Joaquin Cravioto (1922–1998)

P. Arroyo and M. Mandujano*

Fundacion Mexicana para la Salud, Tlalpan, Mexico; and *Universidad Autonoma Metropolitana, Unidad Xochimilco, Mexico

Joaquin Cravioto was born 12 September 1922 in the city of Pachuca, capital of the State of Hidalgo, and died 9 April 1998, in Mexico City. He was a Mexican nutritionist whose work covered most of the second half of the 20th century. He was prominent among the group of scientists working at the end of World War II, who called the attention of world leaders and politicians to the burden of malnutrition on all humans, but especially on infants, the most vulnerable group. His work contributed greatly to the understanding of the nature of childhood malnutrition, its origins and sequelae, and to the establishment of modern prevention, treatment and rehabilitation of malnutrition. As a scientist, he always looked for hard evidence and never lost sight of the fact that the basic origin of malnutrition is to be found in the malfunctioning of society as a whole and the accompanying injustices.

Ancestry and education

Joaquin Cravioto belonged to the 4th generation of a family settled by an émigré from Genoa, Italy, in 1830 in Huachinango, a small mountain town of the Mexican State of Puebla. The long family history of the Craviotos shows a lineage reaching a peak of economic and political power during the second half of the 19th century, followed by a loss of property and fortune during the Mexican Revolution of 1910. These economic and social upheavals may account for the decision of Dr. Cravioto to enroll in the Army Medical School when he moved from Pachuca, where he had attended high school, to Mexico City in 1940.

His experience as a military medical student left an important imprint on his character that, as he later acknowledged, helped him to develop an egalitarian perspective—all soldiers are equal beneath the uniform. This training aroused an interest in Public Health and strengthened his administrative skills. After graduating in 1945, he earned a Master’s Degree in Public Health, and in 1948, clinical pediatrics caught his interest. He joined the Hospital Infantil de Mexico (HIM), and from 1950 to 1952, he pursued postgraduate training in pediatrics, initially at the University of Illinois College of Medicine, and subsequently at the Bellevue Medical Center of NYU. Cravioto’s formal training in scientific methodology started in 1952 at the Sloan Kettering Institute for Cancer Research, and he complemented it with postgraduate training in Biochemistry at the University of Göteborg, Sweden, from 1954 to 1955.

Early work in child malnutrition

Cravioto’s involvement with the Hospital Infantil lasted from 1948 to 1972. Research in infant nutrition had been going on at the Hospital Infantil since 1946 under the aegis of Federico Gomez. The Gomez classification of child malnutrition, which was based on the magnitude of atrophy, had prognostic implications and was one of the main contributions of a research group in which Dr. Cravioto participated (Gomez et al. 1955). Their stratification of malnutrition helped systematize the clinical observations and allowed comparisons with findings of other researchers. Cravioto had joined the group when research had focused on the understanding of the biochemical immaturity of severely malnourished children (Cravioto 1962). Their report led to the adoption of new forms of electrolytes and dietary treatment of malnutrition, which proved essential to decrease the high mortality associ-
ated with this condition. He worked with Ramos-Galvan and Frenk to produce the first description of the nutritional recovery syndrome (Gomez et al. 1952) and to create an inventory of the pathophysiologic and clinical characteristics of severe infant malnutrition, leading to the publication of a systematization of the available knowledge of this clinical condition (Ramos-Galvan and Cravioto 1958).

Malnutrition and mental development

Notwithstanding Cravioto’s contributions to clinical infant malnutrition, his lasting contributions concerned the elucidation of the cause and effect relationship of early severe malnutrition with suboptimal functioning and learning disabilities in later life. To trace back the events leading to this achievement and ascertain the key role Cravioto played in its development is the best way to pay him due homage.

According to Brozek (1994), the first steps taken in this direction have to be credited to Federico Gomez, who was the first author of a 1954 publication in Spanish that gave the first systematic description of the psychological characteristics of malnourished children. This paper mentioned the application of the Infant Gesell Scale (Gomez et al. 1954). At that time, Geber and Dean were doing similar work in Uganda, but their results were not published until later (Gerber and Dean 1956). After this pioneer work, systematic research on the psychological manifestations of malnutrition upon entry to the hospital and during rehabilitation, using the Gesell Infant Scale, was undertaken by Cravioto. He made a preliminary communication of his findings before the Mexican Society of Pediatric Research in 1959. This work was soon followed by a second presentation to the same scientific society on the influence of certain ecological factors on the behavior of the rural malnourished child. A formal publication in Spanish appeared that same year, but the English version was not published for some years (Cravioto and Robles 1965).

The ecological approach to the study of the late effects of malnutrition

It is possible that Cravioto’s epidemiologic background was a key factor for the transition of the group at the Hospital Infantil to attempt a new approach on the underlying causes of malnutrition. Gomez presented the rationale for establishing a permanent rural research center in Mexico in 1956. In his own words he stated: “. . . without the comprehensive knowledge of the substrate of what we call ‘poverty and ignorance’ at family and communal settings, we shall never progress in the investigation of the social etiology and in the prevention of malnutrition.” Under Cravioto’s leadership, the first description of the growth of a cohort of children born in a calendar year in a rural setting during y 1 of life and followed longitudinally was published (Perez-Navarrete et al. 1960). This paper also included information on the incidence of infectious episodes and their effect on childhood growth. A fundamental question of children malnutrition received a preliminary answer, i.e., growth falters around 4 mo of age in malnourished children living in rural environments.

