J. P. Lodge (Boulder) gave a valuable account of techniques for the identification of individual sub-micron particles. Chemical methods exist only for chloride and sulphate particles, but he has found that a number of species, including sulphuric acid in various stages of neutralization by gaseous ammonia and phosphate, can be identified by their characteristic appearance in the electron microscope.

V. J. Schaefer (State University of New York) described the detection of surface active molecules on airborne particles by the use of indicator oils. Pollen grains, ocean spray nuclei and many particles in industrial smog had been found to exhibit surface active properties by this technique.

Papers on electrical properties of particles were given by J. Bricard (Paris), G. Madelaine (C.E.A. Fontenay aux Roses) and by R. Siksnas (Uppsala). Bricard had found that only 4 per cent of the radioactive small ions from the decay of radon and thoron have the expected mobility of $2.15 \text{ cm}^2 \text{V}^{-1} \text{sec}^{-1}$; the remainder have a mobility spectrum with peaks at 0.51 and $0.81 \text{ cm}^2 \text{V}^{-1} \text{sec}^{-1}$. He attributed this to the rapid formation of cluster ions, but in the discussion it was suggested that cluster ions as normally understood could scarcely have so different a mobility and that the effect was more probably due to the formation of Aitken nuclei by radiolytic reactions.

In papers on the development and use of instruments, T. A. Rich (G. E. Coy, Schenectady) described an interesting combination of diffusion and electrical techniques to investigate the size of aerosols and R. E. Davis (U.K.A.E.A., Winfrith) the use of the Nolan Pollak counter in the testing of high efficiency filter systems. G. F. Skala (G. E. Coy, Schenectady) advocated the use of ion chambers to investigate the production of particles from heated substances in conditions of temperature and pressure which would preclude condensation methods. H. Israel and N. Nix (Aachen) re-opened the question of the role of Aitken nuclei in atmospheric condensation by quoting measurements of the temperature drop recorded on expansion in the Nolan-Pollak counter. While their results are in conflict with other measurements, they suggest that the counter detects nuclei activated at a supersaturation of 2 per cent instead of the 280 per cent calculated if an adiabatic expansion is assumed.

It is hoped that the next conference of the series will be held in Prague and Vienna in 1969. W. J. MEGAW

OBITUARIES

George de Hevesy

PROF. DE HEVESY, Hungarian born, who lived latterly in Copenhagen and Stockholm, died on July 5. He was the pioneer in the use of isotopes as revealers of the paths taken by elements in chemical and biological processes—discoveries which have been of immense consequence. Born in Budapest in 1885, he took his doctorate in Freiburg before coming to England in 1911. Later he worked in Vienna before gaining a chair at Freiburg in 1926. Some years later he moved to a professorship in Copenhagen and finally settled before retirement in a research institute at Stockholm. He was the holder of many awards and honorary degrees. These included the Nobel Prize for chemistry in 1944 and the Copley Medal and foreign membership of the Royal Society. He found time to write notable books on his main subject as well as to publish a large number of papers. With Coster he discovered hafnium.

Von Hevesy, as he then was, found himself, a chemist, among the physicists who clustered around Rutherford in Manchester a few years before the Great War. His first success there was his showing that the whole of a minute amount of a radio-element deposited itself from a solution

on nickel, immersed in it, even when the radio-element was actually chemically more reactive than nickel. His first failure—not at all his fault—was his complete inability to separate radium-D from its isotope lead. But with Von Hevesy, this failure led to success, for it showed him that minute concentrations of radio-elements must be successful tracers of their common isotopic elements in chemical and biological processes. Later he found that the tracer-isotope need not be radioactive; so long as its oddness could be characterized, an inactive isotope might do—for example, deuterium. Later still he extended possibilities by making a suitable inactive isotope reveal itself in a mixture by its being made artificially radioactive by bombardment by neutrons; the measurement of its characteristic radiation determined the amount of the element in the mixture quantitatively. His discoveries in all these fields have since had a magnificently fruitful following.

