tent and suffer attack only at humidities greater than 85 per cent. Most rayons (regenerated cellulose) lack nutrients and show some resistance, while cellulose acetate 'silk' is largely unaffected by micro-organisms.

Animal fibres are less liable to attack than cotton; but even so, large losses may occur in warm weather, and again prevailing humidity is the key factor. Wool withstands greater humidity than cotton, and scoured wool only mildews at about 94 per cent relative humidity (about 19 per cent moisture content by weight). Woollen fabrics kept wet, like bathing costumes and paper-makers' felts, suffer bacterial attack, largely by spore-forming rods. Soaps and alkali aid microbial action by providing available fatty-acid and hydrolysed protein, and of paramount importance is the soluble nitrogenous matter. Horse, calf, pig and human hairs offer great resistance, but camel hair, which is fine and soft, is very susceptible. Silk is more resistant than wool, degummed thoroughly-washed silk being similar to regenerated cellulose rayons.

Methods of control of spoilage depend upon whether the need is short-term mildew-proofing during processing and storage or the more persistent powerful action required in rot-proofing. Control of mildewing can be made easier by the adoption in the industry of lower moisture-regain standards, together with reducing mildew capacity by thorough scouring and avoidance of farinaceous sizing materials; and the inclusion of a silica gel or similar desiccant in shipping consignments can be of value. Mildew-proofing by added fungistatic substances is effective, and salicyl anilide alone or paired with silico-fluoride, *p*-nitro-phenol, mercaptobenzthiazole, or acetanilide has excellent proofing qualities. Rot-proofing is a much greater problem in that a substance specific against a wide range of micro-organisms must be used, and this material must be insoluble and stable enough to withstand sun, weather, wetting and drying over long periods. Dr. Burgess dealt critically with the use of many materials for proofing both cotton and wool.

The testing of mildew-proofing of fibres and fabrics is best accomplished by field-trials, but accelerated laboratory tests are useful in which the material after inoculation with test cultures is held at warm-room temperature at humidities of 87-100 per cent and assessed by visual inspection. Rot-proofing tests require pure culture inoculation or soil burial followed by tests of mechanical strength.

The factor mainly relied on in the prevention of spoilage of paper and paperboard is the use of fungistatic materials. Mr. E. Howard (Kenley), who dealt with this subject, pointed out that paper and, to a much greater extent, paperboard are impure cellulosic materials often containing, in addition, rosin, wax, starch, gelatin and many other organic and inorganic substances in varying amounts. Storage conditions of these wrapping and packing materials frequently involve warmth and high humidities, often from their contents, so that frequent loss of strength by rotting and disfigurement by mildewing are not surprising. The only reliable way of preventing losses is to use an effective fungistatic substance, incorporating it either in the paper pulp or impregnating the paper web with it before drying, of which the first is probably more suitable. Mr. Howard listed the qualities desirable in a fungistatic, among the most important of which are a 'biologically active' persistence and ease of incorporation with the pulp stock, having no harmful

effect upon the manufacturing process nor any hazards to personnel during manufacture or in later use. The material must not prevent the disposal of paper-mill effluent, should not impart any undesirable property to the product, and must provide protection at an economic price.

Copper and zinc naphthenates are effective, but give a dark, greasy product with an unpleasant smell and an ability to stain contiguous material. Sodium pentachlorophenate has been widely used, but is steam-volatile and partly lost in the drying section of the making process, besides giving a phenolic odour to the product. 2,2-Methylene bis (4-chlorophenol) is an excellent relatively non-toxic preservative, not affecting colour or feel. The very effective organic-mercurial compounds are very poisonous and raise the matter of toxic hazards in the industry. However, one of them, phenyl mercuric dinaphthyl methane disulphonate, was described as being substantive to tissue protein, and its passage into general circulation is prevented; indeed, it is apparently in use as a wound dressing. These three substances, sodium pentachlorophenate, 2,2-methylene bis (4-chlorophenol) and phenyl mercuric dinaphthyl methane disulphonate, are being exhaustively tested by the British Paper and Board Industry Research Association in accelerated laboratory tests made with impregnated strips of board in contact with Czapek agar in Petri dishes. Three test organisms, *Chaetomium globosum*, *Aspergillus niger* and a *Penicillium* species, are sprayed on singly or mixed as spore suspensions. After two weeks incubation the amount of mould growth is recorded and, when required, the mechanical strength of the paper strip is compared with uninoculated controls. The results indicate that mould-resistant samples were obtained when the following percentages on the dry weight of the fibre were used: phenyl mercuric dinaphthyl methane disulphonate, 0.25 per cent; 2,2-methylene bis (4-chlorophenol), 1.5 per cent; and sodium pentachlorophenate, 1.5 per cent.

