cycles have been the subject of endless debate, and may have to do with changing climates, movements of land masses and the like. But the interesting thing here is that whenever we postulate that this kind of stretching out of a life-cycle is to be explained in some such terms—within an evolutionary frame—we can cite other examples where animal groups have simply become separated from parent stocks, or represent surviving forms of a stock many of whose earlier representatives have become extinct, and yet do not have diffuse life-cycles.

Perhaps then we can put the matter like this: natural selection will be free to act independently on the various parts of the life-cycle of an animal; in some animals this will mean that entirely different selective forces will act on different parts of the life-cycle; yet so long as the selective forces are not so severe as to break any part of the life-cycle the species will be able to maintain itself. The particular (or peculiar) feature of a life-cycle that we examine will be the evolutionary result of a particular group of biological responses of a particular life-history phase to certain particular effects of the environment.

L. C. Cole[3] has attempted to show that life-histories of organisms always have meaning and significance in terms of the survival of the species. He dealt particularly with intrinsic rates of increase, with iteroparity and semelparity, to show the profound effects that these properties can have in the maintenance and growth of populations, and he sketched the evolutionary strengths and weaknesses which might be inferred about a species through their consideration. Nothing I have written in any degree disparages what Cole put forward, and I regard as great the significance of his essay to ecology and evolution. But Cole was dealing with parameters of populations which govern numbers, and through numbers evolutionary success. In another sense Cole clearly showed that these parameters are also adaptations of the species to its environment and way of life, ecological adaptations rather than the morphological and physiological ones we are, even to-day, more used to, but adaptations nevertheless.

In the last analysis the continuance of both populations and species turns on the effectiveness with which life-cycles are completed, despite changing conditions. The extinction of both populations and species is a matter of broken life-cycles rather than death of individuals; that is what makes habitat destruction so sore a point with modern conservationists, and also what frequently places so difficult a burden on them in delimiting and defining habitat.

The ability of a life-cycle to maintain the existence of a population or species or an evolving stock of animals will depend on the genetics of the animal, the particular features of the life-cycle (including adaptations of greater or lesser perfection) at the moment of selection, and these determine what fraction of the population survives and, therefore, the character of the future population or those derived from it. But, as there are many ways to skin a cat, there are many ways to complete a life-cycle, and no animal group has a mortgage on the way to do this successfully.

[1] Tucker, D. W., *Nature*, **183**, 495 (1959).
[2] Bertin, L., *Eels* (Cleaver-Hume, London, 1956).
[3] Cole, L. C., *Quart. Rev. Biol.*, **29**, 103 (1954).

OBITUARIES

Dr. Ricardo Zariquiey Alvarez

DR. RICARDO ZARIQUIEY ALVAREZ, who died at his home in Barcelona on January 27, 1965, was not only a well-known paediatrician but also an authority on certain Spanish Coleoptera, notably the Bathysciinae, and on the decapod Crustacea of the Iberian Peninsula.

Ricardo Zariquiey Alvarez was born in Barcelona on January 3, 1897, and was educated at the Jesuits school. After graduating with distinction in medicine at the University of Barcelona in 1918, he studied in Paris and Lausanne in order to specialize in paediatrics. Like his father, Dr. Ricardo Zariquiey Cenarro, whose medical practice he eventually took over, he was keenly interested in natural history. Together with his father, he made extensive collections of Coleoptera, especially cavernicolous ones, and in a series of papers published during 1917–27, he described many new or interesting species from a wide area of northern Spain. Other arthropod specialists have paid tribute to the two Zariquieys by naming three genera or sub-genera and twenty-eight species or sub-species after them. Their collection of Coleoptera has been bequeathed to the Instituto Español de Entomologia, Madrid.

