



INSTITUTE FOR MICROMANUFACTURING

NEWS OF THE INFINITESIMAL

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A Look Back At 2008

2008 brought growth, new technology, and loss to the IfM.

At the end of June, long time Director for IfM, Dr. Kody Varahramyan moved to Indianapolis as VP of Research for IUPUI.

The search for our next IfM Director continues, with many personal invitations being issued. The IfM Leadership Team, working with Dean Stan Napper, is conducting the search and is working regularly to fulfill the vision and mission of the Institute.

In August, long time staff member Mr. Scott Williams lost a brief battle with Leukemia leaving a great void; but under the direction of Mr. Philip Coane, Associate Director of Operations and his facilities team, the IfM has continued to operate without deferral, helping heal that void and smooth the passage of transition.

In the Fall quarter we were fortunate to have new faculty join us from

Utah, Ohio, and Washington.

A quest for the latest in research and technology materialized in 47 new grants and funding totaling \$1,572,258. From the on-going re-



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search at IfM came a new start-up company with Dr. Scott Gold and students, titled "Aurizon, LLC"; and four (4) patents were issued through research investments at IfM.

The Institute also acquired via grant funding a Sputter Deposition System, XeFe2 Etch System, Wafer Bonder, and Wafer Cleaning System for the processing lab facility, enabling more advanced research and collaboration among faculty, staff,

students and their associates and affiliations.

Many outreach programs contributed to student participation and accolades not only internally, but externally via our JFAP faculty with Louisiana Tech University and Grambling State University, as well as faculty with Biological Sciences at Louisiana Tech University.

Students were invited to present papers at conferences and many more participated via poster sessions conferring their research knowledge learned at Louisiana Tech University and the IfM to the research community.

As we begin a new year, please visit our website at www.latech.edu/ifm to learn more about the faculty, staff, and exciting research taking place at the Institute. We look forward to meeting and collaborating with each of you in 2009, so please check out our individual faculty web pages to learn where we may assist you in your research needs.

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Special points of interest:

- Nanotechnology
- Biotechnology
- Biomedical Nanotechnology
- Environmental Technology
- Information Technology

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Comments are welcomed!



Scientists Recognized for Collaboration

Louisiana Tech University Scientists and Italian National Nanotechnology Laboratory Scientists Recognized for Collaboration.

Louisiana Tech University and the Italian National Nanotechnology Laboratory's joint project, "Nanocarriers for Cancer Therapy" has been selected among the twenty most important scientific projects for Italy - USA collaboration (Progetto Bilaterale Italia-USA). The collaboration was



Professor Yuri Lvov

led by Dr. Yuri Lvov, Professor of Micro and Nanosystems at Louisiana Tech's Institute for Micro-manufacturing, and Stefano Loporatti of the Italian National Nanotechnology Laboratory.

The project was approved and authorized in April of 2008 in Washington, D.C. by the United States Deputy Secretary of State, the United States Ambassador to Italy, the Italian Ambassador and the United States

Science Secretary. It was funded by the Italian government.

The primary purpose of the collaboration was to develop new nanocarriers and to study their uptake in cells for development of new cancer therapies. The work was benefitted by the Advanced Optical and Scanning Probe Facilities of the Italian National Nanotechnology Laboratory and Louisiana Tech's world-recognized expertise in developing advanced nanocarriers for cancer drug delivery at its Institute for Micro-manufacturing. The Italian Laboratory's newly developed Advanced Optical and Scanning Probe tools allowed the teams to characterize at the nano, micro, and macro scale the cellular uptake of nanocarriers and to study intracellular transport and kinetics. It is usually quite difficult to find such a combination of skills at the national level and a bilateral collaboration between international partners with complementary expertise is ideal.

