Journal of the American Mosquito Control Association, 00(00):000–000, 2025

MEMORIAL LECTURE: THE THREE DIMENSIONS OF A COMPLETE LIFE—A TRIBUTE TO JOHN BEIDLER[1]

GORDON PATTERSON

School of Arts and Communication, Florida Institute of Technology, 150 W University Blvd, Melbourne, FL 32901

It is an honor and a pleasure to be here this morning. The pleasure, of course, has been seeing so many esteemed friends: Norbert Becker; Sandra Gewehr, President of the European Mosquito Control Association; Dave Brown; Gary Goodman; and countless others who have shaped my understanding of mosquito control history over the past 35 years. The honor lies in celebrating an organization that, for nearly a century, has profoundly benefited the public, improved lives, and championed the critical need and value of mosquito control.

This morning, I will briefly underscore the remarkable foundation upon which the American Mosquito Control Association (AMCA) stands. I will then dedicate my time to one of the truly exceptional individuals who exerted a transformative influence on the history of mosquito control.

ON THE SHOULDERS OF GIANTS

Isaac Newton famously noted in 1675, "If I have seen further [than others], it is by standing on the shoulders of giants." You, my friends, are the millennial inheritors of that immense legacy, carrying forward a rich history from those very ancestors.

In the 1870s, no medical textbook in the world mentioned any pathogen vectored by an insect. Yet, 147 years ago, a cascade of groundbreaking discoveries commenced. In 1870, Patrick Manson, a young medical officer in what is now Taiwan, unveiled the mosquito's role in vectoring filariasis. Three years later, Carlos Finlay, in Cuba, advanced the audacious hypothesis that a simple insect, weighing less than a grape seed, caused yellow fever. Unfortunately, Finlay could not immediately demonstrate this, because he was unaware of the virus's external incubation period (Faerstein and Winkelstein 2010, To and Yuen 2012).

Further breakthroughs quickly followed. In 1897, Ronald Ross pinpointed the source of avian malaria. Giovanni Grassi's insights emerged the following year, and by 1900, the Reed Commission definitively confirmed Carlos Finlay's prescient observation. Subsequently, H. Graham and Thomas Bancroft identified the mosquito's role in transmitting dengue. Thus, in less than a quarter of a century, the world's medical landscape had been fundamentally reshaped. The mosquito, long recognized as a nuisance, was now clearly understood to be the planet's most dangerous animal (Graham 1903, Rajakumar and Weisse 1998, Feng 2015).

As these medical revelations unfolded, John Bernard Smith, a man aspiring to be a lawyer, became one of America's preeminent entomologists. The legend holds that a keen observer once noted the young attorney's fascination with a fly on the table, overshadowing his interest in his client. From this auspicious beginning, Smith launched a career that culminated in his appointment as New Jersey's state entomologist and a distinguished professor at Rutgers University. Smith focused his attention on the dense, undulating clouds of nuisance mosquitoes that periodically emerged from Newark's meadows. His audacious proposal was to forge a mosquito control movement that could liberate New Jersey from this pervasive pest (Patterson 2009).

In 1912, Smith convinced Woodrow Wilson, then New Jersey's governor and a future president, to establish New Jersey as the first state with a mosquito abatement law. This pivotal legislation served as the genesis of this very organization. Within six months, a chorus of opposition arose, assailing the abatement act. Critics decried the exorbitant cost of mosquito control and dismissed Smith's initiative as fanciful. Skeptics opined, "Mosquitoes are like the weather; who can control whether it thunders or when it rains?" Thomas Headlee, John Bernard Smith's successor, countered by advocating for the organization of the New Jersey Mosquito Extermination Association. That association initiated a campaign that the AMCA vigorously continues today, galvanizing the antimosquito movement.

Three years later, in 1915, California joined the fray. William Herms, a young Berkeley professor, and his student, Harold Gray, persuaded the California legislature to enact the state's second abatement law. Utah followed in 1923, and Florida joined the campaign in 1925. All these efforts converged in 1935 when, amid the Great Depression, a cadre of cost-conscious politicians launched a campaign to terminate mosquito control programs. Once again, New Jersey spearheaded the countereffort. Thomas Headlee and Tommy Mulhern called for the formation of a regional organization to advance the cause of mosquito control. This marked the genesis of the Eastern Association of Mosquito Control Workers. A decade later, Mulhern, Robert Glasgow (New York's state entomologist), and Don Rees (who led Salt Lake City's campaign against blood-sucking pests) championed the formation of the AMCA (Patterson 2009).