About 1934 his father became interested in the decapod crustaceans of which he amassed an extensive collection and on which he published nine papers before he died in 1943. Dr. Zariquiey Alvarez then devoted his leisure time almost exclusively to the Decapoda, although in 1944 he published a paper on the distribution of the dipteran genus, *Phlebotomus*, in Spain. When the civil war ended he built a holiday bungalow near Cadaqués on the Costa Brava, and during the next twenty years he made a thorough investigation of the decapod fauna of that coast from Port de la Selva to the Bay of Rosas. Visits to the fish markets of Rosas and Barcelona yielded some decapod species new to science or new to the Spanish fauna. Local fishermen brought him any unusual finds, and various marine and fishery stations in Spain sent him material for identification.

Dr. Zariquiey was always rather diffident about his hobby, regarding himself as an amateur carcinologist, and frequently consulted specialists in the Paris, Leiden and British museums and elsewhere. He also invited a few specialists to his home in Cadaqués and it was there that the small "Groupe d'Études carcinologiques" was formed in 1955. The main object of the group, which met again in Barcelona in 1955 and in Naples in 1959, was the compilation of a critical check-list of the Mediterranean decapod Crustacea. Zariquiey's suggestion, based on an unsurpassed knowledge of the living animals, that some of the so-called variable species of the museum taxonomist were in reality mixtures of two or more species, met with initial scepticism. But later on specialists had to acknowledge the correctness of this view. His results were published in a series of twenty-five papers during 1945–64; his book on the decapod Crustacea of the Mediterranean coast of Spain (1946) will soon be superseded by an up-to-date revision of the Decapoda of the Iberian Peninsula to be published posthumously. The whole of the Zariquiey collection of decapods has been bequeathed to the comparatively new Instituto de Investigaciones Pesqueras, Barcelona.

In addition to his presidency of the Institución Catalana de Storia Natural, Zariquiey was closely associated with numerous scientific societies in Spain; he was a life-member of the Entomological Society of France and a member of the board of advisory editors of *Crustaceana* from its inception. A rather shy and retiring man, he was exceedingly kind and took a genuine interest in the work and personal affairs of the simple fisher folk from whom he obtained specimens. One had only to see him with his grandchildren to realize how good a children's doctor he was. Those of us who were privileged to visit him in his happy and most hospitable home will always

cherish the memory of those days at Cadaqués; his enthusiasm for crustaceans was most stimulating. Our deepest sympathy goes to his widow, Señora Mercedes Colom de Zariquiey, to whom he was devoted, and to his son, his four daughters and their families.

ISABELLA GORDON

Mr. I. Izsak

ON April 21, 1965, Imre Izsak, chief of satellite research and analysis of the Smithsonian Astrophysical Observatory and lecturer at Harvard University, Cambridge, Massachusetts, died of a heart attack at the age of thirty-six. He was in Paris attending a COSPAR symposium on trajectories of artificial celestial bodies as determined from observations.

In the brief years of his scientific career, he had established himself as a pre-eminent authority on geodesy and had made significant contributions to the study of celestial mechanics. His death is both a deep personal tragedy and an irreparable loss to the scientific community.

Born in the small town of Zalaegerszeg, some two hundred miles from Budapest, Izsak attended the University of Budapest, where he worked in astronomy under the late Karoly Lassovszky (who also later joined the Smithsonian Astrophysical Observatory) and specialized in the investigation of variable stars and galactic clusters. Fleeing Hungary during the 1956 revolution, he began work on solar physics at the Zurich Observatory in November of that year. Two years later he emigrated to the United States and, after a brief period at the Observatory of the University of Cincinnati, joined the staff of the Smithsonian Astrophysical Observatory. On February 24, 1964, he became a citizen of the United States of America. He lived in Cambridge with his wife Emily and an infant son, Andrew.

Izsak pioneered in the development of both theoretical and practical aspects of the application of satellite data to geodesy. He directed the writing of a complex tesseral harmonics programme, which served as a powerful tool in his investigation of geodesy. From it he made determinations of the gravitational potential of the Earth. These results are the best representation so far of the Earth's potential.

