grams of substances other than amino-acids have been devised, notably for sugars and their derivatives[45,46].

Perhaps the most important application of paper chromatography is to elucidate the sequence of amino-acid residues in proteins and polypeptides. This is a problem of fundamental importance, but has long been unsolved because of the lack of methods for handling complicated mixtures of peptides which result from partial hydrolysis ; and, in fact, very few peptides have been isolated and identified[47] by the traditional chemical methods. However, simple peptides behave on paper chromatograms as satisfactorily as amino-acids, and techniques have been devised[4] to separate and identify lower peptides in complex mixtures. The sequence of the amino-acid residues of gramicidin-S was thus established[48] as -(α-valyl) - ornithyl - leucyl - phenylalanyl - prolyl-. Tyrocidin appears to incorporate the sequence -valyl-ornithyl-leucyl- and probably the sequence -aspartyl-glutamyl-tyrosyl- in its structure (Consden, Gordon and Martin, unpublished). There would appear to be a promising field for similar investigations of other polypeptides, the list of which is rapidly growing, consisting of residues of a few varieties of amino-acid or having molecular weights intermediate between simple molecules and proteins.

With the proteins themselves, the mixture arising from partial hydrolysis is likely to be vastly more complex, and it is too much to expect that the structure of a protein could be pieced together from the peptides identified. So far as I am aware, wool is the only protein which has been examined in this way, and preliminary reports have been given by Martin[49] of the identification of nineteen dipeptides of aspartic and glutamic acids[50] and of a number of peptides from the less completely investigated neutral and basic fractions of partial hydrolysates of wool[51]. One conclusion from these studies is that a substantial proportion of the glutamic acid is linked with itself in the wool polypeptide chain. Recently, Consden and Gordon[5] have described techniques for identifying peptides of cystine, and it can be concluded that, in wool, cystine is linked *via* one of its amino-groups and *via* one of its carboxyl-groups to residues of glutamic acid and to residues of most of the neutral amino-acids and that a substantial proportion of proline residues, if not next to, are not far from, cystine residues. The possibility of identifying a large number of peptides in partial hydrolysis mixtures should be a big step forward in our knowledge of protein structure.

It has not been possible to deal adequately here with all aspects of paper chromatography, especially pending publication of the many important developments which are now rapidly taking place. However, enough has been indicated to justify the confident expectation that, before long, this technique will be in common use in many laboratories.

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OBITUARIES

Mr. S. G. Brown, F.R.S.

SYDNEY GEORGE BROWN died on August 6 at Sidmouth, where he went to live on his retirement. He was seventy-five years of age.

Born in Chicago in 1873, his father having gone there to live, he was brought to Great Britain at an early age. He was educated at Harrogate College and University College, London. On leaving college he served as an apprentice in the works of the late Col. Crompton at Chelmsford, where he was principally engaged on calculations and design of dynamos and motors. In 1908 he married Alice Stower, niece of Prof. John Perry, whose close friendship he enjoyed until the time of the latter's death.

It is by his numerous inventions that Mr. Brown became famous. He claimed to have taken out about a thousand patents, commencing when sixteen with a home-made phonograph. In 1899, when only twenty-six years of age, he produced the drum cable relay used in submarine telegraphy. This was followed by the magnetic shunt and other devices connected with duplex working over long-distance cables. Also at this time, with Sir Henry Hozier, he demonstrated a system of directional beam wireless using a parabolic reflector of wire. Signals were transmitted for over a mile between a coastguard station and a lighthouse at Beachy Head. These distances were later increased. This patent was dated 1899.

Finding difficulties in getting his inventions manufactured, he opened in 1910 his own workshops near Liverpool Street, London. After two moves to obtain more space he decided in 1915 to have his own factory built, for which purpose he purchased a large site in Acton, London.

In 1910 he patented his reed type telephone earpiece, by means of which wireless messages could be read when otherwise inaudible. They were adopted as standard by the Royal Navy. He worked on electrical aids for the deaf and was possibly the first to demonstrate bone conduction for hearing. In 1909 he perfected various types of relays for the purpose of amplifying feeble currents both for use in wireless and telephony. This was in the days before the introduction of the thermionic valve. Early in 1914 one of these, the microphone relay, was accepted by the Royal Air Force for use in aeroplanes. By its use wireless messages could be received during flight. The same relays were used by the Admiralty for extending the range of signalling at sea.

