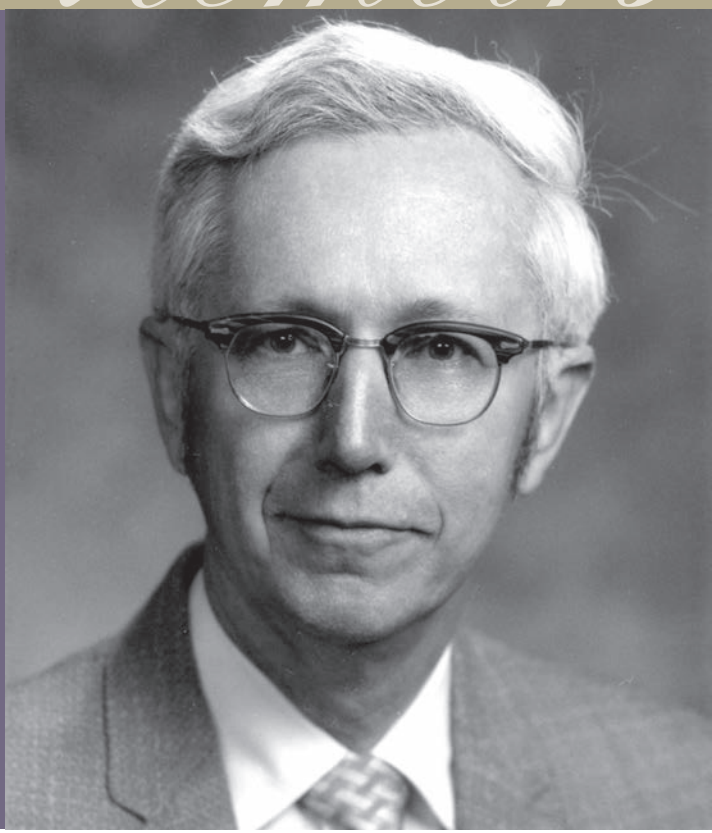
Charles D. Michener

1918–2015

BIOGRAPHICAL *Memoirs*



A Biographical Memoir by
Mary Jane West-Eberhard
and Michael S. Engel

NATIONAL ACADEMY OF SCIENCES

CHARLES DUNCAN **MICHENER**

September 22, 1918–November 1, 2015

Elected to the NAS, 1965

Photography by Office of University Relations, University of Kansas

Mary Jane West-Eberhard and Michael S. Engel

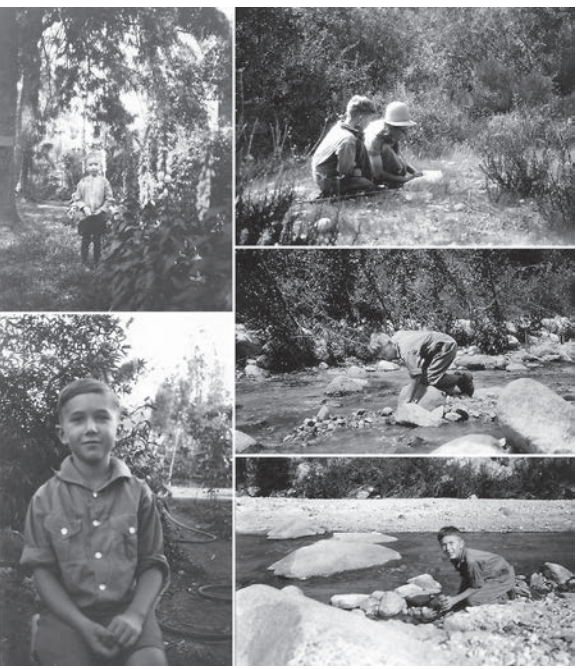
Charles Michener was an important figure in the fields of entomology, evolutionary biology, animal behavior, comparative morphology, and taxonomy, as well as an outstanding field naturalist. He became one of the world's leading experts on bees, publishing several massive compendiums that remain standard references to this day. He also helped pioneer revolutionary advances in the complex methodology of taxonomy and in the new science of sociobiology. He was the first NAS member elected (1965) from the state of Kansas and for many years was the only NAS member from that state.

