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PAUL THORNELL BAKER
1927—2007

A Biographical Memoir by

RALPH M. GARRUTO, GARY D. JAMES,
AND MICHAEL A. LITTLE

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Biographical Memoir

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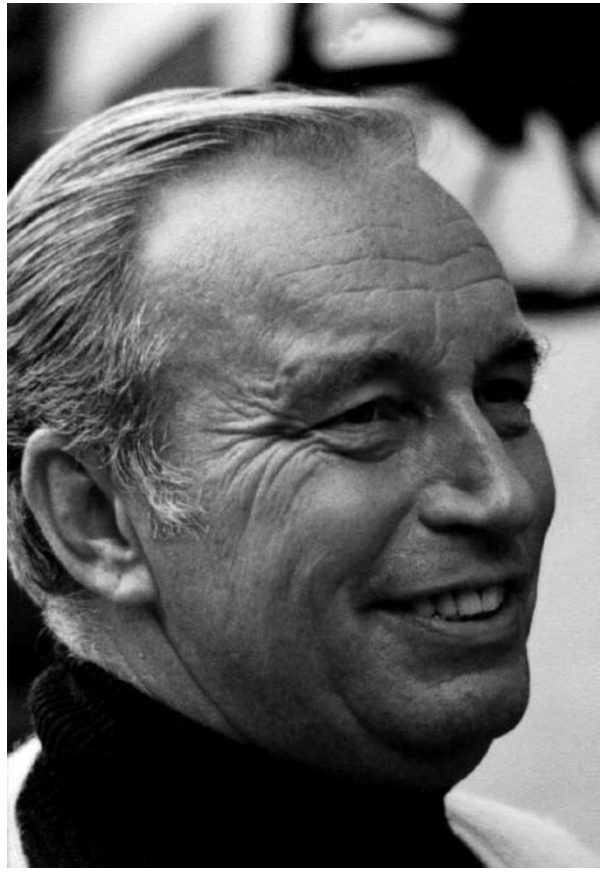

Paul T Baker

PAUL THORNELL BAKER

February 28, 1927–November 29, 2007

BY RALPH M. GARRUTO, GARY D. JAMES,
AND MICHAEL A. LITTLE

PAUL T. BAKER WAS ONE of the most influential post-World War II biological anthropologists and a pioneer in the field of human adaptation to environmental stress. His early studies of physiological and morphological adaptation to heat, cold, and altitude are landmarks, and were followed by studies of health transitions in migrant and modernizing human populations. Perhaps his greatest contribution is that he helped launch a new scientific field, human population biology, and with his large cadre of graduate students, was responsible for its significant growth and the development of national and international scientific associations dedicated to it.

THE EARLY YEARS

Paul Thornell Baker was born on February 28, 1927, in Burlington, Iowa. He was the son of Palmer Ward Baker and Viola Isabelle Thornell. His parents moved from Texas to Burlington, on the banks of the Mississippi River, where they started a dry-cleaning and tailoring business before he was born. Not much is known of Baker's early childhood. His father died in 1936 when he was nine years old. His mother remarried the following year to John Waldo Tiedemann, a farmer with significant mechanical and machinery skills,

some of which were passed on to Baker, who used them in later fieldwork. Baker mentioned, and the family confirms, that when he was about 12 years old he was struck with an unknown paralyzing illness for two years that left him both bedridden and in a wheelchair. During this time, he read voraciously. Growing up on the banks of the Mississippi River and reading the works of Mark Twain, Joseph Conrad, and Joshua Slocum apparently had a significant impact on his adventurous life and lifelong interest in sailing.

Baker attended Burlington High School but left home when he was 17 to live with his grandmother in Edna, Texas, where photos indicate he graduated from Edna High School. He went into the military service right out of high school and served with the occupying army in Italy, from June 1945 through January 1947, a time apparently filled with considerable adventure. After his tour of duty, he returned home not to Burlington or Edna but to Ft. Meyers, Florida, where his mother and stepfather had retired, and entered the University of Miami where he spent 1947-1949. During this time, he purchased the first of many sailboats to pursue his lifelong interest in sailing. He met and married Thelma Marion Shoher on February 21, 1949, and they moved to the University of New Mexico in Albuquerque, where he completed his B.A. degree in 1951. Baker and Thelma were inseparable lifelong partners and she became in many ways his intellectual mentor. Together they forged a career that would lead to the development of a new scientific dynasty in anthropology, built on the foundation of human adaptation to extreme environments.

