

Craig R. Friedrich

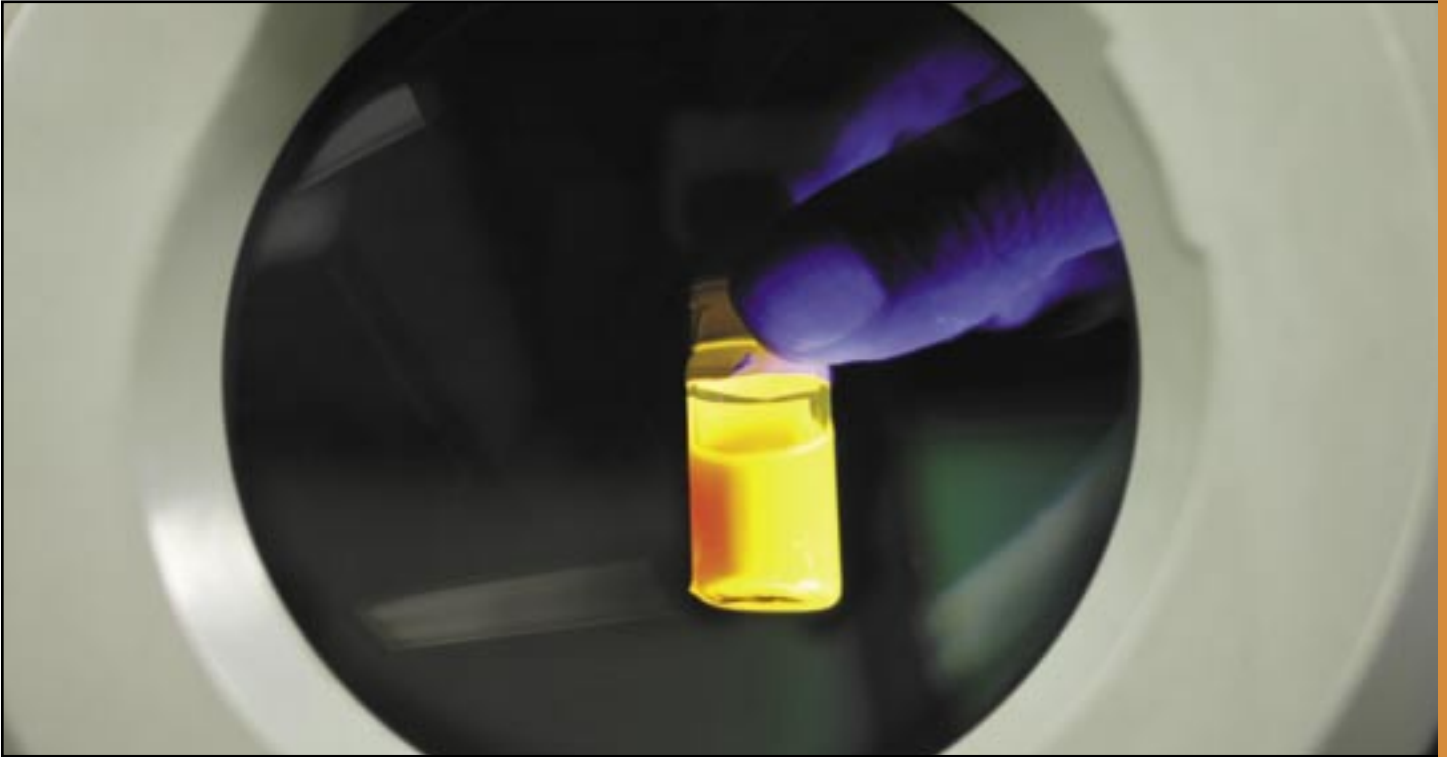
In his brightly lit laboratory, Dr. Craig Friedrich peers into the mechanism of a Langmuir-Blodgett trough, surrounded by part of his graduate research team. Glancing up at his students, he remarks, “This process uses a principle that was first demonstrated by Ben Franklin, who, with a single drop of oil, created a monomolecular film on a pond.” Intrigued, the students discuss Franklin’s theory relative to their own single molecule coating research, which will lead to the development of sensors for the detection of pathogens such as anthrax. With innovations like these protein nanosensors, Friedrich and his team are creating the modern history of nanotechnology.

In the past two decades, nanotechnology—the engineering of functional systems at the molecular scale—has moved from the realm of science fiction into reality. The emerging science has grown exponentially, and with each new development the potential applications for small-scale technologies expand. Friedrich, who has studied micro and nanotechnology for the past 20 years, says, “Nanotechnology is everywhere, and the possibilities and potential societal impacts are limitless.”

Friedrich, a Maryland native, received his BS and MS in Mechanical Engineering from Louisiana Tech and his PhD from Oklahoma State University. He returned to Louisiana Tech in 1987 to begin his research and teaching career in multi-scale technologies. Fascinated by new developments in microtechnology, Friedrich focused on micro-type research and helped develop the *Institute for Micromanufacturing*, where he pioneered machining with small-scale cutting tools—tools which, at the time, were the smallest in the world.

Nanotechnology at Michigan Tech

In 1997, Friedrich left Louisiana for Michigan Tech, and has since played a key role in coordinating the university’s involvement in micro and nanotechnology. He is active in the growing formal structure on campus that is working to coordinate nanotechnology education and research, an effort which facilitates dialogue and cooperation across departments. This type of collaboration, he says, is characteristic of Michigan Tech. “I can’t emphasize enough how easy it is to do cross-departmental research here. It’s an absolute joy.” In that spirit, Friedrich has joined forces with a team of eight faculty members on a nanotechnology contract from the U.S. Department of Defense. He comments, “It’s been a great experience, and we’ve been very successful in developing state-of-the-art technologies.” In the past two years, the team’s efforts have resulted in at least 15 nanotechnology “world firsts.” Among others, the group has, for the first time, patterned opto-electronic protein into structures as small as 100 nanometers using a steerable ion beam, and has shown that these proteins can be activated by nearby fluorescing



A vial of fluorescing semiconductor quantum dots that are used to excite opto-electronic proteins for a nanosensing system. Each quantum dot contains several hundred atoms and fluoresces at a specific wavelength depending upon its size.

quantum dots for nanosensors. “These achievements would not be possible without the outstanding support we’ve received from the university,” says Friedrich. “The administrators, the chairs, and the deans make the process seamless. We are very fortunate here at Michigan Tech.”

The Next Generation

In addition to his research, Friedrich maintains an involvement with the student community at Michigan Tech. He is the Director of the Multi-Scale Technologies Institute and helps support, along with several other faculty members, the Nanotechnology Student Association. He developed and teaches *Micromanufacturing Processes*, a graduate-level course, and also teaches an undergraduate course *Integrated Design and Manufacturing*. Friedrich speaks highly of his students, saying, “The research program here is demanding. We are doing real-world work that has a demonstrable effect on the science, and we turn out excellent graduates who have an education grounded in reality. They can compete with anybody.”

“With motivated students, university support, and cross-departmental collaboration, the future of nanotechnology at Michigan Tech is promising,” continues Friedrich. “We have many groundbreaking projects on the horizon—it’s history in the making.”