Michener began his undergraduate study in the School of Agriculture at the University of California-Berkeley in 1936 and graduated Phi Beta Kappa in three years with a B.S. in entomology. He took a Ph.D. in entomology from Berkeley in 1941 and after a brief stint as a teaching assistant there, joined the American Museum of Natural History (AMNH) in New York as a researcher in Lepidoptera. He became an army officer in 1943, specializing in research on disease vectors affecting troops. He returned to studying Lepidoptera at the AMNH in 1946, but took an opportunity to go back to his main interest, bees, by accepting an associate professorship in entomology at the University of Kansas in 1948. He became department chairman a year later and remained at Kansas for the rest of his career.

Charles Duncan "Mich" Michener was born on September 22, 1918, in Pasadena, California, the second son of Harold Michener (1882–1949) and Effie Josephine Rigden (1881–1971). Mich's parents cultivated the passion of their two sons, Harold David (who went by David) and Charles, for natural history from the time they were small children. Their father, an engineer, had grown up in a California fruit-grower's family that encouraged outdoor activities and an interest in natural history. Their mother, the daughter of English immigrants, completed a master's degree in zoology from UC-Berkeley with a thesis on the systematics of marine dinoflagellates, then began

doctoral studies but gave them up when she married Harold in 1910. Josephine had worked as lab assistant and scientific illustrator for Charles A. Kofoid, a prominent scientist and demanding taskmaster who had deep ethical convictions and commitment to public well being and international good will (Goldschmidt, 1951). The senior Michener family maintained close ties with the Kofoid family long after Josephine left graduate school.

The Michener parents were avid bird-watchers who, along with their sons, banded and observed birds in their wooded garden, but they were a good deal more avid than most. They banded some 45,000 birds at their Pasadena home and published about 30 papers on them (see Engel, 2016, for references). So it is not surprising that Mich became not only a fine scientific naturalist but also a prolific writer.



While both parents encouraged the scientific interests of their sons, they did not overtly push them in any particular direction (CDM pers. comm. to Engel; Pickett, 1991). Mich's mother helped him as a child identify specimens of a great variety of organisms, and with him consulted books on the biology of these specimens. Together they visited museums, went on collecting trips (Figure 1), and constructed keys for the identification of organisms. The family designated an upstairs room in their home as "The Museum" for the storage and study of specimens and added a room adjacent to the kitchen where the boy naturalist could spread out his work. They often sent specimens to experts for identi-

Figure 1. The young naturalist at home and in the field. Left column: Mich in the backyard of the Michener family home in Pasadena, California; above in the early 1920s, below ca. 1928. Right column (top to bottom), all in San Gabriel Canyon around 1929: Mich and his mother Josephine collecting and removing a catch from the net; Mich focused on some aquatic invertebrates; Mich, at work with collecting jar in hand. (Photos courtesy of Michener family.)

fication or as donations to research collections, and Mich had a species of mayfly named in his honor when he was only 16 years old. Later, Mich named a small carpenter bee, *Ceratina nanula rigdenae*, "…for my mother, who first interested me in natural science" (Michener, 1936).

Mich's first childhood specialization was in botany. He made hundreds of colored illustrations of native plants (Figure 2). But in time he began to run out of new species, so he shifted to insects, where the variety was greater. As he had for the plants, Mich began to collect, mount, draw, and identify, at least to family, each of the insects he found, making notes on identification, localities, and biological observations—nests, behavior, life-cycles, and seasonality. Entomologists who worked with his father to control termite damage to power-line poles showed him how to properly mount and label his specimens.

Figure 2. Drawing of a cactus flower (*Opuntia* sp.) by Michener at age nine. (Photo courtesy of MSE).

Mich began to correspond with professional taxonomists at the age of 14 (1932). Following some of this correspondence, Theodore D. A. Cockerell, of the University of Colorado, the world's leading expert on bee taxonomy, invited Mich to meet with him and Philip H. Timberlake, another well-known entomologist, in Timberlake's office at the University of California Citrus Experiment Station in Riverside—just 60 miles from the Michener home. This was a felicitous meeting of mother and son with Timberlake, who began to take Mich on collecting trips in the Mojave and Colorado deserts and served as a regular consultant for identifications and advice. Cockerell and Timberlake encouraged Mich to publish his first scientific paper, on the nests of a little-known bee, at age 15 (Michener, 1935). Mich spent the summer of his junior year in high school, 1935, with the Cockerell family in Boulder, where he worked alongside Cockerell at the university, learning about the morphology and classification of bees.