Izsak also applied himself to the problem of refining the determinations of the positions of the Observatory's twelve Baker-Nunn camera stations for tracking satellites. In a dynamic approach, he used the Observatory's differential orbit improvement programme to obtain residuals in satellite position, and then analysed these residuals in his own tesseral harmonics programme to determine changes in station co-ordinates and the tesseral harmonics of the geopotential. These latter quantities are strongly correlated, and one cannot solve for one without solving for the other. Shortly before his death, Izsak directed the production of a new computer programme to combine the data from Dr. George Veis's geometric approach with that of his own dynamic approach. This has the effect of reducing the correlation of station positions and the tesseral harmonics. These investigations have shown that the geometric and dynamic methods agree well and have produced the most accurate global measurements of points on the Earth: the locations of the stations are all now known to within a few tens of metres, and those with the best determinations to within 10–20 metres. At the beginning of the programme, the corresponding precision was about 100 metres.

As a by-product of these undertakings, Izsak developed techniques for making numerical and analytical calculations using electronic computers. These programmes, which involve problems in celestial mechanics and have significant implications for interplanetary navigation, carry out algebraic operations that would take a life-time to do by hand.

The geodetic work in which Izsak played such a fundamental part will culminate in the publication of the Smithsonian Standard Earth, a concept he and others initiated. That model, which is expected to be the most accurate representation of these features yet available, will incorporate the results of his investigations of the geopotential and of the station co-ordinates.

Izsak wrote a number of scientific papers, including analyses of satellite orbits, a determination of the ellipticity of the Earth's equator, a second-order solution of Vinti's dynamical problem, and various notes on the mechanization of the tedious algebra of celestial mechanics.

Izsak was a warm, charming, witty, gentle person. He gained not only the deep respect but also the spontaneous affection of his colleagues. His association with them was one of mutual inspiration.

Dr. R. F. Farquharson, M.B.E.

DR. R. F. FARQUHARSON died suddenly on June 1 at the age of sixty-eight while attending a meeting of the Medical Research Council in Ottawa.

With his death, Canada has lost the pre-eminent figure of its medical profession. To his work as teacher, research worker, consultant and statesman he brought a fine mind and a great heart. That he cared for people was obvious and everyone felt that his wise judgment was always available to them, as indeed it was. He gave the impression that he was prepared to be generous with his unusual talents, and this was coupled with an equally unusual ability to put them to work.

Early in his career it was apparent that he was a man who could accept responsibility, and over the years it was given to him to a degree that will not be seen again. For almost twenty years his advice was called for in connexion with almost every new medical enterprise. Both professional and lay organizations sought his counsel at their inception and some were fortunate enough to be able to continue to count him as one of their officers. Equally deftly he helped other and older groups who were in trouble and who, as they searched for new courses, needed his wisdom and the backing of his moral authority. It was the good fortune of the Royal College of Physicians and Surgeons of Canada to have him as its president in the crucial post-war years 1945–47, when the entire structure of the College was altered so that it could accept its responsibilities to the country for medicine at the specialist and consultant level. He presided at the transformation in 1960 of the Division of Medical Research, National Research Council, into the virtually autonomous Medical Research Council. During the Second World War he was consultant in medicine to the Director of Medical Services of the Royal Canadian Air Force. Immediately after the War he worked in association with the Director-General of Treatment Services, Department of Veterans' Affairs, and had much to do with the high standard of patient care which was evolved in association with the medical schools. From 1949 until 1952 he was a member of the Defence Research Board. During the discharge of these and innumerable other duties he was held in high esteem as a teacher. He was a brilliant consulting physician who remained to the end quietly and privately surprised that others did not have the skill at the bedside which was his.

It was natural that many honours should come his way. These he carried as lightly and with as little sense of self-importance as he carried the many secrets which were shared with him. In 1946 he was made a member of the Order of the British Empire, and in 1949 came the first of eight honorary degrees. He was elected a Fellow of the Royal Society of Canada in 1960. The clinical investigation unit in his own hospital has carried his name