[1] This Memorial Lecture was presented at the 91st Annual Meeting of the American Mosquito Control Association in San Juan, Puerto Rico, March 3–7, 2025.

THE THREE DIMENSIONS OF A COMPLETE LIFE

Martin Luther King Jr. provides a framework for evaluating John Beidler's life and work. On April 4, 1967, Martin Luther King Jr. delivered a sermon at the New Covenant Baptist Church in Chicago. He observed that the measure of each person's life is defined by three dimensions: length, breadth, and height.

THE LENGTH

There is no disputing that John Beidler lived a long life. When he passed away in December 2022, he was just weeks shy of his 95th birthday. John Beidler was born in 1927 in Orlando, FL, a vastly different place from the Orlando of Disney World and Universal today. The "City Beautiful" was then characterized by its lakes and small streets. To friends, John Beidler fondly reminisced about excursions from Orlando to the salt marshes of Cocoa Beach, FL, fishing, and returning home. His life profoundly shifted shortly after his 16th birthday. His mother rented rooms in Orlando, and some of the renters worked at a quasi-secret US Department of Agriculture (USDA) laboratory on Parramore Street. Young Beidler, a 16-year-old high school sophomore, would sit on the porch, captivated by these men's conversations about lice, bedbugs, and mosquitoes. This marked the inception of a remarkable career.

One day, one of the men inquired, "John, would you like a job working in the lab?" Beidler sought his mother's permission, who then consulted his high school principal. The principal observed that John might derive greater benefit from working at the lab part-time than from his sophomore high school classes. Years later, Beidler recalled his initial assignments: "I did all the dirty work," he stated. "The lice needed to be fed. The bedbugs needed to be tucked in." Yet, it was the mosquitoes that truly captivated his attention. Neither Beidler nor E. F. Knipling, the laboratory's director, knew that the lab was destined to become a hallowed place in the history of mosquito control (Washem 1990, Patterson 2004).

In November 1942, a consignment arrived from the Geigy Pharmaceutical Company in Basel, Switzerland. A Swiss chemist named Paul Mueller had experimented with a compound synthesized by Othmar Zeidler in 1873 (Zeidler 1874). Officials at Geigy sought a toxicant for use against moths in the dry cleaning business. Initially, the material was branded as Gesarol. In November 1942, a shipment of Gesarol reached Orlando. The USDA researchers referred to the compound, dichlorodiphenyltrichloroethane, by its initials: DDT. The first experiments with DDT commenced before Thanksgiving. John Beidler was at ground zero for what would become the development of the insect world's "atomic bomb" (Patterson 2004).

Beidler was present when an engineer and a pilot rigged a breaker bar spray apparatus on a Stearman biplane. He later witnessed the initial experiments using DDT as both a larvicide and adulticide in the salt marshes near the Banana River Naval Air Station in Cocoa Beach. A year later, the 17-year-old participated in the first experiments using DDT against anopheline mosquitoes in Stuttgart, AR. Beidler was tasked with devising suitable receptacles for the tests. He visited Harry Leu's hardware store in Orlando, procured 100 nail bins, loaded them into a pickup truck, and drove to the test site. In Arkansas, the USDA researchers assigned Beidler the job of dusting some of the nail bins with DDT, while leaving others as controls. He then strategically placed the bins throughout the test site. The experiment unequivocally demonstrated the remarkable, residual power of DDT (Patterson 2004).

In 1944, John Beidler, at 18, enlisted in the US Navy. As veterans in this room understand, the military often assigns individuals to tasks diametrically opposed to strengths. In this instance, Navy officials displayed remarkable foresight, assigning Beidler to the Navy Medical Research Center in Bethesda, MD. He spent two years as a young enlisted person working on vector-borne diseases. In 1946, he received an honorable discharge and used the GI Bill to enroll in the University of Florida.

Early in his academic career, Beidler faced a choice of major; he was drawn to both psychology and entomology. Ever practical, he calculated the duration of his GI Bill benefits. He concluded that entomology was a better fit and consequently enrolled in the Department of Entomology at the University of Florida. During his undergraduate years, he returned to Orlando to work at the USDA laboratory. Once again, Beidler was present at a critical juncture in the history of mosquito control. In 1947, Willard King, who led the laboratory after World War II, received a disturbing report: mosquitoes in the Cocoa Beach salt marshes, where DDT had first been deployed as a larvicide and adulticide, were exhibiting resistance. This revelation would catalyze a wealth of studies and fundamentally rethink best practices in chemical control.