In addition to the medical applications, the project will be a crucial



L-R: Professor Stefano Loporatti and Ph.D. Graduate Student Viviana Vergaro

advantage for the multi-disciplinary training of graduate students in the bio/ nano technology environment. Recently, Professor Stefano Loporatti and Ph.D. graduate student Viviana Vergaro of the Italian National Nanotechnology Institute visited Louisiana Tech's Institute for Micro-manufacturing. During the visit, Dr. Loporatti delivered the lecture, "Engineering Micro/Nano Environment via Layer-by-Layer Composite Films for Breast Cancer Cell Controlled Growth," and presented a seminar on using virus arrays for templated nano-lithography.

German Researchers Travel to IfM

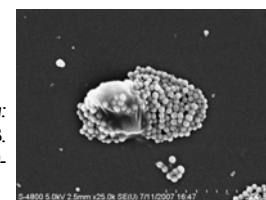
PhD grad student Bettina Franz from the Institute for Microbiology & Biotechnology, Rheinische University, Bonn, and Prof. Alexander Prange from the Max Planck Institute for Colloids and Interfaces, Potsdam are collaborating with us on nanoassembly. Recently, Bettina spent two months at IfM working on polyelectrolyte nanoencapsulation of bacteria, and Prof. Prange visited us for one day for discussing results. It was a difficult time for Bettina: she was living in a dormitory and was working 10 hours per day in the nanoassembly lab. But it was also a rewarding time: Bettina met new friends, visited



L-R:BR: Ph.D. Graduate Students Shantanu Balkundi, Bettina Franz, and Prof. Yuri Lvov; L-R:FR: Ph.D. Graduate Student Dustin Green, and Prof. Alexander Prange

places in Louisiana during Thanksgiving holidays, and prepared a new manuscript which will be submitted

for publication in the Biomacromolecular Science Journal in January 2009. Her closest collaborators at IfM were grad students Shantanu Balkundi and Dustin Green, and their advisors Prof. Yuri Lvov and Prof. Mark DeCoster. Friends in the lab called Bettina with affection: "our beautiful bacteria girl"; and she inspired all the team with her enlightened mind and merry character.



"Half-dressed" bacteria: SEM images of *B. subtilis* coated with 70-nm silica nanoparticles



“Creating Connections” LaTech’s NSF GK-12 Teaching Fellows Program



K12 Teachers Present their Summer Research Projects at National Meetings

Three middle and high school math and science teachers recently presented their summer research projects at three national engineering and scientific conferences. Tanya Culligan, Anna Drago and Janie Hamby were participants in Louisiana Tech’s NSF funded N.E.R.O. ‘Research Experience for Teachers’ program held over a six week period in June and July 2008. These teachers worked in the labs of Louisiana Tech University’s research faculty and were mentored in experimental design and conducting research by engineering and science graduate students as part of their service with Louisiana Tech’s NSF GK12 Teaching Fellows program.

Anna Drago, worked this summer in the lab of Dr. Pedro Derosa, a physics faculty member who holds a joint appointment with Grambling State University. Anna gave a platform presentation at the regional American Chemical Society

meeting held in Little Rock, Arkansas on October 2nd. The title of her presentation was: "Using the Density Functional Theory to Determine the Toxicity of Metallic Clusters on Biosystems." Her co-authors were Mr. Daniel Moller, a PhD student in Biomedical Engineering and a NSF GK12 Teaching Fellow and Dr. Derosa. Anna teaches at Elm Gove Middle School in Bossier Parish.

Tanya Culligan worked in the modeling lab of Dr. Daniela Mainardi for the past two summers. She presented a paper titled, "In Search of the Active Site of pMMO Enzyme: Partnership between a K-12 Teacher, a Graduate K-12 Teaching Fellow, and a Research Mentor" at the American Institute of Chemical Engineers (AIChE) national meeting held in Philadelphia, PA. November 16-21, 2008. Her co-authors were Ms. Katherine K. Bearden, a PhD student in Engineering and a NSF GK12 Teaching Fellow, and Dr. Daniela S. Mainardi. Katie, Tanya and Dr. Mainardi also have a manuscript based on their work under review with the journal Chemical Engineering Education. Tanya teaches at Caddo Parish Magnet High School in Shreveport, LA.

