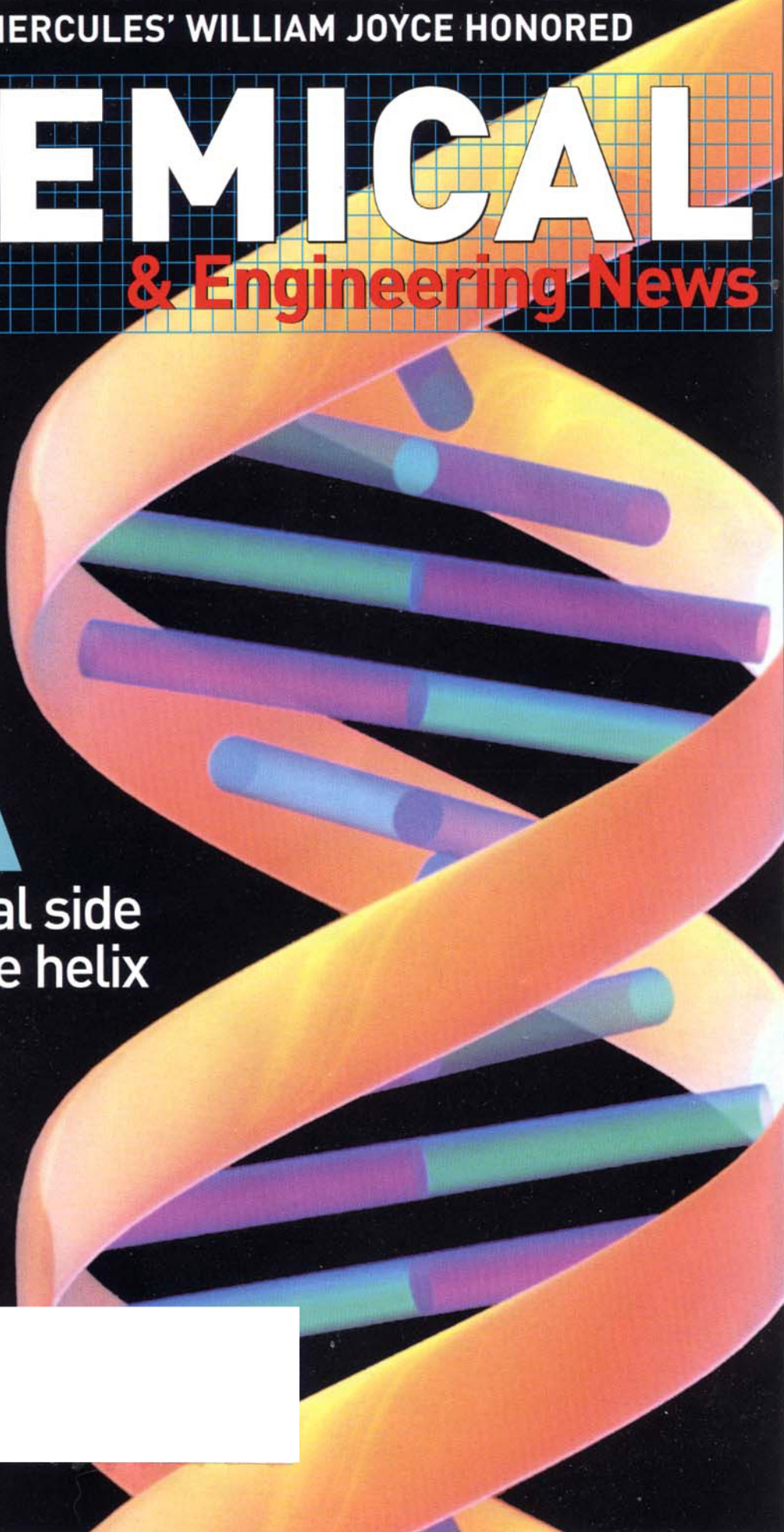
PERKIN MEDAL: HERCULES' WILLIAM JOYCE HONORED