How Baker became interested in anthropology is unclear. He was curious about people, where they came from, and what made them behave as they did. Psychology proved an unsatisfactory discipline for him and a single course in anthropology piqued his interest. At New Mexico he was influenced by a

young professor, Paul Reiter (1909-1953), a recent Harvard Ph.D. in archaeology who taught the introductory physical anthropology course. This inspired Baker to pursue the study of human evolution within anthropology. Reiter encouraged Baker not to stay at New Mexico but rather to pursue the study of human evolution at Harvard. Reiter said he would recommend him to Earnest A. Hooton (1887-1954), an important physical anthropologist at the time—if he would buy a suit before his Harvard interview. Baker bought the suit and after being warned by Hooton that rebels were not very successful in the program, Hooton admitted him in 1951 to begin his doctoral work (Baker, 1996).

His five years in anthropology at Harvard were marked by traditional training in physical anthropology under the direction of Hooton, who had trained a score of Ph.D. students before Baker, students who were well positioned throughout the United States. Baker admired Hooton as a pleasant man and a supportive mentor, but there were others who were exploring new, less traditional research in physical anthropology, and their influence was greater than Hooton's. Stanley M. Garn (1922-2007) and Edward E. Hunt Jr. (1922-1991) were two former students of Hooton at Harvard who Baker (Baker, 1996, p. 2) identified as individuals who "not only taught me the biological anthropology of the living but who remained for me advisors and friends throughout my career." Hooton died in 1954; thus William W. Howells (1908-2005) became his adviser to see him through the dissertation in 1956. Since Baker had limited support while at Harvard, he applied for a position at the U.S. Army Quartermaster Corps in Natick, Massachusetts, a military installation close to Cambridge.

THE CLIMATIC RESEARCH LABORATORY

As a young veteran Baker was probably well placed in 1952 to be employed by the U.S. Army Climatic Research Laboratory, a part of the Quartermaster Corps. He was hired by the chief of the anthropology section, Russell W. Newman (1919-1981). Newman was a biological anthropologist trained at Berkeley after the war who had interests in climatic stress, physiological tolerance to heat and cold, and body composition. The Quartermaster Corps was devoted to providing military clothing and food rations, and evaluating environmental conditions of combat, so knowledge of anthropometrics and body composition was important in assessing troop requirements. Baker, under Newman's mentorship, conducted heat stress research on military personnel at Fort Lee, Virginia (hot-wet) and in the Yuma Desert (hot-dry), and cold stress at Fort Churchill, Canada, on Hudson Bay. The Fort Lee and Yuma Desert research was conducted over three summers between 1952 and 1956 and served as the basis for his Ph.D. dissertation. In these studies comparisons were made between European-American and African-American soldiers who were matched for body composition and size while they exercised in the heat. This research, combining physiology, morphology, and body composition, dealt with how humans responded to extreme environments, and structured much of his later research on human variation and population adaptation to environmental stress. Although Baker came to the Natick lab with a sense of careful scientific design and hypothesis testing, Newman's commitment to the scientific method reinforced and refined Baker's values.

While at the Climatic Research Laboratory, Baker worked with young scientists interested in human health and well-being under extreme environments. He collaborated with Ellsworth R. Buskirk (1929-) and Farrington Daniels Jr. (1918-2002) and became familiar with the research of oth-

ers working on physiology, nutrition, and body composition during and after the war. At the same time, as a student and government scientist he established the practice of preparing government reports on the collaborative research in which he participated. These technical reports then served as the bases for journal publications in the general literature. By the time he completed his Ph.D. in 1956, Baker had established a practice of regular publication of his research as a professional anthropologist.

TRANSITION TO ACADEMIA

By 1957 Baker had already graduated from Harvard and left the Quartermaster research unit at Natick for a research position at Penn State. His research position was not in anthropology but in biophysics at a laboratory with Harald Schraer (1920-), where he was engaged in measurements of bone density in living populations. In those early studies Baker attempted to determine how X-ray density measurements at specific bone sites could predict total bone mass and total bone density. His year of research on this topic was apparently not very successful (Baker, 1996). In 1958 he had the opportunity to join the Department of Sociology and Anthropology at Penn State and continued his research on bone density studies for a few years in collaboration with J. Lawrence Angel (1915-1986) at Jefferson Medical College (later at the Smithsonian Institution) and then abandoned it for human adaptability research, which began in the early 1960s.

When Baker joined the Department of Sociology and Anthropology at Penn State, there was an administrative intent to establish a separate department for anthropology. With his early colleagues William T. Sanders (1926-2008), Frederick R. Matson (1912-2007), Louis Dupree (1923-1989), and Maurice Mook (1904-1973) he began to develop separate

undergraduate and graduate programs in anthropology, including a Ph.D. program. Anthropology became a full-fledged department in 1968 and awarded its first Ph.D. to Michael A. Little (1937-) that same year.

