and what is accomplished thereby. We have not space to dwell on his review of the work of the various Government Departments included in the classification of "research, education, and developmental work." It embraces the activities of the Agricultural Department, the Geological Survey and the Bureau of Mines, the Bureaux of Standards and of Foreign and Domestic Commerce, the Coast Survey and the Bureau of Fisheries, the Bureau of Labour Statistics, the Woman in Industry Service and the Children's Bureau, Educational Work, the Public Health Service, and co-operation by the Government in Industrial Research and Standardisation. We may note, however, that nearly two-thirds of all the expenditures made under this group of services are for the work of the Agricultural Department.

To the scientific research designed to develop the industries of the country Prof. Rosa refers in more detail. He has no difficulty in showing the necessity and the value of an increased expenditure, wisely applied, in this field. In the course of a summary of his argument he well says: "It is stupid and blind to think that because taxes are heavy we cannot afford to do things intelligently. If a farmer's barn burns down, he would not sell half his supply of seed and fertiliser to buy lumber, and then plant only half a crop. He would, if necessary, borrow money to buy more seed and plant a larger crop than usual in order to increase his income and pay for the new barn more easily. Intelligent research by the Government, in co-operation with the industries, is like seed and fertiliser to a farmer. It stimulates production and increases wealth, and pays for itself many-fold. It is as productive and profitable in peace as in war."

If we put aside the temptation to ask why the barn was not insured against fire, the illustration is apt enough for a world painfully recovering from the ravages of war. But America is not the only country where the superficial economists, appalled by the weight of taxation, begin to economise by cutting down expenditure in the productive services of "research, education, and developmental work." It is a pity that Prof. Rosa's paper will not be read by the "anti-waste" apostles. It is easy to gain a reputation for economy by shouting loudly "We cannot afford it," and difficult to realise that there are some things we cannot afford not to afford.

In his second paper Prof. Rosa usefully supplements his general argument in the first paper by a careful inquiry into the actual expenses of the various departments of bureaux of the Government. He begins by admitting that there is in the mind of the general public a feeling that the scientific work of the Government is not carried on so successfully or so efficiently as it should be, and that it probably costs too much. In order to get an accurate knowledge of Government expenditures and to ascertain how they have increased in recent years, the receipts and expenditures of all departments for the last ten years were analysed. The analysis given by Prof. Rosa is full of interest, and is illustrated by several ingenious diagrams. We have not space to review this analysis, but we may note one conclusion: "The *per capita* cost of the civil side of the Federal Government in 1920 was only a little more than half of what it was in 1910 if measured in commodities or in money of equal purchasing power. During this ten-year period the wealth of the country had greatly expanded, the war had come and gone, the problems of Government had enormously increased, and yet the *per capita* cost of these civil activities measured in commodities had fallen to a little more than one-half. In face of these facts people are saying that the Government is extravagant, inefficient, and overdeveloped." That sort of criticism is not peculiar to the people of America.

Cotton Research in Egypt.

THERE has been for many years a great deal of talk about research work on cotton. The Empire Cotton Growing Committee put research in the forefront of its programme, and it was originally suggested that a research institute should be established in Egypt. About the same time the British Cotton Industry Research Association was established in Manchester, but so far it has not done anything in the way of cotton-growing except to discuss methods of co-operation with the Empire Cotton Growing Committee. The latter has, of course, not been able to do much yet, owing to the time necessarily involved in its reconstruction into the new Empire Cotton Growing Corporation.

In the meantime, the Egyptian Government took its own steps by setting up in May, 1919, a Cotton Research Board, consisting of representatives of all the Departments of the Government which are interested in cotton-growing. A very brief preliminary report was published by the Research Board in March, 1920, and the first annual report embodying a review of the work done up to this date is now before us.[1]

The report proper deals in about fifty pages with the experimental work which has been done on cotton during the year 1920. This work has covered a very wide field, including botanical work on cotton and cotton-breeding (in which selection has apparently played a very much larger part than hybridisation), the selection and propagation of seed by the State domains, and a number of variety tests. Experiments on spacing and on the effect of water on the crop are described, as well as the work done in connection with insect pests, especially the pink boll-worm, and some mycological research. The programme of experimental work for 1921 is also outlined. Much of the work is still unfinished, and certain parts of it will be published by the Departments concerned in other forms as soon as results are available.

The Research Board has, however, very wisely not confined this report to its own work, but has added about 75 pages of reports on special questions considered by the Board, many of these more of an economic than of a purely scientific character, and a number of useful summaries of various publications of the Ministry of Agriculture made within the last few years on subjects affecting cotton. There are also reviews of publications from other sources affecting cotton and some very useful appendices. This supplementary matter deals with such questions of direct economic importance as the development of Pillion cotton in Egypt and its threatened supersession of the superior variety known as Sakel. It also covers the development of Pima cotton in Arizona, U.S.A., which looked for a time as if it might prove a serious rival to Egyptian. On the latter point, however, Egypt has probably derived considerable reassurance from the very marked reduction of the Pima crop this year owing to the fall in prices

[1] First Annual Report (1920) of the Cotton Research Board, Ministry of Agriculture, Egypt. (Government Publications Office, Cairo.) 10 piastres (2s. 1d.).