CHEMICAL & Engineering News

MARCH 10, 2003



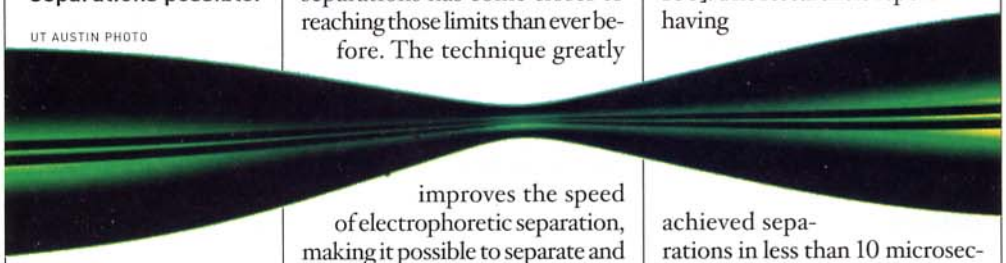
DNA

The chemical side of the double helix

CHEMICAL ANALYSIS

SEPARATIONS IN A FLASH

Microsecond electrophoresis technique separates transient species



JIFFY TUBE High electric fields can be imposed on CE samples in hourglass-shaped region of pulled capillary, making microsecond separations possible.

UT AUSTIN PHOTO

A CAPILLARY ELECTROPHORESIS (CE) technique devised to explore the ultimate speed limits of chemical separations has come closer to reaching those limits than ever before. The technique greatly improves the speed of electrophoretic separation, making it possible to separate and analyze reaction intermediates and other transient chemical species previously inaccessible with CE.

The technique was developed by graduate student Matthew L. Plenert and associate professor of chemistry and biochemistry Jason B. Shear of the University of Texas, Austin [*Proc. Natl. Acad. Sci. USA*, published online at http://dx.doi.org/10.1073/pnas.0637211100]. The researchers report having achieved separations in less than 10 microseconds—about 100-fold faster than any previous CE procedure.

The work "represents a significant advance in ultrafast separation and detection of biologically relevant compounds," write graduate student Jeffrey N. Stuart and chemistry professor Jonathan V. Sweedler of the University of Illinois, Urbana-Champaign, in a *PNAS* commentary. "We certainly expect a number of exciting applications to present themselves for what is now the ultimate in fast separation."

In their initial demonstration of the technique, Plenert and Shear used a laser pulse to rapidly generate a binary mixture of fluorescent hydroxyindole photoproducts in a glass capillary. They obtained baseline resolution of the photoproducts in less than 10 microseconds in a specially designed capillary tube and used laser fluorescence spectroscopy to detect the separated species.

A critical element of the technique is use of a pulled, hourglass-shaped capillary, which makes it possible to attain higher electric field strengths and correspondingly higher separation efficiencies. The electric fields used to carry out CE separations are amplified in the pulled part of the capillary because of higher electrical resistance there.

Prior to their study, the fastest CE separations had been achieved by Stephen C. Jacobson, J. Michael Ramsey, and coworkers at Oak Ridge National Laboratory. They separated a binary mixture on a microchip in under 1 millisecond, using an electrophoretic field strength of about 50 kV/cm. Plenert and Shear have now employed field strengths up to three times as high to separate a binary mixture about 100 times faster in their hourglass capillary.

Potential applications of microsecond CE include studies of other reaction intermediates, rapid biomolecular events (such as neurotransmitter release in synapses), and protein-folding mechanisms. The researchers believe it may ultimately be possible to reduce separation times to the submicrosecond range by optimizing field strengths, sample viscosities, and separation distance, perhaps extending the technique's applicability still further.—STU BORMAN

PHILANTHROPY

Camille & Henry Dreyfus Foundation Names Mark Cardillo As Executive Director

The Camille & Henry Dreyfus Foundation has appointed Mark J. Cardillo as executive director, effective March 4. Cardillo succeeds Robert L. Lichter, who had served in this position since 1989. The foundation was established in 1946 and is one of the few philanthropies devoted exclusively to chemistry. It distributes about $6 million annually through some 10 programs in the chemical sciences.

DREYFUS FOUNDATION PHOTO

Cardillo

Cardillo comes to the Dreyfus Foundation from Lucent Technologies' Bell Laboratories, where he most recently held the position of director of broadband access research. "Bell Labs has strong interactions with many universities, so I've known about the Dreyfus Foundation, and it's always been held in the highest regard," he tells C&EN. "I look forward to helping it advance its goals."

Cardillo received a bachelor's degree from Stevens Institute of Technology in Hoboken, N.J., in 1964 and a Ph.D. degree in chemistry from Cornell University in 1970. He joined Bell Labs in 1975.—LINDA RABER