Imagine genetically engineering a microbe to produce a biofuel by growing on ambient carbon dioxide from the atmosphere and ammonia from wastewater or generated electrochemically. This carbon-neutral bio-electrochemical process is being developed to produce butanol, a biofuel compatible with today's vehicles, and is just one of many projects that Alan West is working on with his colleagues.

West's research focuses on a large number of problems that he says are often characterized as belonging to "electrochemical engineering." He and his team have studied applications of electrochemistry to the production of advanced electronic devices. For example, the "wiring" used to make integrated circuits in logic and memory chips used in personal computers is made through the process of electroplating.

West works on electrochemical application for energy storage (i.e., batteries) and conversion (fuel cells). Working closely with Scott Banta of the Department of Chemical Engineering and Lt. Col. Robert Bozic from the USMA, he has also developed bio-electrochemical sensors that can be employed in a range of applications, including environmental monitoring of potential toxins in groundwater and assessing the safety of drinking water.

West notes that electrochemical technologies will play a key role in sustainable energy, and he and his colleagues have increasingly turned their attention to studies of batteries that can be economically scaled for use in conjunction with large-scale renewable energy production and with a smarter electrical grid. Energy storage such as that provided by batteries accommodates variations in energy production by renewables. For some applications, it may be better to store excess electrical energy in the form of a fuel by using electrolysis (think of a fuel cell running in reverse). In such a technology, a fuel cell is used to oxidize the fuel to produce electricity. West has also been collaborating with Klaus Lackner of the Department of Earth and Environmental Engineering on developing these electrochemical conversion systems.

"We continue to be fascinated by our studies of electrochemical systems because we collaborate with colleagues from a wide variety of disciplines," said West. "It is very gratifying that our work is directly applicable to industrial interests, while addressing long-term environmental and energy needs. We particularly enjoy working with industrial colleagues, in part to keep our ideas grounded in reality and also to provide job opportunities for our students."

B.S., Case Western Reserve University, 1985; Ph.D., University of California-Berkeley, 1989

Applying Electrochemical Technologies for Sustainable Energy

ALAN C. WEST

Samuel Ruben-Peter G. Viele Professor of Electrochemistry