The preparatory work of Guatemala

Cravioto’s opportunity to engage in a new conceptual and methodological approach to the study of the late effects of malnutrition on mental functioning came when he was appointed Associate Director of the Instituto de Nutricion de Centroamerica y Panama (INCAP) in 1962. This post put him in contact with John Gordon, among others; Gordon was part of a team that developed and applied ecological concepts and methods in their classic studies of 11 Punjab villages (Gordon et al. 1963). In addition, the ongoing epidemiologic research program on rural malnutrition of INCAP (Scrimshaw et al. 1968) offered him the opportunity to develop and test in the field an array of methods for evaluating mental performance in children. Perhaps, Cravioto himself offered the best description of the state of knowledge of malnutrition-mental performance relationships at that time, in the opening commentary of the Current Contents issue of August 20, 1979, which designated Cravioto et al. 1966 as “This Week’s Citation Classic”:

“In 1961 it was apparent that treatment based on our knowledge of the biochemical pathology of malnutrition had markedly increased the number of survivors. Since malnutrition could not only deteriorate certain aspects of biochemical maturation but also was capable of producing retrogressions to earlier age specific patterns, we became concerned with the possibility that significant lags in nervous system maturation might also have occurred. It was decided to best document if the reductions in body size characteristic of survivors of early malnutrition were associated with reduced mental development. This decision was based on the consideration that a negative finding would indicate that the lower performance found in malnutrition was a transient phenomenon, which disappeared with nutritional rehabilitation. On the other hand if children after the severe episode still exhibit significant lags, the implications for policy making and national economic planning would be of such an importance that a systematic investigation of the intervening nutritional and non-nutritional factors should be carried on. On a personal basis this would mean leaving the laboratory of biochemistry to enter the realm of behavioral sciences starting from scratch to learn psychology and social anthropology.

At the end of 1962, it was clear that in survivors of early severe malnutrition decreased body size was associated with lower intelligence scores. The time was now ripe for the examination of some of the primary mechanisms underlying cognitive growth, since the psychological tests used only partially suggest the manner in which the nervous system functioning is altered to result in lower levels of intelligence. While searching for a meaningful procedure for measuring brain function, Voronin and Guseenhkov’s paper on the phylogenesis of internal mechanisms of the analytic and synthetic activity of the brain (Voronin and Gusehnikov 1963) attracted our interest; the problem was how to make operational for the child and experimental study of phylogenesis. In deciding how to devise an appropriate test, Herbert G. Birch’s monograph on intersensory development (Birch and Leford 1964) answered our dilemma. Now we could ask if in humans malnutrition influences neurointegrative development as it influences body size. But how to control for the non-nutritional variables that affect mental growth? Since our knowledge of relevant and irrelevant factors was not good enough to make a meaningful selection, we opted for including a question on the role of the socio-economic deprivation generally present in the context of malnutrition.

Birch was invited to review a draft of the paper and to join us as coauthor. His positive response started a truly rewarding association with a most human scientist whose untimely death deprived us of science and affection. Perhaps the many questions raised and left unanswered in the paper, its review of the literature available in English and other languages, a nonintervention research design, the first attempt to test for brain function without intelligence tests, and data documenting that in underprivileged societies bigger is better, while in affluent societies bigger is irrelevant, are our guesses as to why this work is frequently cited.”

Cravioto returned to Mexico in 1965 to look for answers to the many questions that his work in Guatemala had left
unanswered. He took advantage of the experience gained in rural settings from the pioneering studies of the Hospital Infantil. He began a study in which he followed a cohort of all children born in a community in a given year. Of his cohort of 334 children, 22 (7%) developed severe malnutrition. He doggedly followed his cohort for 22 y and collected very important and unique information on the effects of malnutrition in human development. A full description of his methodologies can be found in the Monograph published by the Society for Research in Child Development in 1969 (Cravioto et al. 1969). Because of its importance, we will underscore a few points related to this investigation.

Two sets of variables were systematically searched for, i.e., those relating to the child's family circumstances and background environment, and those relating directly to the child. The background factors involved family interactions, biologic factors and general environmental conditions. The variables of interest of the child ranged from survival to aspects of physical and intellectual lathargy with age. From these two observations deserve special mention. They were the profile of the mother's behavior assessed during the child's examination using the methodology developed by Nancy Bailey, and the inventory of the stimulation available in the home environment developed by Caldwell (1967). It is possible that Cravioto and his colleagues were the first researchers to collect these variables longitudinally in a systematic manner in a rural setting, and relate them to the etiology of infant malnutrition.

The key analytical strategy implemented by Cravioto was to contrast children who developed severe malnutrition with a group of matched controls from the same cohort. The findings confirmed the independent effect of nutritional deprivation on the areas of mental function, particularly language. One major conclusion of this approach was that deprivation acts synergistically with the mother-child interaction, and with the quality of the social environment available during critical periods of the child's development. Several publications on this topic appeared in the 1970s and early 1980s, in Spanish and English. In 1982, a compilation of the methods and findings of nearly 16 years of longitudinal research was published in Spanish under the auspices of UNICEF (Cravioto and Arrieta 1982). Spain honored this book in 1984 with the "Reina Sofia de España" award.

Corollary

At the time Cravioto and his colleagues were engaged in their cohort studies, different research groups throughout the world were attempting diverse strategies in the field of malnutrition. The 1970s witnessed a new era of applied research in human development. A full description of his methodologies can be found in the Monograph published by the Society for Research in Child Development in 1969 (Cravioto et al. 1969). Because of its importance, we will underscore a few points related to this investigation.

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