PERU AND THE EMERGING NUÑOA PROJECT

By 1961 Baker had a secure, tenured position as associate professor in the Department of Sociology and Anthropology at Penn State, and he had already established his credentials as a research scientist with broad interests in biological anthropology. During that same year, Russell W. Newman, Baker's mentor from the U.S. Army Quartermaster Corps, visited Baker and his wife, Thelma, at their home outside State College. Several of Baker's students were invited to dinner to meet the man who had so significantly influenced their adviser's scientific life, and they were instructed to be on their best behavior for this distinguished guest. It was sometime later that Baker's students learned that Newman had suggested that Baker pursue a new line of research at high altitude in which the U.S. military had some interest, and that there might be funds available for this research through the office of the U.S. Army Surgeon General. The concerns of the U.S. military were sparked by border disputes between India and Pakistan and India and China in the Jammu and Kashmir region and the Arunachal Pradesh region of southern Tibet, each of which was a high-altitude zone. In fact, fighting broke out during the Sino-Indian War in late 1962 when bloody battles took place at elevations above 4200 meters. How military personnel would respond to high-altitude hypoxia was of interest to the United States, and how humans in general adapted to hypoxia was an intriguing anthropological problem of interest to Baker, as well. By early 1962 Baker had funding to support research in Peru through the U.S. Army Research and Development

Command, some National Institutes of Health funding for ongoing work in bone density, and a Fulbright Fellowship as a research scholar in Peru and a lecturer in Brazil. The successful Fulbright Fellowship application was suggested by Gabriel W. Lasker (1912-2002), who had been awarded a Fulbright Fellowship to Peru four years earlier.

Baker, Thelma, and their four young children ranging in age from 3 to 11 years traveled to Peru in early 1962, first to Lima, then to the town of Pucallpa and later to the Shipibo settlement of San Francisco, a tropical forest village near the Ucayali River, a tributary of the Amazon. In Pucallpa and San Francisco physiological responses to heat exposure were conducted during exercise of Shipibo natives in the village of San Francisco and *mestizo* (offspring of Spaniards and indigenous peoples) residents in Pucallpa. Baker, with his graduate student Richard B. Mazess (1939-), applied some of the same field research experimental tests of heat stress that he had conducted while with the U.S. Quartermaster Corps.

In the spring of the same year Baker and his family moved to Cuzco, capital of the pre-Hispanic Inca Empire, at an altitude of 3300 meters. At this Andean site his interests were in physiological responses to cold and altitude stress. Soon after the arrival of several other graduate students from the United States, a field station was set up in the town of Chincheros, about 30 kilometers north of Cuzco, at a higher elevation of 3800 meters. Here total body cooling and finger cooling studies were conducted on the U.S. investigators, University of Cuzco *mestizo* students, and Quechua-speaking natives. In addition to conducting research and supervising four students, Baker and his wife maintained an apartment in Cuzco where their family and the four students lived. In early September Baker flew from Cuzco to Leiden in the Netherlands to attend the International Symposium on Temperature Acclimation.

It was organized jointly by the National Academy of Sciences and the Federation of American Societies for Experimental Biology by a distinguished international committee of physiologists, including Joseph S. Weiner (1915-1982) from the United Kingdom. It was there that he met Weiner, who was a charismatic anthropologist and physiologist 12 years older than Baker. They became acquainted and later friends, and it was Weiner who introduced Baker to the small international community of human biologists.

At this time two Peruvian students from the University of Cuzco were assisting with the research and also acting as translators. One of the students had a friend from the remote *altiplano* town of Nuñoa in southern Peru, situated at an elevation of slightly more than 4000 meters. Moreover, Nuñoa was the capital of a rural political district with human pastoral settlements existing at elevations up to 5000 meters. Two of the U.S. graduate students were sent to visit Nuñoa for exploratory work, and the town was later chosen as the site for a longer-term study of high-altitude stress.

RESEARCH ON THE ALTIPLANO

The year 1962 was a watershed period for Baker. Peru was an ideal country in which to explore the influences of climatic stress because of the three distinct physiographic zones of the nation. In the east the hot-wet tropical forests led into the Amazon Basin; at the spine of the nation the cold Andes thrust up to elevations of 6700 meters; and inland from the western coast lies an arid temperate environment where the bulk of the major population centers are located. The success of the field research in 1962 led to a long-range proposal for continuing studies of high-altitude adaptation to cold and hypoxia in Peru. The town of Nuñoa was to be the center of the research that would draw on

Native Americans who represented a population with multigenerational residence at high altitude. The actual research began in 1964 with survey and pilot studies and mapping of the region. During the latter part of the year, a field station and laboratory were built in the town of Nuñoa, and three weather stations were set up at 4000, 4500, and 5000 meters above sea level. The field station in Nuñoa was constructed of adobe bricks, as were most of the structures in the town, but unlike most other structures it had interior plaster walls and ceilings, wooden floors, and cement facing on the outer walls. The central patio was constructed with smooth, carefully fitted river stones that spelled out "Penn State" in the center. It truly was an elegant building by local standards and served for physiological testing, as a residence for most of the field workers, and as a place to gather during cold *altiplano* evenings.

