



Dr. Murray Goodman
1928–2004

In Commemoration of Dr. Murray Goodman 1928–2004

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When Murray Goodman passed away on June 1, 2004, at the age of 75, peptide chemistry lost one of its true pioneers. Our deepest condolences go out to Zelda, his beloved wife of over 50 years; to his devoted sons Andy, Josh, and David, and their wives; and to his cherished grandchildren. In a career of outstanding accomplishment, Murray helped to define peptide chemistry/structure and biology through his science, his journal editorships, and his mentorship of young scientists.

Born in New York City in 1928, Murray received his B.Sc. in Chemistry at Brooklyn College (1949), graduating Magna cum Laude/Phi Beta Kappa. He went on to his Ph.D., studying aspects of photosynthesis at the University of California, Berkeley under Nobel Laureate Melvin Calvin (1953). He was a post-doctoral fellow first with John Sheehan, a renowned peptide chemist, at M.I.T. (1953–55), and then with Lord Todd at the other Cambridge-U.K., in the field of peptide natural products. In 1956, Murray returned to New York as an Assistant Professor at the Polytechnic Institute of Brooklyn. He rose rapidly to Professor (1964) and became Director of the Polymer Institute (founded by polymer chemistry giant Herman Mark) shortly thereafter. In 1970, Murray was lured to the University of California, San Diego in La Jolla, where he was a Professor until his passing. He held several leadership positions at UCSD, including Provost of Revelle College, and Chair of the Department of Chemistry.

Because many naturally occurring biological molecules are too large to study conventionally, creative approaches are required. Early on, Murray recognized that great progress could be made by evaluating peptide-based model systems. In his science, Murray smoothly combined synthesis of various linear and cyclic peptides, peptidomimetics (especially some novel mimetics using the notion of conformational constraint), and polypeptides, with deduction of conformation via NMR, CD, and computations (dynamics/simulations) on the one hand, and pharmacology/bioassays on the other, in a succession of innovations that profoundly influenced peptide chemistry—and

will continue to do so for many years. He studied the fundamental problem of peptide racemization during synthesis, recognizing that oxazolones were major intermediates; and prepared the first crystalline oxazolone. The Goodman group developed stepwise synthesis of oligopeptides, and demonstrated their utility for relating α -helix onset to peptide chain length. Another important contribution from Murray and his associates to peptide synthesis is the development of the urethane-protected α -amino acid N-carboxyanhydrides, the UNCA approach.

Among his structural studies, Murray recognized the role of aromatic and azo-aromatic side chain interactions in polypeptides, and their contributions to secondary structure. He reported one of the first applications of NMR to resolve NH's in a glutamate oligomer at the First American Peptide Symposium (New Haven, 1968). In his conformational work, Murray was among the first to utilize fluorinated solvents—particularly hexfluoroisopropanol (HFIP) and trifluoroethanol (TFE) for CD and UV spectroscopy. In an early paper (1975), Murray discovered 'helix dipoles' and their intrinsic contribution to helix stability, a feature recognized in proteins only many years later. In conformational analyses of bioactive neuropeptides and opioid hormones, Murray developed the ingenious device of 'retro-inverso' peptides—in which the peptide bond intervening between each residue was reversed from CO-NH to NH-CO. The resulting molecules were (i) useful for testing with exquisite sensitivity to the topological requirements of their protein receptors, while (ii) resistant to enzymatic degradation.

The Goodman laboratory thrived over decades in La Jolla. Murray developed an abiding interest in sweeteners, and synthesized stereoisomers of peptide-based molecules to explain the "conformation of taste" (the 'molecular basis' of taste), with a number of interesting sweet (as well as some decidedly bland!) peptides resulting. In another demonstration of his breadth, Murray and his group published a seminal series of papers in *J. Amer. Chem. Soc.* (1996) on "template-assembled collagen-based

polypeptides” including characterization of collagen-like triple helices incorporating peptoid residues. Some of his more recent research centered on structural investigations of conformations of peptides interacting with membrane-bound receptors.

Efforts to answer increasingly complex questions in peptide bioactivity required innovation and interdisciplinary approaches that linked organic chemistry and structural biology. Murray Goodman forged these links, and in so doing, made the major strides that gained him worldwide recognition. A partial list of Murray’s many awards and lectureships includes the Scoffone Medal, the Humboldt Professorship, the Max Bergmann Award, the Ralph Hirschmann Award in Peptide Chemistry, the Herman F. Mark Polymer Chemistry Award, the Arthur C. Cope Scholar Award, and the Pierce (Merrifield) Award from the American Peptide Society. Murray also served as President of the American Peptide Society from 2001–2003.

Murray Goodman lives on in his prodigious publication record—which amounted to more than 500 papers. But Murray’s legacy of leadership in the field of peptide science is also evident through his editorial abilities: It is a tribute to his foresight that he saw the need for a journal specializing in conformational analysis of polypeptides and oligonucleotides—and along with Founding Editors Elkan Blout and Ephraim Katchalski (Katzir)—brought *Biopolymers* into existence in the mid-1960’s. He was its only Editor for over 40 years and his efforts in the mid-1990’s also inspired the spinoff publication *Peptide Science*

which has recently been named the official Journal of the American Peptide Society.

Doubtlessly equal in importance to all said so far are Murray’s contributions as a mentor. He spawned and advanced the careers of a legion of graduate students and post-docs, numbering well over 200. His lab in La Jolla was sought out by professors from all over the world—the U.S., Israel, Italy, Germany, Japan—for sabbatical leaves. He and Zelda graciously welcomed visiting peptide scientists into their home. At many American Peptide Symposia over the years, the mere suggestion that former/present Goodman group members have a ‘reunion’ perennially ended up with 50–60 people descending on the scene. As one of those mentored by Murray, I sense that each of us felt his or her own particular bond of support and reassurance in his presence. And many of us benefited from the friendship of Joseph Taulane, Murray’s trusted associate for over 30 years, who kept the Goodman group running on an even keel.

We to whom he passes the torch recognize Murray Goodman as a dedicated, generous, influential, and talented man. His contributions as a researcher, mentor, editor, and as an unfettered and enthusiastic spokesperson for the always-evolving field of peptide chemistry/structure, will endure in limitless ways. Future conferences will seem odd without Murray at the mike.

CHARLES M. DEBER
on behalf of the Editorial Board,
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