Life with Cockerell was total immersion in the biology of bees. One of us (Engel) recalls Mich describing how he and Cockerell would often retire after dinner to the living room, where Cockerell would sit in his customary chair to converse with Mich or read and work. Cockerell always had next to his chair a box of pinned insects sent from some colleague for identification, and the evening's box of specimens served as material for Cockerell's next paper. Cockerell's research technique was to examine each specimen from a box with a hand lens, and jot down his notes and descriptions in a notebook, as Mich watched. He would then tear the handwritten pages from the notebook, affix a title to the leading sheet, and without keeping a copy for himself, post the handwritten notes to some journal in the morning on their way into the university. Given Cockerell's prominence in the field these submitted manuscripts were invariably accepted and published.

Mich admired Cockerell's knowledge of bee classification. And, as noted by Mich's student Michael Breed, "The generosity of the Cockerells in hosting a promising high school student [probably] helped to shape Mich's own magnanimity as a mentor" (Breed, 2016). But Mich, "although inexperienced…recognized some of the shortcomings of Cockerell's ways" (Michener, 2007): Mich wrote, "He cluttered the literature with enormous numbers of little papers" (Pickett, 1991). Cockerell remarked to Mich that he did not intend to establish a comprehensive classification of the bees: "I've gathered the wood, now it's up to you to build the house" (Michener, 2007). Michener eventually did build the house that Cockerell evidently hoped for, and more. Among his more than 500 publications (compiled by Engel, 2015), his doctoral thesis (1944) revolutionized the systematics of the bees; his book on *The Social Behavior of the Bees* (1974) remains the standard reference on bee behavior and biology; and the monumental *The Bees of the World* (2000) summarized in one masterful 913-page volume the modern classification of the bees. He followed it with a fully revised, new edition published in 2007 when he was 89 years old.

Generous encouragement during Mich's high-school years also came from his older brother, David, who, while a graduate student in biology at the California Institute of Technology, took him to visit labs there and on camping trips in the desert. With David, Mich met, "in their natural habitats (labs, etc.)" young researchers who later became prominent colleagues, including the plant physiologist F. W. Went and the geneticists Alfred H. Sturtevant, and (of special later importance for Mich) Theodosius Dobzhansky [from a 2001 memorial letter by Mich to his brother's family, provided by Daniel Michener].

After high school graduation in 1936 Mich enrolled in the school of agriculture at UC-Berkeley. Beyond the agriculture curriculum he took courses in other sciences and the humanities, such as zoology, botany, and history. He also worked on entomological collections at the California Academy of Sciences, hosted by the beetle expert Edwin C. Van Dyke, who had learned about Mich through Timberlake. As a Berkeley freshman he began to work on the insect collections alongside entomology graduate students and in 1936 joined collecting expeditions with students who became leading systematic entomologists—E. G. Linsley, Robert L. Usinger, Richard M. Bohart, and Edward S. Ross. On a 1937 excursion with Linsley and Usinger he visited the Philadelphia Academy of Sciences, the Smithsonian National Museum of Natural History (Washington), the American Museum of Natural History (New York), and the Provincial Museum (Quebec). This epic undergraduate journey resulted in some important papers by Mich and greatly facilitated his later taxonomic work.

In 1939 Mich graduated from Berkeley with a B.S. in entomology and Phi Beta Kappa, an honor seldom bestowed on agriculture students due to the breadth of award requirements. He immediately began his doctoral studies there as a student of Edward O. Essig, a noted economic entomologist. Essig's classic text, *College Entomology* (1942), featured illustrations of bee morphology prepared by Mich.

Linsley, by then a junior member of the faculty, and Usinger, as a senior graduate student, importantly influenced Mich's graduate education. As a Berkeley teaching assistant in general entomology (1940) Mich met an enthusiastic student of entomology named Mary Hastings (Figure 3), who had recently transferred to Berkeley from UC-Davis. The two of them not only shared a passion for entomology but were kindred souls regarding many ethical and philosophical views that were to make them a strong force in the Lawrence, Kansas community, where they lived for most of their adult lives. The

Figure 3. Charles and Mary Hastings Michener collecting bees, about 1949. (Photo courtesy of Michener Family.)

couple was married on 1 January 1941, after a one-month courtship, and enjoyed nearly 70 years of marriage (Mary died in 2010).