The 1965 field season was one of the most intense and perhaps most productive of the entire Nuñoa project. Ellsworth R. Buskirk, with whom Baker had worked at Natick and who was now also on the faculty at Penn State, was codirector of the project and arrived in Nuñoa with a colleague, two laboratory technicians, and six varsity runners from Penn State. In addition to supervising the exercise capacity studies of the native Quechua-speaking residents of Nuñoa, Buskirk planned to test the effects of different elevations on the exercise capacity of the six athletes in Nuñoa (4000 meters) and at several sites in Colorado (Mount Evans, 4400 meters; Alamosa, 2300 meters; and Denver, 1600 meters). A part of this interest by Buskirk was related to the 1968 Olympics, which was going to be held in Mexico City at elevations over 2000 meters above sea level. In addition to the six athletes and four physiologists, there were Baker and his family of five,

another six anthropology graduate students, several spouses, Peruvian scientists, and Peruvian field assistants.

There were at least 10 studies being conducted sequentially and simultaneously requiring native participants and the investigators as subjects, while at the same time, field surveys and investigations throughout the *altiplano* countryside were being conducted with the use of only one vehicle. Laboratory studies included various exercise tests, peripheral and total body cooling tests, infant psychomotor development, and metabolic and nutritional experiments, while fieldwork involved studies of nutrition, child growth, anthropometrics, cold tolerance, and demographic surveys. In order to characterize the environment, weekly trips were made to the three weather stations by motor bike and horseback to collect temperature, rainfall, and humidity charts. The concentration of scientists, students, and families in an isolated setting inevitably led to conflicts; some associated with personality and stress, others linked to needs for space, equipment, subjects, and recreation. However, lasting friendships were established and remarkable amounts of data were gathered that most agreed justified the petty inconveniences and discomforts experienced by all the coworkers.

EXPANSION OF THE HIGH-ALTITUDE RESEARCH DESIGN

Studies in Nuñoa were conducted through late 1971 and then continued during the summer of 1972 by several of Baker's former students and a next generation of their students. In addition to the studies in the District of Nuñoa, other research was conducted in Macusani (4400 meters) and Ollachea (2400 meters) along the eastern edge of the *altiplano* and into the *montaña* forest. As the project continued over the decade from 1962 to 1972, Baker and his students published extensively in areas of demography, health, disease, nutrition, child growth, hematology, lung function, exercise

and work capacity, and cold tolerance, all within the framework of adaptation to the high-altitude environment, ecology, biocultural relationships, and evolution. His research and that of his students culminated in a major U.S./International Biological Programme synthesis volume, *Man in the Andes,* that he edited with a former student (1976).

In 1967 and 1969 several new dimensions to the Nuñoa project were added, including nutritional, dental, demographic, and genetic studies. Pulmonary function and studies of blood physiological changes in the indigenous highland Quechua population were performed that for the first time included children. Previously, children were primarily included in studies of morphological growth and development. This greatly expanded the conceptual framework of high-altitude research to include an understanding of developmental and genetic aspects of populations undergoing hypoxic stress. By 1971 Baker also had begun sending some of his graduate students to the Himalayas as a means of comparing the biological responses of genetically different populations to hypoxic stress.

Baker's research changed even more when he developed a new paradigm based in part on a time-honored design of migrant studies that Geoffrey Harrison (1927-) had updated for high altitude (Harrison, 1966). Because of increasing streams of indigenous migration to more populated regions in the Peruvian lowlands, Baker wanted to understand if and how adaptational responses at high altitude would change with significant increases in the partial pressure of oxygen associated with migration to low altitude. During a brief visit to Nuñoa during the fall of 1969, Baker took a small group of his students from Nuñoa to the coast of southern Peru (Cocachacra) to begin to set up comparative migrant studies that he had planned. The Tambo Valley and adjacent settlements in the Department of Arequipa were chosen to

continue studies of downward (to low altitude) and lateral (same altitude) native Peruvian migrants. The objectives were to compare migrants and *sedentes* (nonmigrant permanent residents) to determine more clearly their levels of biological fitness and health in their home and their new environments. Baker (1976) had developed a series of research designs to explore multiple stresses in multiple populations that were applied to the Peruvian research and to later research conducted in Samoa and on other Pacific islands.

The period from 1961 to 1972 was a formative one for Baker. He had initiated and conducted pioneering anthropological research at high altitude, he had supervised 14 master's theses and five Ph.D. theses largely based on this work, and he had served as president of the American Association of Physical Anthropologists (1969-1971), his major professional society. At the same time, Baker had become deeply involved in an international program of research that would enable him to interact with a cohort of distinguished colleagues from abroad and help to develop international science in biological anthropology.