In 1950, Beidler graduated from the University of Florida with a Bachelor of Science degree in entomology. He secured his first position with the British company William Cooper & Nephews. William Cooper & Nephews had developed a cattle tick dip, a marvelous cattle dip, with one crucial flaw: it killed the cows. Beidler was assigned the challenging task of devising an effective toxicant that eliminated ticks but kept the cows "mooing." He dedicated three years to this project.

In 1953, John Beidler returned to Florida. He accepted a regional entomologist position with the Bureau of Entomology in the State Board of Health. A revolution in mosquito control was then unfolding in Florida. John Mulrennan Sr., the state's entomologist, had secured funding in Tallahassee, FL, to launch a

statewide program of permanent mosquito control and establish the Entomological Research Center (ERC) in Vero Beach, FL. Initially, Beidler assisted counties along the Gulf Coast in developing mosquito programs. In March 1955, Beidler relocated to Vero Beach to assume the directorship of the Indian River County Mosquito Control District (Washem 1990).

There were indeed comic interludes during Beidler's nearly half of a century leading the county's antimosquito campaign. Early on, Beidler's former boss at the USDA laboratory, Willard King, sought a favor. King, nearing his 80th birthday, required assistance with a research project in Jamaica. He asked Beidler to serve as "his legs" in the fieldwork, and Beidler readily agreed. While enjoying drinks after a day's work in Montego Bay, Beidler learned that a dark, undulating cloud of mosquitoes had descended on Vero Beach. The local paper published a story detailing the city's plight and pointedly noted that the county's mosquito director was 700 mi away in Jamaica. Fortunately, the mosquito control commissioners and Indian River County citizens recognized John Beidler's intrinsic value. Beidler remained the county's mosquito control director for the next 48 years (Darby 1957).

THE BREADTH

The breadth of John Beidler's work is equally remarkable. One of his earliest recognitions was the critical role of permanent impoundments. In the 1950s and early 1960s, he and Jack Salmela, the director of the Brevard County Mosquito Control Program, spearheaded the campaign to integrate impoundments as a key element in source reduction. During this period, he established over 20 impoundments across 3,000 acres. Beidler, however, possessed an awareness, long before others, of the profound biological significance of the high salt marshes. He recognized that these marshes served as nurseries for innumerable living things. He collaborated with colleagues to construct an environmentally responsible mosquito control program (Patterson 2004).

However, there was nothing "chemophobic" about John Beidler. He often quipped that the only consequence he observed from years of working with DDT was that it turned his hair white. John Beidler consistently welcomed a challenge. His innovations in using Paris green are particularly noteworthy. He ingeniously improvised by mixing sand with the toxicant to ensure its effective distribution in the water column. In the 1970s, he applied the same technique with Altosid. During these years, Beidler collaborated closely with Maurice Provost, the director of the ERC. In 1973, the ERC was renamed the Florida Medical Entomology Laboratory (FMEL).

While leading the antimosquito campaign in Vero Beach, Beidler also found time to champion the development of mosquito control in Louisiana. In 1963, Edward Hathaway and Anderson Ritter successfully secured approval for mosquito control abatement in the Pelican State. Winning legislative approval for mosquito control was merely the initial step; Hathaway and Ritter faced the daunting challenge of garnering support for mosquito control within the state's parishes. To succeed, Hathaway and Ritter understood the imperative of securing the backing of Leander Perez, a highly influential political figure in southeastern Louisiana's Plaquemines and St. Bernard parishes. Hathaway, having spent significant time with John Beidler, believed he was the sole individual who could persuade Perez. Beidler took a leave of absence from Indian River, traveled to Plaquemines Parish, and meticulously outlined a program. He journeyed throughout the state, persuasively arguing that Louisiana could achieve mosquito control success comparable to California, Utah, Illinois, Florida, and other states (Washem 1990, Patterson 2009).

Beidler's work in Plaquemines Parish exemplifies the extensive reach of his impact on mosquito control. The breadth of a person's life, in some sense, is measured by the assistance and insight one provides to others. What made John Beidler truly special was not only his insight but also his profound ability to inspire. One of John Beidler's greatest strengths was his attentive listening. He was never confrontational. When others raised their voices, Beidler consistently sought consensus.

