Tenth nanoUtah Conference

Speakers at nanoUtah2013 covered a wide variety of topics in materials and characterization, devices and sensors, energy and environment, and nanomedicine.

Dennis E. Discher, University of Pennsylvania – Dr. Discher spoke on how the membrane protein CD47,a "marker of self," impedes an 'eat me' reaction, known as phagocytosis, when the body detects foreign particles. His work included designing "self peptides" that delay the clearance of nanoparticles. That delay enhances imaging dyes and the delivery of drugs.

Matt Linford, Brigham Young University – How can CDs be made to last 1,000 years? For Dr. Linford the answer meant using a variety of materials testing procedures to find out which depositional materials could provide optimum lifespan.

Ling Zang, University of Utah College of Engineering – Identifying explosives quickly, with a small, hand-held device would be of great help to the U.S. Departments of Defense and Homeland Security who have funded Dr. Zang's work. Dr. Zang and his colleagues have been building and testing nanofibers for the device cores to trap explosives' emissions for quick identification.

You Han Bae, University of Utah, Department of Pharmaceutics and Pharmaceutical Chemistry – According to Dr. Bae, injected therapeutic cancer nanomedicines currently have poor penetration and distribution in solid tumors. He and his colleagues have determined that a kind of self-assembled nanoparticles penetrate better, but for unknown reasons. Further research may show how these particles solve problems related to the transport of nanoparticles to individual cancer cells.

Henry White, University of Utah Distinguished Professor, Department of Chemistry – Dr. White discussed the discovery of a "very sensitive sensing zone" in double strand (ds) DNA adapted to monitor the activity of enzymes on DNA. This may lead to new methods to detect site-specific changes in dsDNA relevant to medical diagnostics.

Rajesh Menon, USTAR Associate Professor of Electrical and Computer Engineering – A technique for creating deterministic structural complexity is essential to achieving high functionality at the nanoscale. Scanning electron beam lithography used for nanopatterning is slow, expensive and error-prone. Dr. Menon discussed two new techniques using wavelength-selective photochemistry

Tenth *nanoUtah* conference draws researchers, industry and students

Utah Science Technology and Research Initiative (USTAR) support continues to move Utah nanotechnology efforts forward

The University of Utah's 10th Nanotechnology Conference and Exhibition, *nanoUtah 2013*, held October 18 and organized jointly by the Nano Institute of Utah and the College of Engineering to demonstrate and showcase advancements in nanotechnology, attracted almost 200 scientists, engineers, students and members of the nanotechnology industry from across the state. Attendees heard 25 research presentations in either "Materials and Characterization," "Devices and Sensors," Energy and Environment," or "Nanomedicine." Graduate students from around the state presented seventy-four posters while members of the nanotechnology industry exhibited their technologies and services.

The gathering, initiated in 2003, has served as a venue for participants in the state's university-based nanotechnology research efforts and members of the state's growing nanotechnology industry to meet, discuss, and collaborate on all things nano. Participants came to hear first-hand from colleagues about the latest research in nanotechnology – those advancements in science and engineering at the atomic or molecular levels that promises to impact everything from communications to drug delivery.

Exhibitors

"Until this conference started, we did not have a state-wide mechanism for pulling together Utah's nanoscience community," says Thomas N. Parks, vice president for research. "Thanks to the continuing excellent support from USTAR, which has allowed us to bring in world class faculty and build-state-of-the-art facilities, the Utah nanotechnology industry has been able to nucleate around the Nano Institute and this conference. The conference has become a great place for the Utah nanotechnology community to 'rub shoulders'."

Established in 2008, the University's Nano Institute (http://nanoinstitute.utah.edu/) provides scientists, engineers and clinicians with a place to work together to attain global recognition in nanoscience and nanotechnology. Support from USTAR (http://www.innovationutah.com/)

has been critical to the growth and success of the nanotechnology effort on the University of Utah campus, said *nanoUtah 2013* program chair Hamid Ghandehari, founder and co-director of the Nano Institute and USTAR professor of bioengineering and pharmaceutics at the University of Utah.

Student Posters: SMBB Building

Richard B. Brown, dean of the College of Engineering, who has seen the growth in nanotechnology at the University of Utah first-hand, agrees.

Thomas N. Parks: Vice President for Research

"One of the goals of the University of Utah's Strategic Plan has been to establish a strong program in nanotechnology, and this conference has been a big part of that," says Brown. "*nanoUtah* has become a place where people can interact – and good connections come of it."

Brown also praises the support of USTAR, support that has enabled the College of Engineering to bring on board 21 world class faculty members and build facilities such as the Warnock Engineering Building (WEB) and the USTAR Innovation Center, the James L. Sorenson Molecular Biotechnology Building (SMBB) and the university's new nanofabrication lab.

Hamid Ghandehari: Program Chair

New nanofabrication lab to benefit all

Richard B. Brown: Dean, College of Engineering

Dennis E. Discher, Robert D. Bent Chaired Professor at the University of Pennsylvania's Biophysical Engineering and NanoBio-Polymers Lab who presented the meeting's Keynote Address, says he comes to *nanoUtah* "to hear what's new."

"I'm quite impressed with the new buildings, programs and the nano fabrication lab," says Discher, who toured the new nanofabrication lab. "Many facilities are very 'hard matter' oriented, for silicon chips. But this looks like it will be a mixed-used facility, including bio-


Dennis E. Discher: Keynote Address

applications and pharmacy, and that means that users in all areas, including students, will be 'colliding.' The new lab is a microcosm of an increased 'collision frequency' factor that one hopes students and faculty will take advantage of. It's brilliant!"

