Magdalen, a year at Berlin under Nernst and two years at the Davy Faraday Laboratory of the Royal Institution.

When the War actually broke out, he was in Australia attending the meeting of the British Association. He returned as quickly as he could and joined the Royal Garrison Artillery, where he got himself into some difficulties owing to his highly unorthodox methods of training recruits. This, in fact, was not really his 'cup of tea' at all and he quickly succeeded in getting transferred to the Royal Flying Corps. By 1917 he was captain-in-charge of all experiments on aeroplanes at Martlesham Heath and was afterwards appointed as deputy to Bertram Hopkinson at the headquarters of the Ministry of Munitions. He carried on after Hopkinson had been killed in August 1918 until he was demobilized in the spring of 1919, when he returned to Oxford.

His experiences during the War had led him to realize the immense importance of the application of science to military affairs. He decided that he would never be outstanding as a pure scientist, and Oxford, therefore, did not give him the scope that he needed to develop his talents. Towards the end of 1920 he joined the Department of Scientific and Industrial Research, and in 1926, at the age of forty-one, became secretary of the Department in succession to Sir Frank Heath. In the same year, he was elected a Fellow of the Royal Society.

In 1929 he was appointed rector of the Imperial College of Science and Technology—a post which he held for thirteen years. He did, in fact, a very great deal for the College, but, during this period, he did a great deal more in other directions.

Ever since the First World War, Tizard had maintained his interest in aeronautics. He had been chairman of the Royal Aeronautical Society in 1924, and in 1933 he was appointed chairman of the Aeronautical Research Committee—a post that he held for ten vitally important years. However, the work for which I shall always give Tizard the highest marks in that period was the job that he did as chairman of the Committee for the Scientific Survey of Air Defence which started work at the beginning of 1935. Tizard's colleagues on this body were originally A. V. Hill, P. M. S. Blackett and H. E. Wimperis, with A. P. Rowe as secretary. I shall always believe that this body, and particularly Tizard himself, were the people who made it possible for Watson-Watt to develop radar, which was the

biggest contribution to the winning of the Second World War. You cannot read the accounts of the development of radar written by such varying authorities as A. P. Rowe, Lord Swinton and Watson-Watt himself without coming to the conclusion that it was Tizard's drive from the outside which ensured that radar was developed at such rapid speed—and not only developed, but also deployed in a usable form.

As the War progressed, Tizard served in the Ministry of Aircraft Production and also as the first—and last—external civilian member of the Air Council. In August 1940 he led a British mission to the United States with the object of disclosing all our scientific secrets. He took with him in his pocket a sample of the magnetron—the thermionic device, perfected in Britain by Randall and Boot, which really made radar work. One American historian said of this visit: "When the members of the Tizard mission brought the magnetron to America in 1940, they carried the most valuable cargo ever brought to our shores. It started the whole development of micro-wave radar and constituted the most important item in reverse lease-lend". In the years after the War, when information on American military research was hard to obtain, Tizard was not slow to recall his war-time mission.

In 1942 Tizard resigned from the Ministry of Aircraft Production and the Air Council to become president of Magdalen College, Oxford; but, although he now had no formal Government appointment, he still continued to advise informally on various scientific problems, and in 1943 he went out to Australia to advise the Australian Government. It was during this trip that he bearded General MacArthur in his den and shattered the morale of the General's aides by flatly refusing to regard him as anything but an equal. Incidentally, he also won a case of sherry off the General by a bet on the length of the War.

By 1946 Tizard was sixty-one. He was very comfortably ensconced as president of Magdalen and it looked as though the excitements were over. His greatest work was, in fact, still to come.

One of the major lessons of the Second World War was the vital necessity to apply science to all forms of Government activity, and this could only really be done provided the right type of scientist was brought into full collaboration in both the formation and implementation of policy. The Services learned this lesson very thoroughly indeed during the War and, as a result, the old Deputy Chiefs of Staff Committee was replaced by a new body in the Ministry of Defence known as the Defence Research Policy Committee. The Committee consisted of those responsible in the Service Departments and the Ministry of Supply, both from the operational and from the scientific angle, for the formulation of requirements for new weapons and for research and development. Its chairman was to be a scientist of high standing appointed for a period of years. At the same time, on the Civil side of Government, a committee known as the Advisory Council on Scientific Policy was also set up. Tizard was persuaded to assume the chairmanship of both these bodies; and, although from 1946 he served full-time in the Ministry of Defence, he gave a great deal of attention to the work of the Civil Council.