Hevesy was a European of the best sort, genial, kind-hearted, a good friend. He did not look strong, but he was a mighty worker dedicated to research. He died in Freiburg. A. S. RUSSELL

Hans Pettersson

PROF. HANS PETERSSON, who died in Göteborg on January 25 at the age of 77, was particularly noted for his leadership of the Swedish Deep Sea Expedition in the *Albatross*, and for his many contributions to the study of the deep sea floor and its sediments. His father, Otto Pettersson, with other Scandinavian scientists, particularly Nansen, Ekman and Helland-Hansen, did much to establish the serious study of physical oceanography at the turn of the century. Hans studied physics in Uppsala under Knut Angstrom and in London under Sir William Ramsay. At first he joined his father in the study of currents and internal waves in Swedish coastal waters, but he soon developed his interest in optical and radio-chemical studies. Between 1922 and 1936 he worked frequently at the Institut für Radiumforschung in Vienna, where he interested a number of specialists in marine problems. He found that although radium is concentrated in deep sea sediments, its concentration in sea water is much less than would be expected from the much greater concentration of uranium. He believed the deficit to be due to co-precipitation of thorium and ionium with the hydrated oxides of iron and manganese. He used the variation of radium content with depth in the sediments as a basis for geochronological estimates. He did much to further the development of deep sea coring devices.

His tremendous enthusiasm for the subject and the success of his work and that of his colleagues persuaded some of his successful compatriots to provide funds necessary for the founding of the Oceanografiska Institutet in 1939 and, in 1947–48, for the round-the-world expedition in the *Albatross*. The expedition was very successful, and its observations and sampling did much to stimulate the growth of interest in marine geochemistry there has been in the past 20 years. Although mainly concerned with the sea floor, studies of the transparency of the water and scattering of light at different depths were also important features of the work.

Pettersson was interested in the contribution of cosmic dust to the ocean sediments, and his latest communication to *Nature* dealt with this subject. He was elected a Foreign Member of the Royal Society in 1956, and retired in the same year from the post as director of the Oceanografiska Institutet. G. E. R. DEACON

Eva G. R. Taylor

PROF. EVA GERMAINE RIMINGTON TAYLOR, who died on July 5, 1966, at the age of 87, was bedridden for the later years of her life and almost totally blind for the last year, but she nevertheless retained her acute critical faculties to the last, and only a few weeks before her

death had dictated her doubts on the authenticity of the Vinland map.

She was educated at the North London Collegiate School for Girls and, after taking a degree in chemistry in the University of London, spent several years as a science mistress at Burton-on-Trent. Seeking to improve her teaching qualifications, she went up to Oxford to take the Diploma in Education. There she came under the influence of A. J. Herbertson and was swept into his activities in developing the 'new geography', both in the Oxford department and through his text-books in the schools. She stayed on as his assistant, working on the preparation of the famous Oxford wall maps and, on a vacation course, met J. F. Unstead. The series of text-books she produced with him had a great influence in the schools.

It was, however, her appointment as lecturer at Birkbeck College under Unstead in 1921 which marked the turning-point in her career. She turned her attention to historical geography and published *Tudor Geography* and *Late Tudor and Early Stuart Geography*. They established firmly her academic standing so that, when Unstead retired in 1930, she succeeded him as professor of geography and so remained until she retired in 1944. In those years she became not only the acknowledged expert in the maps and literature of the Tudor and Stuart periods, but also in the instruments of navigation and the work of contemporary explorers. A series of papers in the *Mariner's Mirror* and the *Journal of the Institute of Navigation* culminated in her *The Haven-finding Art*.

But Prof. Taylor was far from being immersed in the past. She threw herself with enthusiasm into physical planning and became a member of Lord Reith's Consultative Panel in 1941, with the inauguration of the Ministry of Town and Country Planning. She is still remembered by planners as the originator of the 'sieve method'—by eliminating or sieving out areas unsuitable for development for one reason or another there remains a positive field within which to work.