Among the publications summarised are two of special importance by outside experts, who were called in by the Egyptian Government to report on their cotton problems within the last few years, namely, Mr. H. A. Ballou, a West Indian entomologist, and Mr. H. Martin Leake, a botanist in the service of the Indian Government. These independent reports have been of great value to those who are following the development of the cotton position in Egypt. The appendices contain some rather disconcerting statistics of the crop, an account of cotton legislation in Egypt during 1920, and a very useful summary of botanical research on cotton carried out in Egypt up to 1918, along with a bibliography of the chief cotton pests of Egypt.

There is always room for difference of opinion as to the scientific value of the results achieved by research work, and no one who knows the difficulties under which scientific workers in Egypt have laboured in the past would expect any very large results in the short time in which the Cotton Research Board has been in existence. These two years have, in fact, been largely spent in preliminary work, and indeed the new research laboratory at Giza was scarcely finished when the report was written. But no one can question the value of such a compendium of a great deal of the work that has been done in the past. The report will form a useful summary for those interested in all the various lines of activity regarding Egyptian cotton.

University and Educational Intelligence.

THE Merchant Venturers' Technical College, which provides and maintains the faculty of engineering in the University of Bristol, has issued a prospectus for the academic year 1921–22. A prominent feature is the "sandwich" scheme, which engineering students have the option of adopting. By this arrangement the course of five years is divided into three periods of ten months each, which are spent at the University, and three periods of fourteen, two, and fourteen months respectively, spent in engineering works. More than twenty well-known engineering firms in Great Britain co-operate with the University for this course, in many cases offering to receive students with reduced, or even without, premium. The scheme provides an opportunity for a thoroughly well-balanced training for the profession.

THE Edinburgh and East of Scotland College of Agriculture has issued a calendar for the year 1921–22, in which a full account of the courses available at the college will be found. The classes are arranged in conjunction with the science faculty of Edinburgh University, and two courses are open to students: (*a*) for the degree in agriculture conferred by Edinburgh University, and (*b*) for the college diploma in agriculture. Part of the course required for the University degree in forestry is also provided, and there are, in addition, a number of classes devoted to horticulture. A novel feature is the five weeks' course provided in January and February of each year for the benefit of farmers and others who cannot attend a full diploma course. The course extends over two years, the first being devoted chiefly to soils, manures, and farm crops, and the second to feeding-stuffs and the management of livestock; in the coming winter the second part of the course will be given. Local farmers co-operate with the staff of the college in investigating new conditions or special problems arising out of their farming operations, and a number of useful papers have already been published dealing with the results obtained.

Calendar of Scientific Pioneers.

September 1, 1648. Marin Mersenne died.—A schoolfellow and friend of Descartes, Mersenne occupied various ecclesiastical appointments, translated Galileo's "Mechanics," experimented on sound, and was one of the group of eminent men whose meetings led to the founding of the Paris Academy of Sciences.

September 2, 1832. Franz Xavier, Baron von Zach, died.—Retiring from the Austrian Army as a colonel, Zach became the first director of the observatory at Seeberg, Gotha. His *Monatliche Correspondenz*, founded in 1800, was the forerunner of Schumacher's *Astronomische Nachrichten*.

September 2, 1836. William Henry died.—Awarded the Copley medal in 1809 for his contributions to chemical literature, Henry experimented on gases and enunciated the law connecting the pressure with the solubility of a gas.

September 2, 1865. Sir William Rowan Hamilton died.—After a remarkable career as a student, during which he wrote mathematical papers of a high order, Hamilton in 1827, at the age of twenty-two, became Andrews professor of astronomy at Dublin. For many years a correspondent of De Morgan, he was, like him, of a speculative mind. He is best known for his "Theory of Systems of Rays," his prediction of conical refraction, his "General Method of Dynamics," and his discovery of quaternions.

September 2, 1883. Cromwell Fleetwood Varley died.—One of three brothers who were all concerned with the early telegraphs, Varley did valuable work in connection with the Atlantic cables. His brother, Samuel Varley, was a pioneer worker on the dynamo.

September 4, 1784. César François Cassini de Thury died.—The third of the five members of the Cassini family who became members of the Paris Academy of Sciences, César Cassini is best known for his trigonometrical survey of France.

September 4, 1852. William Macgillivray died.—Macgillivray in 1841 became professor of natural history at Aberdeen. His "History of Birds" was published in 1837–52.

September 5, 1902. Rudolf Virchow died.—Placed in the foremost rank of pathologists by the publication of his "Cellular Pathology" in 1856, Virchow for many years was director of the Pathological Institute at Berlin. In later life he rendered important services to ethnology, anthropology, and archæology, and as a public man he was instrumental in transforming Berlin from one of the most unwholesome of cities to one of the most healthy. The centenary of his birth occurs on October 13, 1921.

September 5, 1906. Ludwig Boltzmann died.—A distinguished worker in mathematical physics, Boltzmann studied the work of Clausius and Maxwell, and became an authority on the kinetic theory of gases and on thermodynamics. He held chairs at Gratz, Munich, Leipzig, and Vienna.

September 6, 1902. Sir Frederick Augustus Abel, Bart., died.—One of the first pupils of Hofmann at the Royal College of Chemistry, Abel in 1854 became chemist to the War Office, a post he held for thirty-four years. He made valuable researches on gun-cotton, with Dewar invented cordite, and was an authority on petroleum and coal-mine explosions. He served as president of various institutions, and in 1893 was made a baronet.

September 7, 1882. Joseph Liouville died.—An engineer in the Ponts et Chaussées, Liouville resigned his position, devoted himself to the study of mechanics and pure mathematics, and from 1836 to 1874 edited the *Journal de Mathématique*. To Liouville and Regnault Kelvin was much indebted as a student.

E. C. S.