Mich graduated mid-academic-year, in December 1941, a married man with a Ph.D. at the age of 23. His thesis publication earned the A. Cressy Morrison Prize in Natural Sciences from the New York Academy of Sciences. He took temporary employment as a teaching assistant for the Spring 1942 semester while he looked for a more permanent job. Wartime positions in entomology were scarce, and the vast majority were in economic entomology and agriculture, not the basic science of systematics that interested Mich. Anticipating this, he had done some research on ichneumonid wasps, an economically important group of parasitoids. But his first job involved neither bees nor wasps: it was as assistant curator of butterflies and moths at the American Museum of Natural History (AMNH) in New York. The curator of the Hymenoptera (wasps, ants, and bees) was a long-time associate, Herbert F. Schwarz. So Michener had to concentrate on the Lepidoptera. Even so, this was a research job at a major center for investigation in systematic biology, and he became an accomplished specialist in that large order of insects even though lacking in any previous professional experience.

Meanwhile, as American troops became more deeply involved in World War II, Mich enlisted as a 1st lieutenant in the Army Sanitary Corps. He was assigned to work on disease vectors impacting the troops, first on mosquito vectors of malaria at Camp Shelby in Mississippi, and then on chigger mites at the Gorgas Memorial Laboratory in Panama, where he quickly became an expert in acarology, the study of mites and ticks. As byproducts of this work he produced papers on the bees of Mississippi (1947) and Panama (1954a). This was his first experience in the tropics. Later he traveled to many other tropical areas and developed ties with scientists in many parts of the world, including, especially, Japan, Costa Rica, and Brazil. His unassuming and generous character and his vast knowledge of insects made him an exceptional ambassador of cultural exchange.

In 1946 Mich mustered out of the army as a captain and returned to the American Museum in New York. By this time the Micheners were a family of four. Their two sons, David and Daniel, were soon followed by a daughter, Barbara, and a third son, Walter, born after the family moved to Kansas in 1948. Although his job at the Museum did not include teaching, he had various student volunteers who worked in the collections. Some of them, such as Paul R. Ehrlich, Thomas Eisner (see Berenbaum, 2014), and Jerome G. Rozen, Jr., later became well known for their work on insect systematics and ecology and

acknowledged Mich's encouragement of their interest in insects during those post-war years in New York. While at the AMNH Mich and Mary began writing popular articles on entomology for *Natural History* (published by the Museum) and for other general-interest publications, culminating in their joint authorship of a popular book, *American Social Insects* (1951).

Systematics in the 1940s and 1950s was dominated by questions regarding the nature of species and speciation, and with the synthesis of population genetics and evolutionary biology—the "Modern Synthesis" (Huxley, 1940, 1943). New York was a hotbed of activity and controversy over these developments. Ernst Mayr and George Gaylord Simpson were at the AMNH, and the charismatic geneticist Theodosius G. Dobzhansky was nearby, at Columbia University. Mich participated in these discussions and was clearly influenced by them. He eventually took his place as a leading evolutionary biologist, serving as editor (1962-64) of the journal *Evolution*, which had as its first editor Ernst Mayr, beginning in 1946, the year that Mich returned to the AMNH. That same year the U.S.-based Society for the Study of Speciation became the Society for the Study of Evolution and publisher of *Evolution* (Smocovitis, 1994).

Despite the heady intellectual atmosphere in New York, the Micheners moved to the University of Kansas in 1948. The long commute from his home in New Jersey had become tiresome, and Mich's responsibilities as curator of butterflies and moths left too little time for his true passion, the systematics and biology of bees. Furthermore, Cockerell had recently bequeathed his enormous and important collection to the Smithsonian, much to the disappointment of Schwarz and Mich, who had expected it to go to the AMNH. At about this time Mich attended the annual meeting of the Entomological Society of America, in Chicago, where he met Herbert B. Hungerford, a noted systematist and chairman of the Department of Entomology at Kansas. Hungerford enticed him to consider a move, with the idea that he could eventually assume the position of chair of entomology, as Hungerford was nearing retirement. Mich interviewed at Kansas and accepted the offer of a position, despite advice to the contrary from his New York colleagues, most notably Dobzhanksy, who advised Mich to "let the Kansans stew in their own juices," (Michener, 2007). He took up residence in Snow Hall as associate professor of entomology and became department chairman a year later, a position he held for a total of 15 years (1949–1961, 1972–1975). He was promoted to full professor in 1950 while still in his early 30s.