Janie Hamby was part of a team from the BioMorph lab of Dr. David K. Mills

who presented a poster at the Tissue Engineering and Regenerative Medicine meetings in San Diego, CA. Janie worked with Dr. Mills’ group during the summer of 2007. They presented a poster, ‘A Bioengineered PCL Scaffold for TMJ Tissue Repair’. Her co-authors were graduate students Subhra S. Nag, Deepak Pakalapati, Kanthi Pinnamaraju, Paul Turner and Dr. Sidney Sit (Biomedical Engineering/IfM) and Dr. David K. Mills (Biological Sciences/IfM). Janie worked with Paul Tuner, a former NSF GK12 Teaching Fellow and recent MS graduate in Molecular Science and Nanotechnology.

Winter 2009 Seminar Series IfM Auditorium

*Functional Nanoassemblies:
Fundamentals and Applications*
Chaired by: Tabbetha Dobbins,
Yuri Lvov, David Mills

February 03: 2:00 p.m.
Zhiguo Zheng, X. Zhang, D. Carbo, Y. Lvov, (IfM & BME), “Nanoparticle Production through Ultrasonication with Gradual Desolvation Assisted with LbL Coating”

February 17: 2:00 p.m.
Mridhula Thangaraj, S. Stewart-Clark, Y. Lvov, D. Mill, (SBS & IfM), “Design of Smart Nanofilms for Regenerative Medicine Using LbL Nanoassembly”

Airforce Research Stipend Awarded IfM Student



Shantanu Balkundi, a Biomedical Engineering PhD student under the direction of Dr. Yuri Lvov was recently awarded a 2009 US Air Force Research Laboratory stipend. The stipend was administered by Oak Ridge Institute of Science and Education (ORISE) through DOE and AFRL. Mr. Balkundi works with Tyndall Airforce Base Research Division members Dr.’s Glenn Johnson and Mats Eby on their project “Armored Microbes - Controllable Assembly of Nanoparticles / Polyelectrolyte Shells”. A paper on the topic was recently submitted to the prestigious Biomacromolecules Journal. Mr. Balkundi has worked with IfM more than six years. He received his MS in Biomedical Engineering with advisors Dr.’s Donald Haynie and Yuri Lvov, followed with a year at the LSU Health Center, Shreveport working with Prof. Cherie-Ann Nathan and her group, before returning to IfM to continue working with Dr. Lvov’s group on his PhD degree. Shantanu’s work continues to be successful, and includes collaboration with AFSR, and his former co-workers at LSU Health Center.



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and Less Expensive Consumer Products,
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Vision and Mission

The vision of the IfM is to be a world-class resource for the realization of commercially-viable micro- and nano-systems, contributing to the economic infrastructure of Louisiana and the nation and benefiting humanity as a whole.

The mission of the IfM is:

- To research and develop novel micro and nanosystems for biomedical, biological, environmental, chemical, information technology, and other applications
- To generate and harness commercially viable intellectual property
- To partner with industry, government, and academia in economic development

- To transfer new technology and provide technical training to industry and government
- To develop curricula and educate students in micro/nano scale technologies and systems

The IfM offers a wide range of microtechnology capabilities for the realization of micro electro mechanical systems (MEMS), as well as a complementary array of nanotechnology capabilities for MEMS and other applications.

Nanotechnology, Biotechnology, Biomedical Nanotechnology, Environmental Technology, and Information Technology constitute the five major research and development thrust areas and centers of excellence of the IfM.

Examples of projects include:

BioMEMS efforts aimed at the development of select commercially viable micro and nanosystems for biomedical and biological applications; EnviroMEMS efforts aimed at the development of select commercially viable micro and nanosystems for environmental and chemical applications; Nanotechnology efforts directed at the development of select commercially viable nanotechnologies for BioMEMS, EnviroMEMS, and other applications; Information technology efforts are directly supportive of the State of Louisiana IT Initiative and current efforts include projects for the realization of enabling micro/nanotechnologies for information sensing, storage and processing.



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