This became acutely apparent when Florida's constitution was rewritten in 1968. The State Board of Health, formerly the bastion of mosquito control, was dissolved. Its activities were transferred to the Department of Health and Rehabilitative Services (DHRS). It quickly became evident that DHRS had scant interest in supporting mosquito control. They questioned the necessity of independent mosquito control commissions. Concurrently, DHRS officials advocated for cutbacks in research at the FMEL. The breaking point arrived in 1977 when Tom Gardner, director of central operations at the DHRS, blocked the renewal of a National Institutes of Health grant for malaria research. At the same time, Gardner and Jack Rogers, head of the DHRS's Office of Entomology, opposed the FMEL's recruitment of a wetlands ecologist to study the impact of mosquito impoundments. Maurice Provost, the FMEL director, recognized the critical role of the wetlands. Provost sharply informed Rogers that the DHRS criteria for selecting a young ecologist "would be valid for selecting a young preacher for a predetermined dogmatic slant, but not in selecting man of science" (Patterson 2004).

John Beidler brought calm to this contentious debate. Florida had recently elected a young man named Bob Graham as its governor. Graham, who grew up in south Florida, understood the state's need for mosquito control. Graham established a coordinating committee to redraft the state's abatement act. He invited John Beidler to serve as one of the committee's founding members. The forces of reason ultimately prevailed, and mosquito control was preserved.

THE HEIGHT

In the 1980s, John Beidler proved instrumental in establishing an annual mosquito control short course.

Beidler firmly believed that Florida, and indeed all of America, would benefit from such a course. This initiative was the genesis of the Dodd Short Course and, later, the annual Florida Mosquito Control Association's (FMCA) "Fly-In."

John Beidler retired in 2003 after 48 distinguished years. Throughout his career, he attended an astonishing 50 consecutive AMCA meetings. In 2007, the AMCA recognized John Beidler's immense contributions by bestowing upon him the AMCA Medal of Honor. The award cited his numerous accomplishments:

- AMCA member since 1955, attending 50 consecutive meetings by 2006
- Past AMCA district director
- Past president of the FMCA
- Past assistant editor of the *Journal of the Florida Mosquito Control Association*
- In 1957, at the request of the Jamaican government, he surveyed mosquito and sand fly control possibilities in the Montego Bay area
- In 1963, he conducted a feasibility study for establishing mosquito control in Plaquemines Parish, LA
- In 1968, he served as a member of a team assessing the mosquito control program in the Cayman Islands
- In 1983, he served as a consultant to the state of Minnesota concerning statewide application of malathion
- From 1983 to 1986, he was appointed to the Governor's Working Group on Mosquito Control
- From 1980 to 2003, he served as Chairman of the Research Advisory Committee for the FMEL
- In 1986, he was appointed to the Florida Coordinating Council on Mosquito Control
- In 1997, he was appointed to the Florida White Paper Steering Committee
- In 1998, he was appointed to the Steering Committee for Florida Mosquito Control: Conference on Urban Growth and Its Impact on Future Mosquito Control Problems and Opportunities

His awards include

- 1982: Recipient of the AMCA's Meritorious Service Award
- 2002: Recipient of the FMCA's Service Award
- 2003: Recipient of the University of Florida Distinguished Alumnus status
- 2003: Recipient of Honorary Membership status by AMCA

Retirement did not diminish John Beidler's advocacy and work in mosquito control. In 2008, amid a statewide controversy regarding permethrin use, Beidler, by chance, read the ingredients in a can of powder used to treat head lice. There had recently been an outbreak of head lice among schoolchildren. Beidler meticulously compared the amount of permethrin in the head lice compound to the amount being used in mosquito applications. He discovered that the exposure to permethrin in a typical mosquito control application was a mere fraction of what schoolchildren received. Beidler subsequently penned an article illuminating the disparities between the two formulations. He later mused, "I know what they're saying. Doesn't John have other things to do than worry about head lice?" (Beidler 2015).

What John Beidler worried about most was the potential for us to forget the history of mosquito control's profound impact on making the world a better place. This is a history that began when individuals realized that through diligent, careful, collective work, they could indeed transform the world.

I began with a quotation about the three dimensions of a complete life. John Beidler lived an exceptionally long life. He made a tangible difference by meticulously observing details and then expertly weaving those details into a cohesive fabric of understanding. Weeks before he died, John Beidler articulated his hopes for mosquito control in the 21st century. He hoped for men and women who would "be dedicated and innovative ... over the coming decades, we look forward to seeing great accomplishments" (Beidler et al. 2022).

Listening to someone's life story offers us a chance to reflect on our own journey—where we've been, where we are, and where we're headed. John Beidler's career highlights our shared responsibility to one another. Our profession thrives on the trust of those we serve, and our work is built upon our unwavering dedication to science. These are significant responsibilities, and we hope that one day, others will look at our lives and see that we lived honorably. John Beidler's life and work made a difference in innumerable lives. This quiet, unassuming man was one of the giants in the history of mosquito control. He will be missed!

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