Bruce Gale, associate professor of mechanical engineering, program co-chair and director of the new nanofabrication lab www.nanofab.utah.edu/ housed in the SMBB, agrees that the new lab is *brilliant*. "It's our first state-of-the-art nanofab lab and it's available to anyone who wants to do academic research. It is also available to companies in or outside of Utah."

According to Gale, they can now reach new companies, or bring in work from local companies who previously had to go outside of the state for topnotch nanofabrication services. "This is the machine shop of the future," says Gale. "Now, Utah has one comparable to those around the world, allowing us to do hi-tech research and development at a level we could not reach before."

NanoUtah 2013 has been a good venue to show off the new facility, he explains. Classes in how to use the lab are available and the 12 nanofab staff members will help with the work. The lab's website includes an explanation of the lab's tools.

Students benefit

For Matt Linford, associate professor in the Department of Chemistry and Biochemistry at Brigham Young University and program co-chair, the event offers not only networking opportunities for him and his students, but also provides presentation opportunities for his students. Linford, who spoke on the successful development of a CD that would last 1,000 years, added that he likes the fact that his students can not only hear research presentations, but also have the opportunity to give talks and present posters.

Marc D. Porter, USTAR professor of chemistry and chemical engineering and director of the University of Utah's Nano Institute, agrees that *nanoUtah* is a good place for graduate students to "get their feet wet" by preparing and delivering presentations on their research. The local nature of the meeting also provides a chance for students delivering their first presentation to learn to "manage butterflies."

"The conference has turned into a real breeding ground for collaboration," suggests Porter. "Over the years, *nanoUtah* has increased its focus and breadth, and this is important for our students because they are able to interact with both potential industrial partners and faculty

members. To me, that's one of the real valuable aspects of *nanoUtah*."

Graduate students viewing posters

NanoUtah is also a good place for a student to learn how to help stage a conference, says Chris Radford, a second-year PhD bioengineering student, student liaison to *nanoUtah2013* and member of program organizing committee. Radford took on the task of getting his fellow students involved, especially those students interested in presenting research related to their dissertations and who wanted feedback from faculty members.

"One focus of the conference is to connect students and faculty across Utah," explains Radford, who is working on polymeric drug delivery systems and a better method to monitor those systems. "Because the conference is regional, it gives students an opportunity to see what research is going on at nearby universities, and that proximity allows for closer collaboration."

The long path to commercialization

The long path that stretches from research, to discovery, to testing, to validating proof of concept and finally to commercialization was a topic discussed not only in the formal sessions, but also in the hallways and over lunch. That some innovations may take a decade to reach the patient's bedside or enter into the marketplace to make life easier, better, or make services more efficient, has been an issue under discussion at every *nanoUtah*.

Commercialization panel sees need for more academy/industry collaboration

To enter into the marketplace, discoveries in nanotechnology need to be "commercialized." This panel discussed issues in commercialization, including the time lag from discovery to commercialization, the value of education to tomorrow's hi-tech workforce, whether state funding should support research, and why academia, not industry, is the best venue for innovation.

Glenn Prestwich, Presidential Professor, Department of Medicinal Chemistry, University of Utah

> "From the state's perspective, there is no better investment than in education. We all buy into that."
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> **Aaron Osmond**, Utah State Senator, District 10
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> "My goal as a legislator is to see that we interfere as little as possible while making sure that we hold accountable those who utilize tax resources and that there is, in fact, some return to the taxpayer. We are behind the scenes, but involved in an essential way."
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> **Dave Robinson**, president and managing partner, EZ Lift Rescue Systems
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> "If we want to attract medical device companies and big pharma, we have to have an academic environment that spawns the workforce they will need, and the state has to play a role in that."
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> "It takes a long time to build capacity, to build facilities and hire faculty and let good people go to work generating ideas," notes Parks in laying out the difficult road from discovery to commercialization. "However, good ideas *do* find their way into the marketplace and create high wage employment - but most of the time this does not take two years, or five. These innovations take a long time to come to fruition, so if government and business are serious about building sustainable industry, we have to have a longer timeline."

Researchers such as Ling Zang, professor of materials science and engineering in the College of Engineering, who presented his research on building nanofibers for the functional core of a hand-held sensor for identifying a variety of explosives, has had the persistence, flexibility and - most importantly - the support to carry through that long development process. He thanks USTAR, the Department of Defense and the Department of Homeland Security for the support he has received.

"It takes time, money and people - working in areas from physics to materials science - just to develop the new materials," explains Zang, a USTAR professor. "To get funding you initially have to convince people that your ideas are not only good, but better than traditional methods, and you must also provide proof of concept through testing. Testing takes time and money."

Transferring nanoscience to the real world also requires time, money and energy, he notes. "Fortunately, USTAR provides wonderful infrastructure for doing that, and the University of Utah's Technology Commercialization Office provides a great amount of help as well," says Zang, who has spun out two companies from his discoveries.

Glenn Prestwich, Presidential Professor; Aaron Osmond, Utah State Senator; and Dave Robinson, President EZ Lift Rescue Systems

According to Dave Robinson, president and managing partner of EZ Lift Rescue Systems who spoke on the commercialization panel, research into nanotechnology does not happen in big companies; it has to be driven by academic setting because that's where problems are defined and solutions are created. When a device or advancement has been finalized, then academia needs to look to commercial partners to put the new technology into the marketplace, he says.

"Without academic research into nanotechnology we would not be on the verge of a revolution in technology, a revolution that will change the world," concludes Robinson.

Story by Randolph Fillmore, Florida Science Communications