important when the free path is no longer small compared with the other lengths involved. Cercignani prefers analytical methods of solving the integral equations involved; he lists problems which have been discussed numerically, but gives little detail.

The book has been attractively prepared. It reads easily, though this is in part because of the suppression of (not always unimportant) ancillary matter. It attempts to give exact proofs where possible; to achieve this it has sometimes to make non-physical assumptions which limit the range of validity of the proofs. One is not always sure that the book is concerned with actual gases; however, as a mathematical exposition it possesses refreshing novelty.

T. G. COWLING

Obituaries

Professor P. W. Robertson

PHILLIP WILFRED ROBERTSON, who died in London on May 7, was born in Auckland in 1885. From Wellington College he proceeded to Victoria University College, graduating MA with first class honours in chemistry in 1905. In recognition of his academic competence and his ability in sport, especially hockey and tennis, he became the first of Victoria's Rhodes Scholars (1905). At Trinity College, Oxford, he took MA with first class honours in chemistry and subsequently at Leipzig he was awarded a PhD. He became successively professor of chemistry at Rangoon College, Burma (1909–11), lecturer at Imperial College, London (1911–19), and professor of chemistry at Victoria University College, Wellington (1920–49).

As an undergraduate, Robertson had an unusual aptitude for research. Even at seventeen it was obvious that he had in mind one of his principal objectives—to investigate the relationship between chemical constitution and physical properties. By the age of nineteen he had published in the *Journal of the Chemical Society*, London, and also in the *Transactions of the New Zealand Institute*, eight scientific papers entirely on his own. His earlier contributions touched on analytical chemistry including the well known method for halogen estimation, and on the mechanism of aromatic substitution. In extensive researches on cryoscopy, Robertson discovered the tendency of fatty acids to form double molecules which explained *inter alia* the two inflexions in the melting point and solidification curves of mixtures of adjacent even numbered fatty acids and assisted in the development of the theory that the component acids in the double molecules were held together by hydrogen bonding.

Much of Robertson's later work was concerned with the mechanism of organic chemical reactions, especially in connexion with electrophilic addition and substitution of halogens. Several of his papers on the importance of hyperconjugation in chemical substitution reaction appeared after his retirement in 1949, the last paper being published in the *Journal of the Chemical Society* in 1956.

Robertson's contributions to chemistry were paralleled by his literary achievements. They comprised two books, a number of short stories and a few poems. The earliest work published in 1920 under the title *The Soul's Progress : Mezzotints in Prose* has been compared by Richard Le Gallienne with Walter Pater's *Imaginary Portraits*. Its thread is continued in the autobiographical *Life and Beauty*, a testimony to the author's ability to interpret foreign cultures, literatures and writers. His short story *Odyssey in Wellington Harbour* has been described as a masterpiece of contemporary New Zealand prose.

His last publication appeared in *Biology and Human Affairs* in 1967 in the form of a profound treatise on colour words and colour vision.

In the preface to his first book he wrote: "There have been some who imagine that natural sciences will eventually solve the riddle of the universe, while others have insisted, and perhaps rightly, that art being pure intuition, is a more certain key to a problem, one at least of whose factors is infinity". In his unassuming way, Robertson endeavoured to approach the problem from both sides.

Correspondence

Will there be Catastrophe ?

SIR,—I am deeply saddened by the comfortable conservatism and complacency of your leading article "Will there be Catastrophe ?" (*Nature*, **223**, 550; 1969).

The basic issues involved seem to have been avoided. Only minor occasions in which technological progress has clashed with social values were considered. But why does society have a say (and then usually too late) merely in the side effects of technology ? Why are not the principal choices determined socially (i.e., selecting which of the opportunities presented by scientific research are to be developed) ?

The reason seems to be that the public is mostly unaware of the choices available and scientists are too uninterested to inform them of the range of technological opportunities. The answer to this dilemma lies, largely, in an education system which instils in scientists an awareness of society and of their own special social responsibilities.

Passive acceptance of the *status quo* and a complacent view of science are the antithesis of such a policy and just the type of attitude that suggests there will be a catastrophe.

Yours faithfully,

DAVID BIGGINS

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Sussex.

Putting the Moon where it Belongs

SIR,—In the article "Putting the Moon where it Belongs" (*Nature*, **223**, 333; 1969), where you are discussing the scientific objectives of the Apollo flight, you say: "Where basic science is concerned, for example, it would probably have been possible to avoid some of the mistakes of the past few years if NASA had been more closely in relationship with the scientific community. Some of the Biosatellite experiments would have had a poor showing if they had been put through the kind of intellectual mill to which academic research proposals are usually subjected, and is it really sensible to go looking for magnetic monopoles in samples of Moon dust recovered from the Moon this week ?"

Since I am the principal investigator who proposed the monopole search to NASA, it would appear that *Nature's* question (if it is not rhetorical) should be answered by me. I have just re-read my 1967 proposal, which is unfortunately too long to be reproduced with this letter, and I find the arguments presented at that time still valid. The opening sentence of my proposal reads: "Modern experimental physicists are generally agreed that the discovery of any one of the following three objects would constitute a major breakthrough in our understanding of the physical universe: (1) free magnetic

monopoles, (2) the heavy particles (quarks, etc.) whose existence has been postulated to explain the observed regularities in the 'spectroscopy of fundamental particles', and (3) gravitons, or some observation of gravity waves." (In view of the very recent discovery of gravity waves by Joseph Weber, I was pleased to be reminded of this sentence.)

