effect of *p*H is difficult to measure because of the acid products of reaction, which themselves can be inhibitory to bacterial growth. Different opinions are expressed on the effect of temperature, some authors stating that it is slight or negligible, while others find that reduction of temperature below 20° C. tends to give increased efficacy. These differences may possibly be due to errors in the methods of analysis of the ozone as well as to impurities present or to products of ozone reaction. Oxides of nitrogen, for example, which can be present in large proportions depending on the method of preparing the ozone, can exert a considerable enhancement in disinfecting efficiency.

Although the popular belief is that canned foods are virtually sterile, this is not the case in practice according to Mr. Osman Jones (London), who discussed "The Survival of Bacteria in Wholesome Canned Foods". He pointed out, for example, that foods of low *p*H value are adequately preserved by a mild heating to kill moulds, any bacteria present being incapable of development owing to the acidity. Meat products are seldom sterile in the proper sense : up to 25 per cent of certain tinned meats have been found to contain bacteria, and Savage has put this figure, in some cases, as high as 100 per cent. Tinned meats have been kept organoleptically sound for several years, although containing viable bacteria, one of the most notable examples being that of a tin of meat brought back from the Parry Arctic expedition which, on opening after 113 years, yielded six different strains of bacteria. Pork has been inoculated with *Clostridium sporogenes* and, after heat treatment, has been stored at 37° C. for long periods without showing any deterioration, in spite of the survival of small numbers of the inoculated organisms. Sudden reactions, however, have been known to take place after relatively long periods of storage, and these may be due to slow internal reactions such as nitrite – nitrate changes. Environment affects considerably the heat resistance of bacteria, and spore-formers are found to be more resistant in cooked meat than in raw material, and again more resistant if protected by fats. The reason why organisms should remain dormant for long periods is, at present, obscure.

Discussing the "Sterilization of Surgical Dressings", Dr. R. Maxwell Savage (London) directed particular attention to the different properties of superheated and supersaturated steams, stating that the former is inefficient as a sterilizing agent unless the temperature is raised to that for normal dry-heat sterilization. He illustrated diagrammatically how in steam autoclaves the normal sterilizing temperature and pressure could be attained either by a saturated steam cycle, as is usually carried out, or by a superheated steam cycle, in which case sterilization may not be properly achieved. Considerable care is necessary to eliminate air so far as possible as this tends to layer in the autoclave and also to give rise to 'superheated' steam, and so reduces the efficiency of sterilization. It also tends to layer around the surfaces of objects being sterilized and prevent full access of the steam. Moreover, air is always being introduced into the system via the steam mains supply, hence the need of adequate venting of the autoclave is apparent.

Contrary to expectations, dressings wrapped and sealed in paper present no difficulty in sterilizing. This is presumably because there is sufficient moisture in the dressings to provide steam to saturation point. Similarly, dry-heat sterilization of sealed packets can be achieved more readily in closed than open packets, again due to the small amount of steam generated through the seal. Dr. Savage agreed that air-venting of dressing drums is most important, and that there are good arguments for eliminating metal containers entirely. He also thought that one effect of superheated steam is to dry off the organisms and so render them heat-resistant.

Mr. G. Sykes (Nottingham) dealt mainly with the "Sterilization of Air" as required on a large scale for antibiotic fermentations. He pointed out that sterilization by chemical means is impracticable because of the danger of the carry-over of the disinfecting material into the fermentations, and that heat treatment, although very efficient, is again impracticable on a large scale on economic grounds. Ultra-violet radiation, although suitable for many purposes, is unsuitable in this case because of its limited efficiency both in terms of time and of its inability to deal with bacterial spores and protected organisms. The precipitron, likewise, had not proved sufficiently effective in service.

Mr. Sykes then discussed the various filter materials which are commonly used in practice, and showed that both granular and fibrous materials can be used. Efficiency of filtration depends on various factors, including the size of the air-borne particles to be removed, the size of the granules or fibres of the filter, the electrostatic properties of the filter and air flow-rate, and this was demonstrated with filter materials such as alumina, glass wool, steel wool and slag wool. These findings bear out the various theories of air filtration. A coarse granule or fibre filter is less effective than a finer one, and the packing density of fibrous filters is significant ; increase of air flow-rate gives a more efficient filtration. Of the various materials tested, slag wool, as previously reported by Cherry and colleagues, was found to be the most efficient. With this material at a suitable packing-density, even after prolonged continuous use, organisms have rarely penetrated beyond about 3 in.

These papers will be published in full in the *Journal of Applied Bacteriology*, copies of which are obtainable through the Society for Applied Bacteriology.

OBITUARIES

Prof. R. W. Wheldon

Prof. Robert William Wheldon died on January 15, shortly after collapsing in his office in the School of Agriculture, King's College, Newcastle upon Tyne. His death is a severe loss to the University of Durham and to the many agricultural interests with which he was connected. He was widely known as a scientist, a farmer and a public servant.

Robert Wheldon was born in the county of Durham on January 17, 1893. He was a farmer's son and as such entered Armstrong College as a short-course student, having received his school education at Rutherford College. In this course, he showed his considerable ability and went on to take a degree in agriculture, graduating in 1915. He was immediately appointed by his professor, Douglas Gilchrist, to the teaching staff of the Department of Agriculture, and he afterwards served this Department, first as lec-

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turer with Prof. Gilchrist and his two successors, and later as professor.