A woman of strong personality and trenchant language verging on abuse, there were occasions when it was easier to be on the other side, for she never minded opponents who hit back. But her positive opinions were based on wide knowledge, and the bubble reputations she delighted to prick usually deserved this treatment. She retained her maiden name throughout her life and, though proud of her two sons, she kept her domestic life entirely separate from her academic. Shortly after her retirement her work was recognized by the award of the Victoria Medal of the Royal Geographical Society, and her students, subscribing in large numbers, endowed a named lecture at the Society in her honour. L. DUDLEY STAMP

Fritz Zernike

PROF. FRITZ ZERNIKE, who died on March 10 in Groningen, Holland, was born in Amsterdam on July 16, 1888. His father was headmaster of an elementary school and his mother had been a schoolteacher. Their six children formed a lively and intellectually stimulating family. At nineteen, as a student of chemistry at Amsterdam, Zernike was awarded a gold medal by the University of Groningen for an essay on a probabilistic treatment of a certain parlour game. In 1912 he received another prize for work on critical opalescence, and in 1914 his collaboration with L. S. Ornstein resulted in the Ornstein-Zernike formula, which plays a central part in the theoretical and experimental investigation of the critical point. In 1915 he obtained his doctor's degree with a thesis, *L'opalescence critique, théorie et expériences*, in which the formula for extinction by scattering near the critical point was derived by means of the grand canonical ensemble. The experiments he reported agreed with the theoretical result and made possible a determination of Avogadro's constant to within a few per cent.

In the meantime, Zernike had become an assistant to J. C. Kapteyn, the astronomer at Groningen, but soon afterwards he was appointed a reader in theoretical physics at the same university, and then, in 1920, a full professor. He continued the investigation of the pair correlation function $g(r)$ occurring in the Ornstein-Zernike formula, and in collaboration with J. A. Prins applied it to X-ray diffraction in liquids. His interest in statistical physics also led to a study of the influence of Brownian motion on the measurement of small currents and, characteristically, he put his theoretical understanding to practical use by constructing an improved galvanometer.

Zernike's unique combination of mathematical insight and technical ability proved very fruitful when he directed his attention to optics. Rather than obscuring a problem by laborious calculations, he would reduce it to its simplest mathematical elements which would then serve as stepping-stones for his physical intuition and inventiveness. For example, he showed that the difference between the rival theories of Abbé and Rayleigh concerning the microscopic image formation is nothing but a difference in order of integration. The discovery of phase contrast microscopy in 1932 was virtually a natural consequence of this method; in fact, when Zernike explained the principle it was hard to understand why it had not been discovered earlier. Perhaps that makes understandable why, when he offered his invention to Zeiss, the leading optical industry in those days, the haughty reply was: "Wenn es interessant wäre, so hätten wir es schon längst selbst erfunden". Yet some development work was carried out at Zeiss, and the first motion picture of cell meiosis was made. Phase microscopy did not become widely known, however, until Arthur T. Bryce, of the U.S. Army, arrived in Jena in 1945 and immediately realized its importance.

Meanwhile, Zernike turned his attention to another problem in microscopy—What is the influence of small aberrations on the diffraction pattern in the image plane? As an appropriate mathematical tool he introduced "circle polynomials" and, in collaboration with B. R. A. Nijboer, the work was successfully completed in 1942. In the same years Zernike developed the concept of "degree of coherence", constructed a useful poor man's ultracentrifuge using the motor of a vacuum cleaner, published a quantitative treatment of the Senftleben effect with C. van Lier, gave an approximate treatment of the phase transition in binary alloys, and worked on the technical problem of how to manufacture the phase rings needed for his microscope.

Relativity theory and quantum mechanics were of less interest to Zernike, presumably because they lacked the intimate connexion with technical applications which made classical physics so fascinating to him. He was not easily persuaded to publish his results and ideas, but when he wrote an article it was carefully planned and lucidly written. His public addresses were full of brilliant ideas and he had a masterful way of utilizing a simple analogy to throw new light on an old problem. His contacts with other scientists were rather limited, partly because he was so much absorbed in his own research, and partly because he felt ill at ease with people who could not appreciate that the short, often witty, and sometimes caustic way in which he expressed his opinion was just another aspect of his search for unadulterated truth. Unfortunately, this gentleness made him rather defenceless in the turmoil of university politics. His friends, however, will not forget how his great knowledge, widespread interest, and penetrating and refreshingly unprejudiced views made his conversation an intellectual enjoyment.

Official recognition came late, first in the form of the Rumford Medal in 1952, and in the next year the Nobel Prize for his invention of the phase contrast microscope. Zernike was a Foreign Member of the Royal Society of London. N. G. VAN KAMPEN