Mich's career in Kansas shows how an exceptional scientist can make an institution into a world center of excellence in a particular field. As department chairman he promoted the hiring of entomologists from outside the state rather than only from Kansas, as was common at the time. With his presence and policies the Kansas Department of Entomology grew in diversity and reputation, attracting students from around the world. Mich broadened his own expertise by teaching courses with such titles as General Entomology, Medical Entomology, Insect Physiology, Insects and Man, and a graduate-level survey course on Evolutionary Mechanisms that discussed current publications on evolutionary biology (Pickett, 1991). Some of his early graduate students were protégés from his time in New York, including Jerry Rozen and Paul Ehrlich. Eventually he supervised more than 40 doctoral students and a large number of master's-degree students and undergraduates.

Kansas entomology was also put on the map by Mich's development of the *Journal of the Kansas Entomological Society* (*JKES*). Mary served as managing editor from 1954 to 1968, and Mich made the Journal a primary outlet for his research: approximately 20 percent of Mich's papers appeared in the *JKES* over a period of more than 60 years (1949–2012). With his own papers and those of his many students and colleagues around the world, the journal became an essential resource for researchers interested in insect biology, systematics, and evolutionary biology. Mich was at the founding committee meeting for the *Annual Review of Entomology* and was a founder in 1968 and associate editor (1970–1990) of the *Annual Review of Ecology & Systematics*. In a preface to Volume 22, which was dedicated to Mich, Richard F. Johnston, long-time editor of the journal, wrote that he considered Mich to be "the professional soul of the overall editorial process" during the 23 years he had served on the editorial board (Johnston, 1991).

Mich and his students accumulated a wealth of basic biological data on bees, including comparative studies of social interactions. His publications on the social evolution of bees began in the early 1950s (1953, 1954b) and became seminal papers in the field later known as sociobiology. At the same time he began to work together with Robert R. Sokal, his colleague in the Department of Entomology, on a long-standing issue in systematic biology: the apparent subjectivity of classifications—especially, the seemingly arbitrary choice of different classificatory schemes for the same group of organisms by different investigators. Some researchers claimed that taxonomy was an art, not a science, and many, with careful analysis of variation within a taxon and prodigious memory for particular specimens and details, developed an intuitive classification that was not always specified so as to be understood by others.

Sokal, who was greatly influenced by the mathematical approach of Sewall Wright, one of his graduate advisors at the University of Chicago, strongly advocated using quantitative methods and believed that statistics could be applied in taxonomy in order to resolve differences resulting from poorly specified methods. Even though Sokal was not a systematic entomologist, he and Mich had much in common (Michener, 2012). Sokal's first scientific paper, written as a student in Shanghai (where his family had settled after fleeing Austria in 1939), described the head morphology of a dragonfly; and his dissertation at the University of Chicago was a statistical analysis of geographical variation in the morphology of an aphid, supervised by Wright and Alfred Emerson, a leading expert on the taxonomy and social life of termites.

Both Mich and Sokal were still comparatively junior to many of the established authorities of the day but were well acquainted with the pros and cons of the dogmas that were in place. According to Paul Ehrlich (in Brosi and Ehrlich, 2016), who was a Michener student at the time, the Sokal-Michener collaboration grew out of heated debates in a seminar where Michener and the entomologists at first adamantly resisted Sokal's ideas. They decided to put them to a test in which Sokal would develop statistical methods and then apply them to a group of solitary bees that Mich had already extensively analyzed using traditional methods, to see what they could learn by comparing the two methods. Sokal's view prevailed: Mich and company concluded that his method, "...can be used to remove some of the subjective bias from taxonomy" (Michener and Sokal, 1957; Sokal and Michener, 1958, 1967). Breed (2016) points out that the 1958 paper developed what became known as UPGMA (Unweighted Pair Group Method with Arithmetic Mean), which led to a standard statistical technique for finding hierarchical clusters in numerical data. Breed believes that Mich was a "co-conspirator" in Kansas professor Joseph H. Camin's development of the Caminalcules, an imaginary set of organisms used to test ideas about how systematic techniques interact with evolutionary hypotheses (Sokal, 1983).

The Sokal-Michener approach came to be known as "numerical taxonomy," and it led to much controversy and debate among taxonomists. But the phenetic (an adjective referring to observable similarities and differences between organisms without regard to assumed genealogy) system employed was a major conceptual and methodological leap for biological systematics. It has been called, by a leading proponent (Sneath, 1995), "the greatest advance in systematics since Darwin or perhaps since Linnaeus" in view of its effects on phylogenetics, molecular taxonomy, morphometrics, and other applications beyond taxonomy. Although phenetics has been supplanted in phylogenetic work by

other quantitative methods, its derivatives remain appropriate tools for many aspects of ecology, behavior, and other fields of comparative biology.

