CLIMATES FOR RESEARCH

Scientists in Organizations

Productive Climates for Research and Development. By Donald C. Pelz and Frank M. Andrews. Pp. xii+318. (New York and London: John Wiley and Sons, Inc., 1966.) 80*s*.

THIS is the work of two American social psychologists and it deals with the factors which are favourable to progress in original scientific research when the work is done both by individuals and teams. Observations and opinions of the work of more than 1,300 scientists in university, industrial and government laboratories in the United States were obtained. The numbers of scientists considered were large enough for a proper statistical analysis of the results. The authors claim that the book is based on more extensive objective and quantitative data than has ever before been examined in this area. The study is particularly useful in that the crucial laboratory factors can be modified to some extent by the heads of research departments, managers, and the scientists and technicians themselves. There can be no doubt that much of this investigation is valid for work in British scientific research institutions, but there are differences. The great difference in esteem between the Master's postgraduate degree and the PhD which is held in America does not obtain to the same extent in Britain. The deeper purse which finances many investigations in the United States and the generous staffing which is conducive to adequate teamwork with a well-spread set of complementary specialisms, common in America, are rarer and ideal in Britain. Reasonable financial rewards will operate as a stimulus both to the individual as a person and to the team as an organization which often requires highly sophisticated and expensive apparatus, which on occasion will try the resources of heavy engineering. Research, even in subjects other than physics, has moved far from Rutherford's "tobacco-tin stage".

The authors have portrayed their findings with many charts and tables, and have provided a complete description of the research on which the findings are based. This, in itself, is useful as a model and guide for other workers in sociological fields, who at times have used statistical formulae with little background knowledge of experimental techniques and the interpretation of results. It should be kept in mind that all the statistical analysis in the world may be helpless if the very rare Newton, Planck or Rutherford is caught in their net!

The chief areas which were explored by the authors of the book were freedom, communication, motivations, satisfactions, creativity, age, groups and co-ordination. The principal factors of the results of the researches show that effective scientists were self-directed by their own ideas and valued freedom. But at the same time they allowed several other people a voice in shaping their directions; they interacted vigorously with colleagues. Effective scientists did not limit their activities either to the world of "pure science" or of "applied science" but maintained an interest in both. Their work was diversified. Effective scientists were not fully in agreement with their organization in terms of their interests; what they personally enjoyed did not necessarily help them to advance in the structure. Effective scientists tended to be motivated by the same kinds of thing as their colleagues. At the same time, however, they differed from their colleagues in the styles and strategies with which they approached their work.

In effective older groups, the members interacted vigorously and preferred each other as collaborators; yet they held each other at an emotional distance and felt free to disagree on technical strategies. Thus, in numerous ways, the scientists and engineers who were studied did effective work in conditions which were not completely comfortable, but contained "creative tensions" among forces pulling in different directions.

Among the interesting by-products of the research, which appeared when it seemed important to remove the effects of certain extraneous factors, was the fact that PhDs in government research in America published 50 per cent more than university PhDs, and assistant scientists in government research published twice as much as those in industry. This appeared to stem from the obligations of government laboratories to let the public know where their money was going. Again, the relatively low publication rate among scientists in industrial laboratories could be attributed to "company security".

W. L. SUMNER

OBITUARIES

Professor H. N. Green

HARRY NORMAN GREEN, who died on May 16 at the age of 64, published many papers on nutrition, traumatic shock and the immunological aspects of cancer.

He graduated MB, ChB from the University of Sheffield in 1924 and the next year gained his BSc, with first class honours. His MSc and MD followed in 1926 and 1927. He then combined the posts of clinical assistant to Sir Edward Mellanby at the Royal Infirmary, Sheffield, with that of research assistant in the department of pharmacology. After two years as lecturer in pathology at Cambridge, he returned in 1935 to Sheffield as professor of pathology. In 1953 he became director of cancer research at the Universities of Leeds and Sheffield and professor of experimental pathology and cancer research at the University of Leeds.

Green was interested in that part of experimental pathology which has a bearing on clinical medicine. His earlier work, in collaboration with Sir Edward Mellanby, concerned the effects of vitamin A deficiency in the spread of infection. The advent of the sulphonamides as clinically effective antibacterial agents led him to study their mode of action. He demonstrated that bacteria produced one, or possibly more, factors capable of inhibiting the action of the drug. He made considerable progress towards the characterization of these factors.

The advent of the Second World War produced an immediate interest in traumatic shock; Green was approached by the Medical Research Council to investigate the problem. On the basis of conclusions drawn from the clinical examination of cases of industrial injury, he and his collaborators began to examine the problem experimentally. It was shown that adenosine triphosphate and related nucleotides accounted for the shock inducing properties of muscle extracts. A period as leader of British Shock Team 2, Royal Army Medical Corps, enabled him to demonstrate the release of nucleotides from the injured tissues of battle casualties and thus to confirm in man the experimental findings. The background to this work was described in a monograph with Dr H. B. Stoner, entitled *Biological Actions of the Adenine Nucleotides*.

Green's interest in cancer started with a series of investigations on the carcinogen, 2-acetylaminofluorene. These were followed by the study of those fractions of coal tar which were able to inhibit the growth of transplanted tumours in animals, work which was never published in full because of the fear of raising false hopes of an impending cure for cancer. A number of chemically pure tumour inhibiting but non-carcinogenic compounds were isolated and were also shown to be without effect on induced or "spontaneous" tumours in rodents. It was the consideration of this work which led, in 1954, to the immunological theory of cancer. The idea that immuno-

logical mechanisms might be responsible for the integrity and balance of the many different tissues of the body and that cancer might be the expression of a failure of these mechanisms was, at the time it was published, revolutionary and was one of the milestones leading to the resurgence of interest in immunology applied to cancer. The explosive growth of interest in cancer immunology led Green and his colleagues to prepare a text on an immunological approach to cancer which is due for publication within a few months.