From the early age of eighteen he farmed on his own account and at the time of his death he occupied some seven hundred acres of farm-land in County Durham. Here, his pedigree herd of Jersey cattle hold an international reputation. However, his main endeavour was in the fields of agricultural teaching and research. His academic career was substantially influenced by his early training under Gilchrist, at a time when the experimental work at Cockle Park on grassland improvement was becoming world famous. As a member of the staff of the Agricultural Department, and later as director of the Cockle Park Station, he was responsible, in a very practical way, for much of the improved grassland husbandry techniques since applied to farming. His first personal contribution to agricultural research, however, was connected with the manuring of the potato crop, and he obtained his D.Sc. in 1927 as a result of this work.

The period 1940–53 represents a time of considerable development of agriculture within the Newcastle Division of the University of Durham. Prof. Wheldon used all his wide knowledge and experience untiringly for the furtherance of agricultural education and research. At the beginning of the War, while still a lecturer, he was appointed acting head of the Department, and gave it fresh life. He was awarded a personal professorship in 1943 and was formally appointed as professor of agriculture and rural economy in 1947. In that year, the Department of Agriculture was enlarged to a School of Agriculture with its own faculty within the University, and with Prof. Wheldon as its first dean. In 1944, the University acquired the tenancy of a 742-acre farm at Nafferton for use as a teaching farm, and in 1945 took over Cockle Park Experimental Station from the Northumberland County Council. The numbers of students and postgraduate workers increased tenfold under Prof. Wheldon's leadership.

His skill and experience were used outside the University in the application of scientific developments to farming practice, and he played a leading part in both technical and administrative work in agriculture in the North of England. During the war period, he served with the Durham County Agricultural Executive Committee and was appointed chairman of this Committee in 1952. In addition, from September 1952 he represented the Minister of Agriculture as his personal liaison officer in the Northern Province. He undertook this work although he knew full well that by doing so he was adding to the risks of ill-health.

Prof. Wheldon was a past president of the English Jersey Cattle Breeders' Society and vice-president of the newly formed World Jersey Cattle Bureau—an organization created in no small measure by his personal efforts. His old students knew Prof. Wheldon as a great friend and an inspiring teacher. Through them, his influence on the science and practice of agriculture will go on in many ways. He was a modest man and a great Christian, who enriched the experience of all who worked with him. Above all, he will be remembered by his colleagues and friends in a very personal way, especially for his kindliness and wise counsel. J. S. HALL

Prof. H. Benndorf

DR. HANS BENNDORF, professor emeritus of physics in the University of Graz, Austria, died on February 11, 1953. He was born in 1870 at Zurich and was the son of the well-known archæologist, Otto Benndorf. He studied mainly in Vienna, and he was appointed lecturer in the University there in 1899. During 1904–36 he was professor of physics in the University of Graz, where the Institute of Physics was, under his direction, a place of many-sided scientific investigations. Both the many students of physics and his colleagues knew him as a rigorous and critical yet kind-hearted teacher, always willing to give them assistance.

Of the scientific investigations of Benndorf, those in atmospheric electricity and seismometry are the best known and they were of great importance for further investigations. The Benndorf quadrant electrometer for registering the electrical field in the atmosphere is known throughout the world. Many other problems of pure physics, too, were dealt with at Graz under the guidance of Benndorf; for example, problems of the propagation of electrical waves, examination of luminescence and piezoelectricity, and measurements of ionization in electrical discharges. The great number of investigations at Graz directed by Benndorf was made possible by his genius for experimentation with limited resources, as there was little money in the Institute of Graz.

Benndorf's books and his theoretical papers, too, are distinguished by clarity of style, and he advised his co-workers to follow his example with regard to this. In the preface to the first volume of *Physica Acta Austriaca*, which came out in 1948 under Benndorf's stimulation, he urged young physicists to give a clear exposition of their work. Benndorf had the results of his investigations published only when he was absolutely sure of them, for he believed that physicists working in the same field should not have to study unnecessary literature.

The scientific work of Benndorf was acknowledged by his election as a member of the Academy of Sciences in Vienna in 1929.

Benndorf married his cousin, Rosa Wagner, daughter of the well-known political economist Adolf Wagner, of Berlin; they had four children. The eldest, Wolfgang, was until recently librarian in the University of Graz. His daughter Nora emigrated with her husband, a medical man, to the United States. Two of Benndorf's sons were reported missing in the Second World War.

Benndorf corresponded with many friends throughout the world and he also visited them, for he loved travelling. He was an ardent player of the viola in his leisure time, and was an excellent mountain climber. His strength of character and warmth of heart gave support and consolation to many in times of political stress. A. SZÉKELY

WE regret to announce the following deaths:

Mr. A. Campbell, one of the original members of the staff of the National Physical Laboratory, on February 6, aged ninety-one.

Prof. Kotaro Honda, formerly of the Tohoku Imperial University, known for his work on magnetism and in metallurgy, on February 12, aged eighty-three.

Mr. David Milne, C.I.E., formerly economic botanist to the Government of the Punjab, and during 1923–33 dean of the faculty of agriculture, Punjab University, Lahore, aged seventy-seven.

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