TRANSITION TO THE PACIFIC AND SAMOA

With the completion of the Nuñoa project and the end of the International Biological Programme (IBP), Baker's career took a new direction. It was sparked by his growing interest in how environmental and culture changes affected the biology of a human population. This evolution in focus occurred because it became clear that migration, which had been an important element of the Andean research design, had with it a culture change component that could itself have significant biological consequences. While he was able to develop some understanding of how growth, development, and socialization in one environment affected the health of migrants in a new environment from migrant studies in

the isolated District of Cocachacra on the southern coast of Peru, it was not possible to distinguish the biological changes occurring as a result of the natural environment from those that were culturally mediated. He concluded that in order to address this problem, a biologically and culturally different population needed to be studied (Baker, 1996).

In 1973 Baker went to Hawaii and met with Joel M. Hanna (1938-), who had been part of the high-altitude project team in Peru and who was then a faculty member in the Department of Physiology in the medical school at the University of Hawai'i, Manoa. Hanna had conducted some growth research in the South Pacific, specifically among Samoans beginning in 1969, and suggested to Baker that an in-depth study of Samoans living in various settings might be able to address some of the questions concerning the impact of culture change on human biology. He pointed out that lifestyles of Samoans varied from traditional in villages in Western Samoa to modern and urban among migrants in cosmopolitan settings on Oahu and in San Francisco, respectively. These populations were genetically similar since migration from the Samoan Islands had been relatively recent. At that time a research plan was crafted and the Samoan Migration Project took shape, with research to be undertaken among populations in Western and American Samoa and also among migrant Samoans living in Hawaii and perhaps San Francisco. At this time there were also other island migrant studies currently underway in the Pacific, such as the Tokelau Island Migrant Study under the direction of Ian Prior (1923-) which primarily focused on changing health patterns (Prior et al., 1977). After discussions with Hanna, Baker also consulted with Prior in developing the Samoan project (Baker, 1996).

Ultimately, the Samoan project would be different from other survey projects in the Pacific in that it would incorpo-

rate a broad adaptability focus including child growth and development, fertility, demography, genetic variation, nutrition, exercise and work capacity, and population ecology. The project would also have a health focus, evaluating the correlates of obesity, diabetes, and cardiovascular diseases, which plagued Polynesian populations generally and the Samoans in particular. In addition, the project would provide a mechanism to train yet another group of graduate students in human population biology.

HAWAII AND AMERICAN SAMOA

While Baker had sent some of his graduate students to work with Hanna at the University of Hawai'i, Manoa, in 1974, the Samoan migration project did not begin in earnest until 1975. At that time, Baker sent a large contingent of graduate students and two postdoctoral trainees to undertake a health survey and demographic assessment of several migrant communities in Hawaii. That year Baker laid out his study design for the overall project, which was published in 1977 as part of a series of Man and the Biosphere (MAB) Technical Notes (1977).

The students who were part of the Hawaiian and subsequent American Samoan field research were largely funded by a Human Adaptability training grant awarded to Baker from the National Institute of General Medical Sciences. In 1976 following the Hawaiian studies Baker sent graduate students to the islands of American Samoa for a similar health survey and demographic assessment of the nonmigrant Samoan population. It was during this field season that the heterogeneity in American Samoan lifestyle was discovered. Specifically, villages in and around Pago Pago harbor on Tutuila, the main island of the American Samoa island group, were much more modern and westernized. This probably resulted from American influences, since

Pago Pago harbor had been developed as a naval base by the United States during World War II. Other villages on Tutuila were more intermediate, and those on the Manua group of islands, which had been visited by Margaret Mead (1901-1978) much earlier in the century, were the most traditional in their social organization and culture. Because of this cultural heterogeneity within American Samoa, the focus of the project expanded to include an examination of the separate effects of modernization and migration on various biological and health outcomes.

In 1977 further survey work was conducted in Hawaii, and in 1978 Baker and another group of graduate students went back to American Samoa for more specialized studies of the human ecology of the islands as well as studies of work capacity and genetic variation. Although many of his students had presented preliminary findings from this fieldwork at the annual meetings of the American Association of Physical Anthropologists, the first publications from the Samoa work appeared in 1979 in *Human Biology*. These papers examined the influence of modernization and migration (1979) on Samoan blood pressures. Numerous later publications by Baker and his students chronicled the findings from these field seasons.

WESTERN SAMOA

In late 1978 the focus of fieldwork shifted from Hawaii and American Samoa to the islands of Western Samoa, the other half of the Samoan archipelago. These islands had a completely different history from those of American Samoa, having been a colony of Germany prior to World War I and then a protectorate of New Zealand until their independence in the early 1960s. It was expected that the lifestyles of Western Samoan villagers would be much less affected by Western influences. Entry into Western Samoa was facilitated by the

addition of Martin Orans (1929-), a cultural anthropologist from the University of California, Riverside, who had conducted field work in Salamumu, a village on the island of Upolu. The 1978 field season was short, primarily focused in Salamumu, and was directed in the field by Ivan G. Pawson (1945-), another of Baker's former high-altitude students. Pawson later conducted a survey of Samoan migrants to San Francisco as part of the project as well.