The papers described briefly above will be published in *extenso* in the *Proceedings of the Society for Applied Bacteriology*.
T. RICHARDS

OBITUARIES

Prof. Edwin J. Cohn

EDWIN J. COHN, Higgins university professor at Harvard University, died in Boston on October 1. He was an outstanding investigator of the physical chemistry of proteins, and the initiator and organizer of the large-scale systematic fractionation of blood plasma proteins, which has made important contributions to medicine and public health. He was born in New York City on December 17, 1892, the son of Abraham and Maimie Einstein Cohn. His decision to undertake a scientific career was made while he was a student in Amherst College. On the advice of Jacques Loeb, he transferred to the University of Chicago, where he received the B.S. degree in 1914, and the Ph.D. in 1917. His doctoral thesis dealt with the physiology of spermatozoa and the physical chemistry of sea water, the latter study being undertaken with Lawrence J. Henderson, of Harvard, who, together with Loeb, was an important guiding influence in Cohn's development. At this point Cohn decided to devote himself to the study of proteins, as substances of prime importance to the

living organism, and that decision guided him throughout the rest of his career. Protein chemists were relatively rare in those days. Cohn studied with two of the greatest—Thomas B. Osborne in New Haven in 1917, and S. P. L. Sørensen in Copenhagen in 1920. During the Second World War he worked with Henderson on the physical chemistry of bread-making—a problem then of urgent practical importance. He returned from Europe to Harvard in 1920, when Henderson offered him a position in the newly created Department of Physical Chemistry in the Medical School. This Department, of which he shortly became the head, was the centre of his activity for the rest of his life.

Prof. Cohn's early researches were concerned with the factors affecting the solubility and the acid-base equilibria of proteins; he was one of the first to recognize the importance for protein chemistry of the Debye-Hückel theory of interionic forces, and to apply it in his solubility studies. The discovery of the liver treatment of pernicious anaemia by Minot and Murphy led him to undertake the purification of the active principle. Isolation of the active component—identified twenty years later as vitamin B₁₂—was not achieved; the human patient was at that time the only available experimental animal for testing the liver fractions, and all available patients were rapidly cured. However, the practical advance achieved was great; the extracts prepared by Cohn's methods promptly replaced whole liver in treating the disease.

These studies never deflected him from his concern with protein chemistry. However, about 1928 he turned to the study of the amino-acids, peptides and related substances as simple models of known structure which might be employed to elucidate obscure aspects of the physical chemistry of the proteins. The recognition by E. Q. Adams and N. Bjerrum that amino-acids, when electrically neutral, were dipolar ions (*Zwitterionen*) served as a clue of fundamental importance in these studies. Cohn became the centre of an active group of investigators, who explored the far-reaching implications of dipolar ion structure of proteins, amino-acids, and peptides. Among other accomplishments, much was achieved in relating solubility to structure in compounds of this class, in terms of electric charge distributions within the molecule, of the presence of polar and non-polar groups, and of the effects of the dielectric constant and the ionic strength of the medium.

The work of the laboratory began again to centre on the proteins about 1938; and this tendency was accelerated by the outbreak of the Second World War. Cohn was early aware of the gravity of the problem of blood transfusion, and he recognized that concentrated serum albumin would have many advantages over whole plasma as a transfusion medium. Moreover, the other fractions of blood plasma proteins could then also be separated from the same blood, and made available for clinical use, each for a particular function. With support from the Office of Scientific Research and Development, and with the great war-time blood-donor programme of the American Red Cross, this vision was carried into practice with extraordinary success. More than half a million transfusion units of serum albumin, derived from about two million blood donations, were prepared in the United States during 1942–45, in addition to the vast number of donations used as whole blood or for dried plasma. Gamma-globulins, fibrin foam and film, and isoagglutinins for blood

typing were other practical products of the fractionation programme. The large-scale methods of separation developed, involving precipitation with ethanol at low temperatures, with careful control of pH and ionic strength, were profoundly influenced by the earlier studies on amino-acids and peptides; the rapid progress made in the war-work would indeed have been impossible without the theoretical background developed over the earlier years.

The scale of operations in the war-time programme was indeed large, requiring close collaboration between chemists, clinicians, immunologists and others, and rapid industrial application of the processes worked out in the Harvard pilot plant. Cohn was the driving force behind the programme; his extraordinary gift for directing and co-ordinating a great organization, which he himself had largely created, was for the first time called fully into play. The concentrated attention which he devoted to every detail of every process was astonishing; plans for improvements and modifications poured forth from him in a never-ending stream, and the enthusiasm with which he pressed his colleagues to put every new idea immediately into practice was at times somewhat overpowering. Yet, with all his passion for detail, he never lost his vision of the situation as a whole.

After the War, the laboratory drew visiting investigators from all over the world—more than thirty came from foreign countries between 1946 and 1953, as well as many from within the United States. The emphasis in research shifted toward fundamental studies on proteins, especially blood proteins, but a close relation to problems of medicine and public health remained. Indeed, Cohn drew no distinction between pure and applied science; he devoted himself with equal zeal to abstract questions of protein structure and to the problems of making albumin and gamma-globulin available on a large scale, and with proper safeguards, to the public. During the last years of his life he developed a machine for making blood fractionation largely an automatic procedure; this is now being manufactured on a small scale for trial use in blood donations, and may lead to further far-reaching developments.

Cohn was twice married: to Marianne Brettauer in 1917, and, after her death, to Rebekah Higginson in 1948. His home was always a centre of hospitality for numerous friends and colleagues. Besides the passionate intensity with which he devoted himself to his research interests, he retained a keen interest in art and literature, and was an active student of the history of science. The numerous workers who came to undertake research with him underwent a discipline both exacting and imaginative, and many will retain vivid memories of an intensely active laboratory headed by an extraordinary man.

JOHN T. EDSALL

Prof. Stefan Pienkowski

THE death on November 20 of Prof. S. Pienkowski, coming so soon after that of Prof. C. Białobrzęski, has dealt a grievous blow to Polish science, which has thus lost its acknowledged leaders in both experimental and theoretical physics.

Stefan Pienkowski was born in 1883 in a small Polish town, then under Russian occupation. After his early education at home he went to study at the Universities of Heidelberg and Liège, where he later was a member of the teaching staff. Immediately