Between 1946 and 1950 Tizard laid the real foundations of co-operation at the top level between the scientist and the military authorities. His own position and effectiveness did much for the recognition in other fields of the need for, and value of, scientific advice. I do not believe there was any other person who could have done this with anything like comparable success. For one thing, in spite of the fact that neither he nor anybody else regarded him as an outstanding pure scientist, his standing in the scientific world was extremely high. Even by 1946, five universities had awarded him honorary degrees, and in subsequent years five more followed suit. For another, he had shown, in the days before the Second World War, his capacity to see what was important, from the national point of view, to develop and, perhaps even more, the ability to get other people in high places to accept his view. He inspired—and in this he was almost unique among the leading scientists of the day—immense respect and confidence among officers of all the Fighting Services. He had a very genuine appreciation of, and sympathy with, their problems and they all knew he wanted to help.

He dominated any committee of which he was chairman, not—as so many other people try to do—by talking all the time, but by his skilful appreciation of the characteristics of the people sitting with him and of the appropriate moment at which to intervene. Sometimes, these interventions took the form of an exhibition of bad temper. Most people thought this was spontaneous; but, in point of fact, it was most carefully rehearsed, as those who had to brief him for the meeting well knew. In those days, his moments of real anger were quite rare, and they almost invariably arose out of his unceasing warfare with what he regarded as administrative stupidity.

He was, perhaps, at his most impressive when presiding over the periodic meetings of the Commonwealth Advisory Committee on Defence Science, to which scientists and serving officers came from all over the Commonwealth. Here, he inspired a slightly awed but affectionate respect. He was, of course, a brilliant conversationalist, and the entertainments which accompanied these Commonwealth meetings gave him opportunities which he seized to the full.

He was on excellent terms with the Chiefs of Staff, particularly in the earlier days. As time went on, however, he began to be regarded as the 'Great Man', and his visits to the Chiefs' meetings became rather more formal occasions. There was, in fact, something rather magisterial about his manner, especially on any formal occasion. Even on an informal occasion, he was not a man with whom one took undue liberties. Nevertheless, to those who worked with him closely, he was a very real friend and by no means difficult.

In 1950 his health began to fail and by doctor's orders he had to slacken off a great deal. He did not take kindly to this change, but there was no doubt that he began to get tired rather quickly and then became a little bad-tempered. He recognized this, however, and I can only remember one occasion which had unfortunate results. By 1952, Tizard had begun to lose some of his confidence in himself. He thought that his health had deteriorated to such an extent that his useful working life was over, and he therefore resigned from the public service. There is no doubt that a measure of the old zest and vitality had gone out of him.

He was not, however, a man who could be idle, and for the remainder of his life he occupied himself

as a director of Glaxo Laboratories, Ltd., and other public companies. In spite of many attractive offers, he refused to join any commercial organization primarily concerned with the Defence effort. He took the view—and I am sure rightly—that he had been in far too central a position in the defence field to allow him to make his special knowledge available to a single company engaged in such work.

His health improved appreciably after he retired, and right up to the day of his death he was the most delightful and inspiriting dinner companion. A typical form of activity into which he entered with all his usual enthusiasm was the year he spent in 1955–56 as Prime Warden of the Goldsmiths' Company. I am sure the Company benefited from his wisdom.

No account of Tizard would be complete without some reference to his quarrel with Cherwell. This originated in 1936 over the Committee on the Scientific Survey of Air Defence, and eventually got so bad that the two men could not endure in silence each other's presence in the same city. This, indeed, was the only matter on which I ever found Tizard really unreasonable, but Cherwell was worse. In fact, in this matter, both these eminent gentlemen behaved like a couple of spoiled children. The tragedy of it was that this quarrel prevented Tizard gaining the confidence of Winston Churchill when the latter returned to power in 1950.