Baker organized a much larger field season from the fall of 1981 through the summer of 1982, in which studies of work capacity, cardiovascular biochemistry, nutrition, morbidity and mortality, and stress physiology and endocrinology were undertaken. During this field season, it also became apparent that there was diversity of lifestyles in Western Samoa as well. The most Westernized lived in and around Apia, the capital, and there were much more traditional life ways in villages that were remote from the capital on the island of Upolu and also in villages on the island of Savaii. While further studies in the Samoan Project continued through 1990, mostly under the direction of Joel M. Hanna in Western Samoa, American Samoa, and Hawaii, Baker ended his forays into the field with the 1981-1982 field seasons. In 1984 he, Hanna, and Thelma Baker organized a meeting at Penn State to put together a synthesis volume of the Samoan studies. The result was the edited volume *The Changing Samoans: Behavior and Health in Transition* (1986), which included contributions from Baker's and Hanna's students, as well as the other senior professionals who had played a part in the Samoan Migration Project.

PARTICIPATION IN INTERNATIONAL RESEARCH PROGRAMS

In the early 1960s the International Council of Scientific Unions (ICSU), now the International Council for Science, initiated a program of research called the International Bio-

logical Programme (IBP). The theme was "The Biological Basis of Productivity and Human Welfare," and the program was global, ecological, and multidisciplinary. One of the original seven sections that were designated for active research was Human Adaptability (HA), where the goal was to study the ecology of human populations and their variation on a global scale (Weiner, 1977).

Baker became heavily involved in planning for the HA section, first, as a director of the Peruvian Nuñoa project; second, through a Wenner-Gren Foundation HA planning meeting in Austria in 1964 (1966); third, by his contribution of an important article on multidisciplinary research (1965); and fourth, through his appointment to the National Academy of Sciences /National Research Council (NAS/NRC) U.S. Executive Committee on the IBP in 1970. Then in 1971 he established the National Science Foundation-sponsored Human Adaptability Office at Penn State University, which assisted in the coordination of all HA research arising from U.S. activities. As Baker (1996, p. 5) noted in a brief memoir: "I now find it difficult to recapture in words the excitement I felt about the ideas, the people, and the potential scientific results of the HA effort." The HA research embodied many of the theoretical perspectives and concepts that had captured Baker's imagination and that he had promoted throughout his scientific life.

Baker's IBP/HA and other international activities intensified during the early 1970s when he was less immediately involved in the Peruvian field research. In addition to his membership on the U.S. IBP Executive Committee, he was a representative to the Permanent Council of the International Union of Anthropological and Ethnological Sciences (IUAES), and a member of both the National Academy of Sciences Committee on the Effects of Herbicides in Vietnam

and the ICSU Commission for Predictive Analysis of World Ecosystems. He also began to be involved in UNESCO's Man and the Biosphere Programme (MAB).

After a decade of the IBP in 1974, several international programs were identified as appropriate to "transfer" much of the research that had been developed as a part of the IBP (Weiner, 1977). The UNESCO MAB program was the most favored, being composed of 13 projects. Of these only one addressed the direct research interests of human biologists—Project 12: "Interactions Between Environmental Transformations and the Adaptive, Demographic, and Genetic Structure of Human Populations." Other projects were derived from former IBP ecosystem approaches and dealt with specific ecosystems or biomes (e.g., tropical and subtropical forests, temperate forests, grazing lands, arid lands, mountain zones), where it was possible to incorporate human population studies but where ecological research predominated. Baker's participation in MAB was first as a cochair of Project 12 in the United States in 1973 and later as chair of the Project 12 Directorate in 1975. In 1975 he was also appointed as a member of the U.S. National Committee for MAB, and he chaired the committee from 1983 to 1987. Moreover, he served as chair of the NRC Subcommittee on UNESCO Science Programs for two years until the United States withdrew from UNESCO in 1984. These scientific activities became less rewarding to Baker as the MAB program became more political, having been moved to the U.S. Department of State, and was gradually transformed to a program of applied science and conservation. He resigned as MAB chair in 1987 and shifted his efforts to other national and international science activities.

Throughout his career Baker was committed to an integration of the human biological and social sciences, collaborative international science, multidisciplinary science, and the

recognition of anthropological science as a major player in the national and international science community. Following his election to the National Academy of Sciences in 1980, the last two decades of his professional life (1980s and 1990s) were devoted to these commitments. He was president of the International Association of Human Biologists for a decade in the 1980s and helped to transform this association into a viable professional organization. He was active in two of the unions of ICSU: the International Union of Biological Sciences (IUBS) and the International Union of Anthropological and Ethnological Sciences (IUAES). In fact, he was one of the key scientists who supported the membership of IUAES in ICSU in 1993 in the face of general scientific opposition to the humanistic bent of the social sciences during this period.