Sokal's stance on quantitative methods was more radical than that of Mich, whose experience in systematics and natural history made him open to a broader approach. Mich believed that quantitative methods "must not be allowed to separate the systematist from the organisms themselves for only by knowing their behavior, ecological relationships, the functions of their various structures, etc., can we understand and interpret taxonomic data" (1963a: 170). Mich envisioned, in an article on "Future developments in taxonomy, (1963a)" that a radical scheme of uninominal species designations would eventually replace the traditional binominal genus-species system of nomenclature, and foresaw the development of "instruments for automatic discovery and recording of characters and of systems for storage and retrieval of data" to facilitate the enormous task of species identifications and literature searching that was already overwhelming taxonomists. Then "the means of transmitting much information…would cease to be by way of printed articles and books but might take some other route, so that journals would be relieved of publishing a great deal of detailed data" (ibid, p. 168). This prophecy of Mich's, made more than 50 years ago, is now borne out by such methods as DNA barcoding, computer analysis and storage of mass data, and electronic publishing, though uninominal taxonomy was of course never adopted.

Paul Ehrlich noted in correspondence with us that Mich, whatever the context, "never said a bad word," even during the heated controversies over numerical taxonomy. But he could be a formidable opponent in scientific debate. David Hull described Mich as "a quiet, gentle man…who does not enjoy participating in raucous polemics…[but] in scientific combat [he is] also highly effective, some might say deadly" (Hull 1988, p. 118). He was effective because he not only mastered traditional and quantitative methods but was also an unrivaled authority on the taxonomy and biology of large groups of organisms, where he could apply and evaluate those methods. His influence was heightened because despite being an acknowledged authority he was never dogmatic and was never uncompromising except in his integrity. During his long career he sometimes reversed well-known previous conclusions in the light of new information.

Mich's attention to behavior drew him and his students into another area of controversy, the sociobiology wars that began in the 1960s with the publication of English evolu-

tionary biologist William D. Hamilton's papers (1964a, 1964b) on kin selection and then gained momentum in 1975 with Edward O. Wilson's *Sociobiology*. The social insects (wasps, ants, bees, and termites) offered critical early testing grounds for sociobiological ideas because of the extreme beneficence of their sterile females ("workers"), who devote their lives to helping others ("queens") without themselves reproducing. The bees were particularly important for tests of theory because they show a range of flexibility and complexity in their societies.

Mich was poised to capitalize on his vast knowledge of the biology of the bees to examine hypotheses about social evolution, for he and his students had studied a great variety of social and non-social bees, from those that nest alone, as solitary females, to those that live in highly organized groups like those of honey bees and tropical stingless bees. He was already a pioneer in the comparative study of bee social evolution (see 1958, 1963b), and he became the leading advocate of mutualistic origins—one of three competing explanations (see, for example, Lin and Michener, 1972) for the origins of "altruistic" behavior (self-sacrificing beneficence), having seen that mutualism (cooperation without self-sacrifice and without extraordinarily high kinship) could be an alternative to kin selection among relatives and parental manipulation as a starting point for highly evolved sociality. Mich's definitive book, *The Social Behavior of the Bees* (1974), appeared just before Wilson's *Sociobiology* and anticipated many of the key points that emerged from discussions of genetic and ecological aspects of social behavior. Breed (2016) points out that it was Mich's student Suzanne Batra who first used the now-standard term "eusocial" for worker-containing groups (Batra, 1966).

The importance of social insects for testing ideas about social evolution, and of systematists for understanding their biology, led one of us (MJW-E) to acquaintance and friendship with Mich and other entomologists of his generation. A coincidence in travel plans led to a remarkable 1973 meeting, at the Eberhard/West-Eberhard household in Cali, Colombia, of three of them (Figure 4): Mich; O.W. Richards, the world's leading expert on social wasps at the time (Southwood, 1987); and Howard E. Evans, a leading expert on the systematics and natural history of solitary wasps, who had been MJW-E's post-doctoral sponsor at Harvard (West-Eberhard, 2004). On a joint field trip to Anchicayá, in rainforest west of the Andes, someone collected an insect larva so peculiar that none of the three could identify it, even as to order. This led to a debate among these three titans of entomology that was a spectacular display of virtuosity. Mich certainly held his own, but he and Richards lost out to Evans, whose guess that it was a beetle was later confirmed with a microscope and a set of books, one of them (a revision of