By any standards, Tizard was a great man who made a large contribution to the nation's affairs. He had a very real foresight and was rarely proved wrong. I am still waiting for someone to take seriously the warning which he issued towards the close of his presidential address to the British Association in 1948. He knew little about agriculture in detail, but, as with all the other subjects he touched, he had a wide view of the necessities. "I shall predict", he said, "that unless the prevention of disease among plants and animals and all other scientific problems of the supply of food are studied on the same kind of scale by men of similar calibre as are the problems of human health, chaos and misery will result". How right he was.

F. BRUNDRETT

Dr. Mary D. Waller

DR. MARY DÉSIRÉE WALLER, who died at the age of seventy-three on December 11, was widely known for her precise and beautiful work on vibrating plates and as an outstanding teacher of physics. She came of distinguished scientific ancestry, her father being Augustus Désiré Waller, who first showed that the electric currents set up by the beating of the human heart could be recorded, and her grandfather Augustus Volney Waller, whose name is commemorated in 'Wallerian degeneration'.

Educated at Cheltenham and Bedford College for Women, as a young woman she was appointed demonstrator in the Physics Department of the London (Royal Free Hospital) School of Medicine for Women, a Department of which she later became head and in which she continued her research after her retirement in 1947. It was in 1932 that she first came into prominence by her discovery that metal plates could be thrown into regular vibration by the suitable application of a block of high-density carbon dioxide. It shows great scientific percipience that her discovery derived from the fact that an itinerant vendor of ice-cream had directed her attention to the way in which a bicycle bell rattled when in contact with ordinary solid carbon dioxide.

With this solid carbon dioxide technique, the mode of action of which she explained, she carried out extensive and precise studies of the modes of vibration of metal plates of square, rectangular, circular and elliptical form, illustrated by beautiful photographs, the series recording the vibrations of a square plate being particularly striking. Her last published work included some interesting observations on the ridges formed by particles of different size and shape in the sound field between a vibrating plate and a parallel horizontal surface. At the time of her death she had nearly completed a book dealing with her work on vibrating plates, the appearance of which has been announced by the publisher. It is to be hoped that a colleague will finish the work and see it through the press.

Dr. Waller was a woman of great integrity and kindliness, whose brightness and charm made her a welcome figure in scientific, and other, circles. As an accomplished teacher she endeared herself to generations of students in her Department. She was devoted to the subject that she made her own, but her interests were wide and she was a delightful conversationalist. She lived for many years with her friend, Dr. Bertha Turner, at a charming house in the neighbourhood of Regent's Park, in which she died.

E. N. DA C. ANDRADE

Mr. Cyril L. Collenette

CYRIL COLLENETTE, who died suddenly on November 2 at the age of seventy-one, devoted most of his life to the study and service of natural history. His boyhood days were spent in the stimulating surroundings at Woodford, then a country parish in the heart of Epping Forest, and this early bent for the pursuit of Nature's secrets and offerings was never to leave him. He became a world-wide traveller naturalist in such places as Malaya, French Guinea, the Matto Grasso and British Somaliland, making valuable additions to collections, especially of insects.

Collenette's main life's work began and ended at the British Museum (Natural History), South Kensington, as an associate and world authority on the large family of moths, the Lymantridae. Apart from his museum work, he was a keen spare-time botanist and bird observer, ever willing to pass on his experiences and recordings to such bodies as the British Trust for Ornithology (he was one of its earliest ringers), and the London Natural History Society (a member since 1907 and one-time president). He was on the Committee for the Birds of the Royal Parks, as well as on that of the London Natural History Society during the compilation of its book, "Birds of the London Area".

His own books include "A History of Richmond Park", written during 1937 when living at Richmond, and "Sea-girt Jungles", written on his return from a long Pacific sea voyage on the *St. George*, a sailing vessel which visited such places as the Marquesas, Easter Island and the Galapagos. He told me that this was one of the most exciting and rewarding episodes of his natural history career.

His colleagues at South Kensington will miss their tall and friendly companion, and all who sought out his advice and friendship will mourn an ever-willing helpmate and kindly friend.

ALFRED LEUTSCHER