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Editorial

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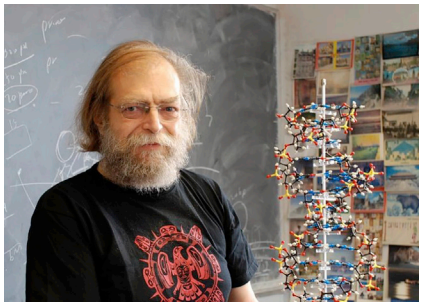
Innovations in biophysics: A sampling of ideas celebrating Ned Seeman's legacy



With great pleasure, I share with you this wonderful volume of contributions reflecting innovations in biophysics, celebrating the work of my dear friend, colleague, fellow *Biophysical Journal* editor, and true innovator, Ned Seeman (1945–2021).

We offer you four perspectives and reviews on the following: Ned's crystallographic legacy (1); key sequence-specific binding motifs of nucleic acids to proteins, and associated solvation networks, that emerged from the early work of Seeman, Rosenberg, and Rich (2,3); and recent advances in self-assembling 3D DNA crystals, reflecting the DNA nanotechnology field that Ned pioneered (4).

The 15 research and computational tool contributions focus on diverse topics spanning volume changes in double-stranded DNA by computations and experiments (5); an RNA aptamer database (6); helicase activity of the Zika RNA virus (7); G-quadruplexes analyzed by machine learning (8); looping in cohesin- and CTCF-bound nucleosome systems (9); origins of life (10); homologous pairing in short double-stranded DNA colloids (11); binding of phosphorylated peptides to nucleic acids (12); and several intriguing applications of DNA origami to tomographic markers in DNA nanostructures (13); supramolecular DNA nanostructures (14); assembly/disassembly of DNA nanostructures (15); nanoscale motor/walker systems (16); rotary DNA origami devices (17); DNA nanostructures based on lipid bilayer platforms (18); and primitive forms (19).

All these contributions reflect the ever-growing body of research on versatile nucleic acid systems in complexation with other molecules, as well as intriguing applications to technology and medicine. It is sad that Ned is not here to read these articles and the innovations he spawned, but I am sure he is continuing to share his wisdom, wit, and heart with his new neighbors and colleagues.

As I wrote in the essay about him that appeared in the Biophysical Society newsletter in January 2022 (20), Ned pioneered research that reflects a successful marriage of his unique creativity and superb grounding in the physical and mathematical sciences. From M.C. Escher to DNA knots to robots and medical applications, Ned's vision was broad, while his craft was meticulous. Besides his unique innovation in science, Ned is remembered by his friends and colleagues as a kind-hearted "tough guy" who spoke the unfiltered truth, fought for what he believed in, and disregarded convention or fashion. Ned's directness and courage were a breath of fresh air in an increasingly bureaucratic world. He saw through people with hidden or unfair agendas, be they on our campus or in Washington, DC. He had no problem telling them what he thought and never considered any possible consequences.

Drawn to math and science early on in his elementary school education in Chicago in the 1950s, he later became fascinated by macromolecular physical chemistry as he earned his Bachelor of Science degree from the University of Chicago in 1966 and PhD in crystallography/biochemistry from the University of Pittsburgh in 1970. This was followed by postdoctoral research at Columbia University and at the Massachusetts Institute of Technology (with Alex Rich).

During his 5 years at the State University of New York Albany as an assistant professor, Ned built Holliday-junction constructs, and with various ideas about sticky polymer ends and branching, he was well on his way to developing novel self-assembling DNA junctions. This work led to a collaboration with Neville Kallenbach and to Ned's joining the Chemistry Department at New York University (NYU), offering Ned an open environment commensurate with his

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creativity and vision. With friends and colleagues here at NYU and throughout the world, Ned founded and developed the field of DNA nanotechnology more than 35 years ago. He loved to tell the story of how he was inspired by M.C. Escher's woodcut, "Depth," in the early 1980s in a bar to create sticky ends and branches in DNA structures. His programs and numerous creative devices brought Ned recognition and many honors and awards (see the NYU Department of Chemistry website). The photograph featured here, provided by his wife Barbara Lipski, is how many of us remember Ned: in his office, wearing an unpretentious T-shirt, and near his favorite molecule.

DECLARATION OF INTERESTS

The author declares no competing interests.

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