TRAINING THE NEXT GENERATION

In tandem and integral to Baker's programmatic research initiatives was his development of doctoral students over three decades, many of whom have gone on to further define and expand the field of human population biology that he helped launch (1982). There are three aspects of this initiative that are particularly interesting and informative. First, Baker selected students who had a strong desire to achieve, who were goal oriented, who had strong interests in fieldwork, and who often had skills, intellectual and manual, that would significantly enhance his pragmatic research. In most cases his early students did not originate within anthropology. Their undergraduate training was often in the natural sciences, including physics, mathematics, zoology, geology, premedicine and medicine, forestry, computer science, as well as a few from anthropology.

Second, this interesting mix of disciplinary backgrounds acted as a crucible for the development of ideas and aided

in the cross-disciplinary perspective and framework he provided. Baker took these raw graduate students and began to mold them, providing them with both depth and breadth and integrating them into his multidisciplinary research and training program. Indeed, he received two training grants from the National Institutes of Health, one for the Nuñoa high-altitude project and one for the Samoan migrant and health transition project, grants that played a critical role in the development of his students.

Third, throughout his career he collaborated primarily with his former students rather than with other colleagues in the field. Eventually his cadre of the more than two dozen doctoral students that he trained or significantly influenced often went on to make substantial and diverse contributions to the field of human population biology. A list of these students and their research areas follows:

PH.D. STUDENTS WHO WERE SUPERVISED BY BAKER

Michael A. Little, 1968, cold stress, Peru
Roberto Frisancho, 1969, human growth, Peru
Charles J. Hoff, 1972, human growth, Peru
Brooke Thomas, 1972, energy flow, Peru
Ralph M. Garruto, 1973, blood physiology, Peru
Charles A. Weitz, 1973, work capacity, Nepal
Jere D. Haas, 1973, infant growth, Peru
Donald Austin, 1974, heat stress, Congo
Andrew E. Abelson, 1976, altitude and demography
Cynthia M. Beall, 1976, infant growth, Peru
James S. Dutt, 1976, altitude and fertility, Bolivia
Sarah F. Harbison, 1977, nuptiality and fertility, Samoa
William H. Bedoian, 1979, energy flow, Tunisia
Lawrence P. Greska, 1980, work capacity, Samoa
Stephen T. McGarvey, 1980, modernization, Samoa
James R. Bindon, 1981, morphology, Samoa
Cindy J. Parsons, 1982, migrant morphology, Samoa
Timothy B. Gage, 1982, ecology and food, Samoa
Gary D. James, 1984, stress responses, Samoa

Carol Ballew, 1984, hypoxia and newborns, Bolivia
David L. Pelletier, 1984, diet and disease, Samoa
Douglas E. Crews, 1985, mortality, Samoa
Jay D. Pearson, 1988, stress, Samoa, Hawaii
Diana E. Schendel, 1989, body fatness, Samoa
Shelly M. Zansky, 1991, maternal age and growth, United States

OTHER STUDENTS WHOSE WORK BAKER STRONGLY INFLUENCED

Richard B. Mazess, 1967, work capacity, Peru
Joel M. Hanna, 1968, cold stress, Peru
Anthony B. Way, 1972, work capacity, Peru
Ivan G. Pawson, 1974, human growth, Nepal
Norris M. Durham, 1974, primate ecology, Peru
Leslie Sue Lieberman, 1974-1976, postdoc, Samoa, Hawaii

AWARDS AND HONORS

Baker's awards and honors were numerous and reflected his increasing professional contributions to research, student training, and service. Fulbright, NATO Senior Scientist, and Guggenheim fellowships were awarded in 1962, 1968, and 1974, respectively. These were followed by the Distinction in the Social Sciences Award from his home university in 1977, which reflected his commitment to integrated social and human biological sciences. He was elected to the National Academy of Sciences in 1980, and then shortly after, in 1981, he was given an Evan Pugh Professorship at Penn State. Over the next 10 years, several awards reflected his international recognition: in 1981 he was the Thomas Huxley memorial lecturer and medalist of the Royal Anthropological Institute of Great Britain and Ireland; in 1985 he was the Gorjanovic-Krambergeri medalist from the Anthropological Society of Zagreb; in 1988 he was awarded the Yugoslavian Order of the Golden Star with Necklace; and in 1990 he was made an honorary member of the Croatian Academy of Medicine.

