

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 rock-salts, 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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