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Department of Chemistry

Student Seminar Series

9:45 a.m. Tuesday, April 8, 2014 • 331 Smith Hall

Professor

Jacqueline K. "JK" Barton

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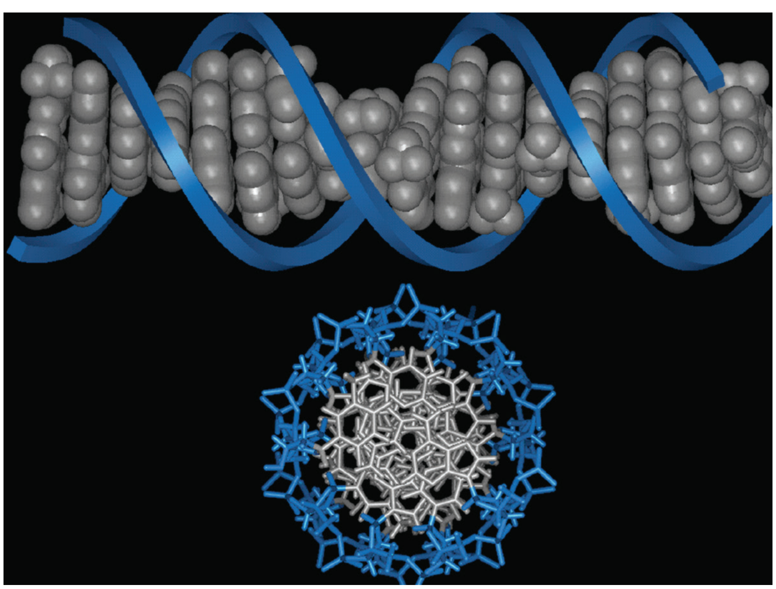
California Institute of Technology

DNA-Mediated Signaling

Website:
http://www.its.caltech.edu/~jkbgrp/BartonBiography.htm

Abstract

DNA-mediated charge transport can yield redox chemistry over long molecular distances in a reaction that reports on the integrity of the intervening base stack. Moreover, increasingly, proteins involved in DNA replication and repair have been found to contain 4Fe-4S clusters, common redox cofactors in biology. DNA-modified electrodes have been utilized to determine redox potentials for these metalloproteins bound to DNA; this electrochemistry establishes the ability of the metalloproteins to carry out redox chemistry at physiological potentials in the DNA-bound form. Studies are also described to characterize how these DNA- binding proteins containing 4Fe-4S clusters may utilize DNA charge transport chemistry for long range redox signaling.



Host:
Anna Komor

Jacqueline K. Barton is the Arthur and Marian Hanisch Memorial Professor of Chemistry and chair of the Division of Chemistry and Chemical Engineering at the California Institute of Technology. She earned her doctorate in inorganic chemistry at Columbia University. After a postdoctoral fellowship at Bell Laboratories and Yale University, she became an assistant professor at Hunter College, City University of New York. In 1983, she returned to Columbia University, becoming an associate professor of chemistry and biological sciences in 1985 and professor in 1986. In the 1989, she joined the faculty at Caltech, and began her term as chair of the division in 2009.

Barton has pioneered the application of transition metal complexes to probe recognition and reactions of double helical DNA. She has designed chiral metal complexes that recognize nucleic acid sites with specificities rivaling DNA-binding proteins. These synthetic transition metal complexes have been useful in elucidating fundamental chemical principles that govern the recognition of nucleic acids, in developing luminescent and photochemical reagents as new diagnostic tools, and in laying a foundation for the design of novel chemotherapeutics. Barton has also carried out seminal studies to elucidate electron transfer chemistry mediated by the DNA double helix. She first showed that oxidative damage to DNA can arise from a distance through charge migration through the DNA duplex. She established that DNA charge transport chemistry is exquisitely sensitive to intervening perturbations in the DNA base stack, as with single base mismatches or lesions. This chemistry has since been applied in the development of DNA-based electrochemical sensors and explored in the context of long range signaling within the cell. Through this research, Barton has trained more than 100 graduate students and postdoctoral students.

Barton has received numerous awards, including the Alan T. Waterman Award of the National Science Foundation, the American Chemical Society (ACS) Award in Pure Chemistry, the ACS Eli Lilly Award in Biological Chemistry, ACS Garvan Medal, and the ACS Breslow Award in Biomimetic Chemistry, ACS Baekeland Medal, the Fresenius Award, the ACS Tolman Medal, the Mayor of New York's Award in Science and Technology, the Havinga Medal, the Paul Karrer Medal, the ACS Nichols Medal, the Weizmann Women & Science Award, the ACS Gibbs Medal, the ACS Cotton Medal, and the ACS Pauling Medal. She was a fellow of the Sloan Foundation, a Dreyfus Teacher-Scholar, and an NSF Presidential Young Investigator. She is a recipient of a MacArthur Foundation Fellowship, and she has been elected to the American Academy of Arts and Sciences, the American Philosophical Society, and the National Academy of Sciences. She received the 2010 National Medal of Science from President Barack Obama.