National recognitions included the Distinguished Service Award from the American Anthropological Association in

1989; the Mahatma Gandhi Freedom Award from William and Mary College in 1991; the Charles Darwin Lifetime Achievement Award from the American Association of Physical Anthropologists in 1993; and the Franz Boas Distinguished Achievement Award from the Human Biology Association in 2000. His first significant fellowship was awarded when he was 35 years old, in 1962, and the last recognition was when he was 73, in 2000. These awards reflect his contributions across several disciplines, including anthropology, human biology, medicine, and even the humanities—a tribute to his broad interests and sensitivities.

RETIREMENT AND CONTINUING INFLUENCES

Baker, prompted primarily by his wife, Thelma, retired from Penn State in 1987 at the relatively young age of 60. However, he continued to have a significant impact on the field of human population biology. During the next decade, he came regularly to national and international scientific association meetings, published two dozen scientific papers, served as vice president and chair for several international scientific organizations, and served on the editorial boards of three scientific journals, two of them new appointments. During this period, he moved from State College, Pennsylvania, to Kaneohe, Hawaii, where he continued to play a role in the Samoan project, even mentoring three of his doctoral students, the last of whom completed the degree in 1991. It was customary for most of his students to attend the Human Biology Association meetings, the organization he cofounded in 1973, and the American Association of Physical Anthropologists, both traditionally scheduled during the same spring venue each year. In these weeklong scientific meetings he continued to influence his former students,

discussing research, theoretical issues, and the politics of science, as well as advising them and others on career issues and choices. His involvement in these activities was extensive during his retirement years.

BAKER'S OVERALL CONTRIBUTIONS TO SCIENCE

Throughout his career Baker was committed to good science, careful research design, and hypothesis-driven inquiry. At the time he began his career in biological anthropology in the 1950s the field was characterized by poorly formulated ideas, weak theory, typological thinking, and largely descriptive research reporting. There were, of course, exceptions, but the profession was not healthy and had been stagnant between the two world wars (Harrison, 1997). It was at this stage in the profession that Baker brought new ideas from his own experiences, his graduate training at Harvard, and from his research at the U.S. Army Quartermaster Corps. The profession of biological anthropology was at the cusp of a major transformation, and he played a pivotal role in that transformation.

Baker's scientific contributions can be separated into three eras: (1) the 1950s at Harvard and the Quartermaster Corps, where his work was largely on climatic tolerance (heat), environmental physiology, bone biology, and body composition; (2) the 1960s at Penn State University, where he continued some of his earlier research and then extended these studies to high-altitude populations in Peru, broadening his work to include nutrition, demography, child growth, ecology, genetics, and exercise capacity; and (3) the late 1970s and early 1980s when the Samoan research centered on migration as a research design and health change as a theoretical focus.

The first era was spent learning the fundamentals of complementary laboratory- and field-based research where

a significant focus was on comparing physiological responses to extreme climatic stresses such as heat and cold between ethnic groups. What was unique about this work was the application of evolutionary and adaptation principles as an explanatory framework for the intergroup variation. During this era, Baker honed his skills of rigorous research design and experimentation in the natural settings. Overall, his early studies of physiological and morphological variation related to environmental and climatic stresses stand out as landmark contributions to the understanding of how human populations have spread and adapted to the myriad of environmental conditions they face. He also incorporated a lifespan approach in these studies of environmental physiology, evolution, and human growth and development that further advanced and broadened the understanding of human adaptability (1974).

The second era of his research was totally original and applied the principles developed during the first to the problem of adaptation to naturally occurring low-barometric pressure in a Native American population living at high altitude. How were members of this Andean, Quechua-speaking population able to adapt and reproduce themselves under conditions of chronic hypoxia, conditions that led to debilitation in sea-level residents? The theoretical framework was adaptational and evolutionary, and the database necessary to understand these relationships extensive and multifactorial. The scientific output from this project was substantial, and new comparative methods of population analysis were developed with an emphasis on improving field research designs employing some of the tools of the experimental laboratory scientist (1976).

In the third and final era Baker applied the research designs that were so successful in the Peruvian and earlier comparative natural environmental studies to the problem of why

there is a health transition with cultural change. Population and evolutionary theory was applied to a framework exploring the consequences of culture change (through Westernization) on acute and chronic health risks among Samoans in the South Pacific. In this case a well-adapted Samoan complex of behavior and biology was being transformed by migration or in situ exposure to a modern, Western lifestyle.

In the human sciences, experimental models require careful thought and sensible design. Baker was able to exploit natural experimental models (environmental stress, migration), apply anthropological models (biocultural interaction, culture change, acculturation), incorporate evolutionary principles (adaptation, genetic-environmental interactions), expand small-sample physiological studies to the population level (stress, reproduction, demography), and bring together scientists with a variety of backgrounds to achieve a common goal (multidisciplinary or transdisciplinary science). He was truly a pioneer and architect of what many now call the modern field of human population biology.

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