Figure 4. Michener (right) with Howard E. Evans (left) and O. W. Richards (center) in Cali, Colombia at the home of William Eberhard and Mary Jane West-Eberhard, base for joint field trips at a time when there were few tropical field stations in South America (1972). (Photo courtesy of Mary Jane West-Eberhard.)

the classic Augustus D. Imms textbook) written by Richards.[1]

Mich's ideas about the evolution of social behavior and allied themes had the great merit of always being based on data from natural populations, eventually supplemented, in the hands of Mich and his students and associates, by innovative methods of lab rearing that simulated natural conditions and allowed for unprecedented observations and controlled experiments (see Batra, 1964; Stockhammer, 1966; Michener, et al., 1971; Bell, 1973). It is worth emphasizing that the inspiration for experimental manipulations arose initially from comparative study of natural populations, where hypotheses could be tested, without manipulation, through careful observation and quantification of local, seasonal, and geographic variation (see Michener and Bennett, 1977).

Mich and his associates were leaders in experimentally documenting the existence and mechanisms of kin-biased aid among cooperating individuals, lending key support for the importance of kin selection (Hamilton, 1964a) in social evolution. Mich (with Edward M. "Ed" Barrows) was the first to demonstrate individual recognition in invertebrates, setting the stage

1 Richards played an important if little-known role in the studies of social evolution that concerned Michener, because he hired Hamilton at Imperial College, Silwood Park, having traveled with him on Royal Society expeditions to tropical America that helped to encourage Hamilton's strong interest in social wasp behavior. Richards was a sophisticated ecologist and evolutionary biologist who wrote an important early article on sexual selection in 1923 as well as a book (Robson and Richards, 1936) that challenged the pan-adaptationism of the new synthesis in evolutionary biology, focusing on the sometime non-genetic nature of variation and the lack of concrete evidence for selection.

Figure 5. Michener excavating natural nests of bees (above) in Playas del Coco, Costa Rica, 1963, and (right) with his student Michael Breed in Cali, Colombia, 1976.
(Photos courtesy of Michener family, above, and Mary Jane West-Eberhard, right.)

for an explosion of research on kin recognition in animals. His book, co-edited (with D. J. C. Fletcher), *Kin Recognition in Animals*, reviewed evidence from a wide variety of taxa, from isopods to mammals (Fletcher and Michener, 1987). Although Mich (2007) thought that the book was given "surprisingly little attention" and was "largely a failure…from the point of view of [his] personal development," in fact it was a widely cited landmark, documenting the widespread occurrence and diverse mechanisms of kin recognition.

Mich was not a charismatic lecturer or an aggressive bio-politician. He was gentle and soft-spoken. One of his students, Sydney Cameron, described his words as, "always paced, never louder than one-on-one" and often spoken "as though mixed with air so they came out with an ever-so-slight, but always audible, whisper." Given his aversion to sharp words and stinging scientific discussion, she found it amusing that on the culinary side he had a predilection for nachos with jalapeño peppers.

Michael Breed (2016) described Mich's approach as a graduate advisor: He was "unfailing in his support for his graduate students," a person who was "quiet, unassuming, and

never sought to publicize or promote his [own] work," but was nonetheless a demanding taskmaster. "He was always kind and gentle, but I'd have to say I worked really hard to avoid seeing him otherwise" (Breed, pers. comm.). "You never wanted to meet Mich in the hallway without having progress to report, as he unfailingly knew exactly where you had been with a project the last time you talked and he always remembered what you had promised to do, and by when" (Breed, 2016). He went out of his way to introduce students to scientists with similar interests, at the university, where he had a steady stream of prominent visitors, and at scientific meetings, where, rather than giving a keynote address he would make himself available to talk at length with people in the halls. His office door was always open, and there was sometimes a line of students waiting to see him. Several of them noted Mich's remarkable ability to turn abruptly back to his work the moment a conversation had ended.

In a 1991 oral-history interview (Pickett, 1991; Michener, 2007), Mich resisted singling out any of his outstanding students or taking credit for their successes: "I think the main thing is to get good ones and leave them alone…I always have my door open…I think it's important that they be treated as colleagues that you trust and not as somebody that you have to watch. And…they live up to that trust."