Searches for physical phenomena of the kind just mentioned have a special fascination for experimental physicists in that if one multiplies the chance for success (which is admittedly very low) by the scientific importance (which is enormous), the product compares favourably with that of the more routine experiments on which one spends most of one's scientific life.

It is now 21 years since Dirac showed that the existence of monopoles was consistent with all known physical phenomena, and would explain the otherwise inexplicable facts of electric charge quantization. The existence of monopoles would of course also bring symmetry to the sources of electric and magnetic fields—a symmetry that is conspicuously absent from Maxwell's equations, which demonstrate the complete symmetry between the fields themselves.

My file of reprints of papers concerning monopoles now numbers more than fifty, and involves work initiated or performed by an illustrious group of physicists including Dirac, Fermi, Teller, Amaldi, Purcell, Schiff and Schwinger. Theory and experiment indicate that magnetic monopoles must be created in pairs, in energetic nuclear encounters. The accelerators at Brookhaven and CERN cannot produce magnetic monopoles, so, until the Serpukhov 76 GeV and the Weston 200–400 GeV machines can be tried, the search for monopoles must depend on primary cosmic ray bombardment. The Earth's atmosphere is a likely target that has been investigated many times without success. The difficulty concerns the ultimate fate of the monopoles produced—there have been many answers to the question "Where do monopoles come to rest after being produced in the atmosphere by high energy cosmic rays?" The problem is complicated by the Earth's magnetic field and its frequent reversals during geological time. Searches have been made for monopoles in ice from the north magnetic pole, in outcrops of magnetic ore in New England, and in cores from the ocean floor.

To avoid problems of diffusion in the atmosphere, searches have been made in meteoritic material. There, one of the problems involves the ablation of the interesting surface material; any monopoles present in the meteorite could be lost with the surface layer, as the meteorite burned in its passage through the atmosphere. (Measurements of cosmic ray produced nuclides in meteorites yield the best information concerning the degree of surface ablation.) The second problem in using meteorites is that any bulk sample should contain equal numbers of north and south monopoles; monopoles slow down very rapidly in solid matter, so a free north and south pole would end up in close proximity. Effective monopole searches in meteorites can therefore be made only in ground-up material, in which, for statistical reasons, corresponding north and south poles find themselves in different test samples. "Moon dust" has been churned by micrometeorites to the point that it resembles the ground-up meteorites that museum curators so dislike to see prepared.

The Moon's surface is unique in that it has been exposed in vacuum to primary cosmic rays longer than the meteorites, in a non-magnetic environment, and the exposed surface can be brought through the atmosphere in a "box within a box", so that ablation effects can be ignored. The "churning" of the Moon's surface by meteoritic impact simply lowers the monopole density in the surface layers; monopoles can't be lost except in mutual annihilation. All of these factors have convinced me that my associates and I can make the most definitive search for magnetic monopoles yet proposed or attempted. Furthermore, the search is non-destructive; it doesn't subtract a microgram from the available sample, and it didn't add a microgram to the weight of the lunar module, nor subtract a microsecond from the time the astronauts had to do science on the Moon. And, for the reasons I gave earlier in this letter, I think the continuing search for magnetic monopoles, whenever the chance arises to do the job more effectively, is very worthwhile and in the best scientific tradition.

Yours faithfully,

LUIS W. ALVAREZ

University of California,
Berkeley, California 94720.

University News

Dr John T. Wilson has been appointed provost of the **University of Chicago.** Dr Wilson was deputy director of the US National Science Foundation until his move to Chicago a year ago.

Announcements

Methuen and Co. Ltd are the British publishers of the book *Induction and Intuition in Scientific Thought* by P. B. Medawar, the American edition of which was reviewed in *Nature* (**222**, 1095; 1969). The British edition is available in hardback (16*s*) and paperback (7*s*).

Dr André Guinier, professor of solid state physics at the Faculty of Science of Orsay, France, has been elected president of the **International Union of Crystallography.**

International Meetings

September 23–24, **Vertebrate Palaeontology and Comparative Anatomy,** Newcastle upon Tyne (Dr A. L. Panchen, Zoology Department, University of Newcastle upon Tyne, UK).

September 23–24, **High Speed Photography,** Birmingham (Mr R. J. Cox, 44 Gade Avenue, Watford, Hertfordshire, UK).

October 6–10, **Safety Aspects of Hot Laboratory Equipment and Remote Control Systems,** Vienna (International Atomic Energy Agency, Kartner Ring 11, A-1010, Vienna, Austria).

October 6–10, **Forest Symposium,** Belgium (Special Committee for the International Biological Programme, 7 Marylebone Road, London NW1).

October 7–10, **Separation Methods,** Lausanne (Schweizerischer Chemiker, Falkennstrasse 12, Ch 8008 Zurich, Switzerland).

Sabbatical Itinerants

In the hope of providing some practical assistance in the good cause of mobility between laboratories, *Nature* advertises the needs for housing of families about to take up periods of sabbatical leave. To begin with, no charge will be made for advertisements like this. It is hoped that a period of experiment will show what form these advertisements could most usefully take and whether they are effective.

Wanted: Furnished accommodation in Oxford area, preferably in city, for visiting Australian scientist, December 1969–July 1970. Please contact: P. H. T. Beckett, Department of Agricultural Science, Oxford (57245).