Mr. Brown conducted considerable research on rare metals for contact purposes. At the request of the Admiralty he designed the electro megaphone for loudspeaking on warships. One form of this instrument is used on the London Underground Railways for speech between guard and driver. The late Admiral Lord Fisher personally wrote thanking Mr. Brown for his work on relays for detonating mines, using the current from a selenium cell operated by the rays of a searchlight.

The greatest of Mr. Brown's inventions, however, and the one that he himself ranked as his highest achievement, was his gyroscopic compass. The two principal features are the vertical axis and the liquid ballistic. By the first, friction is reduced to a minimum by raising and lowering the whole of the north-seeking parts, including the gyro wheel, at more than a hundred times a minute, using a column of oil, pump-operated. To overcome quadrantal error, common to all gyro compasses, he replaced the solid weight used to precess the compass by a liquid which was free to flow from side to side of the wheel during the rolling of the ship. To work in conjunction with his compass he designed an automatic helmsman which makes it possible to steer a course at sea direct from the compass. He further made a multiple repeater for the ease of steering by hand, also a recorder on which the course of the ship can be plotted on a moving chart. His last invention was a gunnery control compass. This demanded an extreme accuracy at sea only previously associated with a laboratory compass working in a stationary position on land. Such a compass was completed and had passed Admiralty requirements when its adoption was delayed owing to the Second World War making its application impracticable.

With the introduction of broadcasting, Mr. Brown turned his mind to mass production, thousands of pairs of headphones being produced daily. He gave the name to the loudspeaker. While he produced many types fitted with horns he foresaw the development of the large cone diaphragm back in 1910, when he referred to its possibilities in his receiver specification.

During the First World War, Mr. Brown served on the Research Committee for the Detection of Enemy Submarines, the Inventions Board and the Admiralty Ordnance Council. He was elected a fellow of the Royal Society in 1916. In March, 1909, he read a paper before the Royal Institution on "Submarine Telegraphy", and in 1920 one on the "Gyroscopic Compass".

Apart from his activities with the Company that bears his name, he founded and was chairman of the Telegraph Condenser Company.

With all his inventions Mr. Brown acted as his own designer. He was an accomplished engineer capable of giving advice in any department of his works. He was held in great respect by his staff, with whose assistance he earned a great reputation for the high quality of all his work.

H. PASMORE

Prof. Marcel Brillouin

THE Nestor of French physics, Marcel Brillouin, formerly professor of physics in the Collège de France, died on June 16 at the age of ninety-four. He belonged to a generation of men of science who could not only master the whole realm of their subject but also make important original contributions to almost every branch of it. As a result they were able to present that subject to their students in a most perfect form, thus providing them with a solid foundation for their own future activities in this field. Prof. Brillouin's lecture courses at the Collège de France provide an outstanding example of this almost extinct art, and many of them have been published in book form, like the well-known "Leçons sur la viscosité des liquides et des gaz"

Like many great physicists, he started as a mathematician at the École normale; but his natural inclination soon diverted him first to mechanics and later to physics as a whole. Thus he acquired skill in the use of mathematics as well as in the handling of apparatus which enabled him to carry out investigations requiring refined experimental and mathematical techniques at the same time, which is so rarely found in physicists of the present generation.

Only a brief indication of Brillouin's most important research subjects can be given here. In hydrodynamics he did fundamental work on the theory of discontinuity surfaces in liquid flow and the formation of vortices on similar lines to Helmholtz, and in aerodynamics he developed a theory of the dispersion of sound. In thermodynamics he devoted himself to the study of permanent deformations of solids and to the specific heat of black body radiation, and he derived the proportionality of this quantity with the third power of absolute temperature. The kinetic theory of matter was enriched by Brillouin's contributions to the theory of diffusion and viscosity in gases and liquids, and he also took part in the once topical controversy on the apparent contradiction in statistical mechanics between the reversibility of the laws of dynamics and the irreversibility of those of thermodynamics. He was very much interested in geophysics as well, and he con-