Michener's generous nature, his good eye for promising students, and his eagerness to deeply explore the bee faunas of the world made him an effective global ambassador of science in many areas of the world. His students and collaborators became active researchers in Brazil, Mexico, Costa Rica, Panama, Canada, South Africa, Thailand, and Japan, some of them becoming founding leaders of large research groups. He and his family spent an entire year (1955) in Curitiba, Brazil, where he was a Guggenheim fellow and learned Portuguese. He spent 1958–59 as a Fulbright scholar in Australia, where he studied bees throughout the continent and on various South Pacific Islands. His collaborations with Brazilian scientists spanned the 60 years between the 1955 research and his death in 2015: Mich's son Walter wrote to Brazilian colleagues to thank them for a video tribute that was played to him just days before his death.

Michener's considerable diplomatic abilities were called into play when an aggressive cross between European and African honeybees escaped from the hives of a Brazilian apiculturist. Rather than publicizing blame for an unfortunate accident, he led a committee of the National Academy of Sciences to study the spread and commercial importance of these "Africanized" honey bees (see Michener, 1973) and supervised three Kansas doctoral theses on their biology and effects on native bees.

There are other examples of Mich's taking time from his main research interests for activities benefitting the general good, and he clearly supported such activities by other members of his family. Mary was deeply committed to humanitarian and community affairs, and a leader (among other activities) of a long and ultimately successful campaign to establish public bus transportation in the city of Lawrence. In the 1970s her Lawrence bookstore, "ADVENTURE a bookstore," was a unique resource for scientist-friends abroad like Bill Eberhard and Mary Jane West-Eberhard, then in Colombia without direct access to any large academic library, who could order and receive books via international airmail and then pay her later with personal checks.

When the Micheners learned from a grandson about a teenaged schoolmate who had been unjustly committed to a mental institution and needed a place to live following her release, they took her in and then sponsored legal protection against a recurrence of her institutionalization. While at their home the young woman wrote a moving first-hand account of her experiences in a state mental institution, published (A. Michener, 1998) by the University of Chicago Press with the help of a careful and sympathetic senior editor (the late Susan Abrams) and using as her new surname "Michener," adopted with the Micheners' permission. When some readers questioned (in Amazon reviews) the veracity of the book and authenticity of the 16-year-old author, Mich wrote a convincing endorsement without identifying himself by name, saying, "My wife and I are the old couple mentioned in the epilogue." Mary Michener's obituary (W. Michener, 2010) includes a long list of organizations she supported, with time and donations, a list that reflects the nature of the Micheners' humanitarian concerns.

Mich himself was a long-time correspondent of the Committee on Human Rights of the U.S. National Academies. He wrote a typically modest assessment of his own humanitarian role, as a postscript addendum to the 1991 oral history interview (Pickett, 1991):

> *Beyond science, I might have done more for various worthy causes, but unfortunately I limited myself to contributing money, writing letters, participating in peace demonstrations, and helping to produce Paul Ehrlich…I am always uncomfortable in front of a group trying to convince them of something. In other words, I am not as good as many others at debate, politics, bio-politics, and the like. This is my excuse for doing what is fun for me, research, discussing the findings, and helping others to do the same.*

Mich described himself as a person with a lifelong "obsession" with bees (2000), and he considered himself "fortunate" to have been able to study them. "I do not remember making a conscious decision that I wanted to become an entomologist and a professor…I remember that several times lying in bed before going to sleep, I imagined myself giving a great lecture on some, probably entomological, topic to a large audience" (2007, p. 4). In a striking parallel, his son Walter described a moment, the day before Mich died, when:

> *his mind seemed not to be in the same room with his body. He seemed to be addressing a group, probably of students, and with his eyes closed he said with a half-smile, 'I suppose all I have to say about these critters is that I don't know much about 'em.' (W. Michener, 2015)*

It was a reverie with an uncanny resemblance to the recurrent childhood dream that Mich had described in his 2007 autobiography, quoted above.

Charles Michener was a person who literally lived and dreamed his academic role with calm humility for an entire lifetime, from its nascent inklings to the day he died. He did not see himself as others have seen him—as a giant of the sciences of entomology and evolutionary biology, a master teacher, a global diplomat of science, a man who personified passion for research, and a rare source of wisdom and just advice. His work shows the value of deep understanding of a particular group of organisms for the advancement of the science of biology.

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