Green's great strength was his ability to join together facts and concepts from apparently unrelated fields and thereby to add to the understanding of the subject in which he was interested. He took great pride in the activities of his son and daughter and of his wife, whose increasing reputation as a painter delighted him.

D. B. CLAYSON

Friedrich Frans Koczy

FRITZ KOCZY, who died on April 18, was born in Vienna in 1914. He studied mathematics and physics at the University of Vienna during 1934–38; in 1936–38 he worked on his PhD thesis at the Institute for Radium Research under the direction of Dr Berta Karlik. At that time this institute was one of the leading centres for the study of natural radioactivity; its exciting scientific and intellectual atmosphere made a lasting impression on Koczy. His research was directed towards testing a hypothesis of Otto Hahn, that the coloration observed in certain samples of rocksalt was caused by the presence of RaD-F-G—these salts supposedly deposited from radioactive waters emanating from thermal springs. Koczy measured the helium contents of blue and white rocksalts, found no significant differences and disproved the hypothesis. In 1939, at the invitation of Hans Pettersson, the noted Swedish oceanographer, Koczy left Nazi occupied Austria to become a research fellow and to assist in establishing the Oceanographic Institute at Göteborg, Sweden. His chief interest was the application of radioactive methods to oceanographic problems. In particular, he was interested in the distribution of uranium and thorium and their decay products in the oceans, the sediments, and on the continents. On the basis of his measurements of lead isotopic ratios, Koczy calculated the age of the Earth to be 5·3 billion years. This value disagreed considerably with the favoured estimates of the time; however, it is in excellent agreement with the age of 4·5 billion years, generally accepted in the past few years. Koczy simultaneously engaged in a variety of scientific projects involving many disciplines; he cultured plankton on a large scale, investigated the factors influencing light propagation in sea water and the relationship of light levels and biological activity, and was one of the earliest users of underwater photography as a scientific tool.

Shortly after the end of the Second World War, when plans for the now-famous Swedish deep-sea expedition of 1947–48 were approved, Koczy played an important part in the preparations; he was especially active in the conversion of the *Albatross* into a research vessel and in the acquisition of scientific equipment, particularly difficult at that time. He participated in the entire fifteen month expedition which greatly profited from his scientific insight and experimental skill. The organization and analysis of the experimental material collected during the expedition occupied Koczy for several years. He assumed responsibility for processing, analysing and publishing the extensive echo-sounding records. Koczy developed a unique method for obtaining water samples close to the ocean floor, which could be used even at great depths; the samples obtained in this manner yielded results which established him as a pioneer in the study of the properties of deep oceanic waters. Most important, however, was that Koczy was able to formulate his ideas about the geochemical balance of the radioactive elements in the hydrosphere on the basis of his measurements of radionuclides in oceans and sediments.

In 1957 Koczy accepted an invitation from Dr F. G. Walton Smith, director of the Institute of Marine Sciences University of Miami, to go to Miami to develop a division of physical sciences. Here he assembled a large group of world famous research scientists engaged in activities ranging from underwater acoustics to the study of radionuclides produced in sediments by cosmic rays. His efforts were very important in making the institute one of the world's leading oceanographic research centres. Koczy felt a strong obligation to establish a good teaching programme and he was instrumental in making the institute one of the best in the training of graduate students.

While at the University of Miami, Koczy continued his investigations of natural radionuclides in sea water and sediments. He became a leading authority on age determination of ocean sediments. Under his direction a dating method was developed which was based on the ratios of the activities of protactinium-231 (a daughter nuclide of uranium-235) and thorium-230 (a daughter of uranium-239); capable of dating sediments up to 200,000 years old, it is the most commonly used and reliable of the various geochronological methods. Koczy also showed that the concentration of radium-226 in the oceans was too great to be derived from land sources. He proposed that the radium diffused from the ocean sediments (this was a particularly important discovery, for radium-226 is the only natural radioactive tracer released in quantity at the bottom of the ocean). On the basis of the vertical distribution of concentrations of radium, Koczy calculated vertical mixing rates for deep ocean waters and the time of residence of these water masses.

Koczy never dismissed the practical side of his work because of his profound understanding of the social functions of science. He became concerned with, for example, the relationship of oceanography to fisheries and radioactive waste disposal at sea. His capabilities and his concern for the development of science naturally led to an involvement with scientific policy on a national level. Koczy was appointed early a member of the National Academy of Sciences Committee on Oceanography and for four years was one of its most active and enthusiastic members. In the same period, he sat with the Earth Sciences Advisory Panel of the National Science Foundation. He also held advisory positions with the Atomic Energy Commission, the Environmental Sciences Service Administration and Bureau of Commercial Fisheries. In addition, he was on the editorial boards of many scientific publications. Koczy was involved in one of oceanography's most imaginative investigations of the sea, the Joint Oceanographic Institutes Deep-Earth Sampling, the purpose of which was to drill into the ocean floor to obtain long core samples in an effort to expand the understanding of the origin and history of the ocean basins. Koczy was also chairman of the Gulf Universities Research Corporation, an organization devoted to oceanographic investigations of the Gulf of Mexico and the Caribbean through the co-operative efforts of universities in the area.

Although a dedicated scientist, Koczy took a great interest in cultural activities throughout his life. His colleagues in Vienna recall that he was a voracious reader and frequently visited the theatres and museums; he is reputed to have attended almost every concert of the Vienna Philharmonic Orchestra in his student days. At the time of his death he was on leave from the University of Miami and was a distinguished visiting professor at the University of Hawaii.

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