Louisiana EPSCoR
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LA Tech/Italian Collaborative Among Top 20 Research Proposals

A Louisiana Tech University and Italian Nanotechnology Laboratory (NNL) joint research project has been selected among the 20 most outstanding scientific projects of the 2008 bilateral agreement between the U.S. and Italy (Progetto Bilaterale Italia-USA) for scientific and technological cooperation.

Titled *Nano-carriers for Cancer Therapy*, the project's primary objective is to develop and study the uptake (absorption and incorporation) of drug nano-carriers in cells for the development of new cancer therapies. Such tiny capsules containing a potent anticancer drug, for example, will selectively deliver to thick cells only, drastically increasing the efficiency of the treatment while decreasing the required quantity of medication.

The research collaborative is based on NNL's research on advanced optical and scanning probe facilities and the LA Tech Institute for Micromanufacturing's expertise in developing advanced nano-carriers for cancer drug delivery that was supported in part by the National Science Foundation's LA EPSCoR program.

The LA Tech team is led by Drs. Yuri Lvov, holder of the Tolbert Pipes Endowed Chair on Micro and Nanosystems, and Mark DeCoster, Associate Professor of Biomedical Engineering and Principal Investigator, Cellular Neuroscience Laboratory. Leading NNL are Drs. Roberto Cingolani, NNL Director, and Stefano Leporatti, Senior Researcher.

Noting that it is difficult to find such a combination of skills at a national level, Dr. Lvov, a pioneer and internationally recognized expert in nanotechnology, says the project will also provide comprehensive graduate student training in multidisciplinary bio/nano technology.

Signed in April 1988 and renewed every five years, the bilateral agreement's 2008 request for proposals resulted in over 400 scientific submissions, of which 46 were selected for financing and 20 as "significant bilateral projects."

Other U.S. universities selected among the top 20 scientific projects are Virginia Tech, Georgia Tech, Caltech, Harvard University, Columbia University, Florida State, Penn State, NY Polytechnic, and University of California, San Francisco.

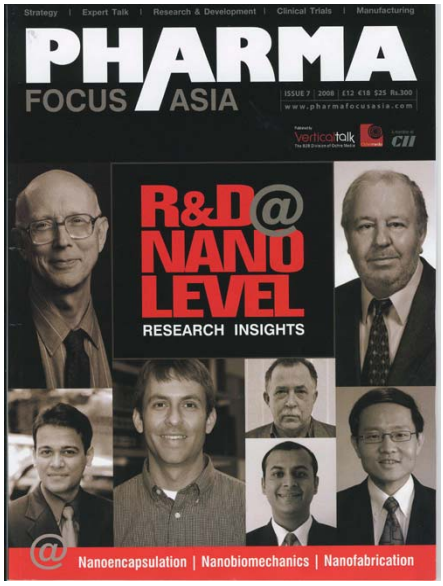
Tiny Medical Delivery Systems Pioneered by LA Tech Researcher

A Louisiana researcher who pioneered the delivery of medicine to diseased human cells via tiny vessels smaller than a cell is already an internationally recognized expert in nanotechnology.

It's about to get better. Louisiana Tech University Professor Yuri Lvov and his team of researchers have a patent pending for a novel nano-encapsulation technology system that may be used to substantially enhance the ability to treat cancers and their metastases.

"The novel system has several advantages over current chemotherapy approaches," says Dr. Lvov. "These include minimal side effects on the immune system, high specificity and selectivity for target cells, and easy administration of the nanometer-sized particles.

"It also avoids the administration of drugs that are too concentrated, which we found can actually reduce their potency against targeted cancers and metastases. They are instead released slowly, retaining their biological activity over extended times."



Dr. Yuri Lvov (top right) and former LA Tech graduate student Anshul Agarwal, third from left, bottom featured on the cover of Pharma Focus Asia, one of the world's largest pharmaceutical science journals.

The system employs a layer-by-layer (LbL) self assembly technology, also pioneered by Dr. Lvov, which fabricates multilayer films without complicated instruments or chemical reactions. That technology is also used to construct ultra thin films with thicknesses typically in the nanometer range, as well as in such industrial applications as eye lens modification and microcapsules for sustained insulin release.

Already the recipient of six U.S. and Japanese patents, Dr. Lvov has another five pending. Two of those five—including the above referred to *Layered Nanoparticles for Sustained Release of Small Molecules*—were funded in part by the LA EPSCoR program.

Dr. Lvov, whose work is ranked among

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the three most cited papers on molecular self-assembly, is the author of two books and 12 book chapters and the recipient of grants and industrial contracts exceeding $5 million in the last five years.

Most recently, he led the LA Tech team that, in collaboration with the Italian Nanotechnology Laboratory (NNL), was selected among the 20 most outstanding scientific projects of the 2008 bilateral agreement between the U.S. and Italy for scientific and technological cooperation (*See Tech/Italy article page 1*).

Another international spotlight was shown on Dr. Lvov when in July 2008 the cancer drug nano-encapsulation developed by him and Anshul Agarwal, a LA Tech bioengineering doctoral candidate, was featured in an issue of *Pharma Focus Asia*, one of the world's largest, most respected pharmaceutical science journals. They shared the cover of the publication with some of the world's leading nanotechnology researchers.

Written in collaboration with Northeastern University pharmaceutical researchers, the article looked at nano-encapsulation of low-soluble cancer drugs and presented an innovative approach for adjusting drug release rates and attaching antibodies at the outer shell layers for targeted drug delivery. Their subsequent National Institutes of Health Research Project Grant (RO1) proposal on this topic was recently rated among the top 13 percent and recommended for $1.5 million in funding.

"We may be able to drastically increase the efficiency of existing low-soluble cancer drugs by way of their nanoparticle formulation," explains Dr. Lvov. "We are working with several institutions around the country that are currently in the process of testing our new drug formulation."

Dr. Yuri Lvov (right) and LA Tech biomedical engineering graduate student Shantanu Balkundi.

"Already the recipient of six US and Japanese patents Dr. Lvov has another five pending...two of which were funded in part by the LA EPSCoR program."

Pharma Focus Asia was not the only publication to recognize Dr. Lvov's pioneering work in nanoencapsulation and drug reformulations. He has had over 160 papers on the topic published in peer-reviewed journals and in 2007 was named Innovator of the Year by *Small Times* magazine, beating candidates from Princeton University and companies across the nation. The award was based on his work related to important cancer drugs.

That recognition followed on the heels of his 2006 designation as Louisiana's outstanding researcher in materials and emerging technologies by the Louisiana Materials and Emerging Technologies Conference. The honor spotlights a researcher who has made significant provisions through either progressive research over a long period of time or ground-breaking research over a shorter time. Dr. Lvov has done both.

Since joining LA Tech in 1999, the Russian-born chemistry professor has led the university's nanotechnology research, and introduced a number of research areas based on nanoassembly. He also established collaborations with Germany's Max Planck Institute of Colloids and Interfaces in Berlin and Japan's National Institute's famous Tsukuba Research Center.

Besides nanocapsules for drug delivery, his research has found industrial applications in biocompatible nanocoating and microfiber processing for better paper. His industry achievements include nano-engineered protein drug encapsulation with the Baxter Corporation; eye lens nanocoating for specific hormone absorption with Novartis Corporation; and nanoassembly for public and paper processing with SAPPI Fine Paper Corp., Smurfit-Stone Container Corp., and International Paper Company.

Noting that the university is among the nation's leaders in nanotechnology, which involves engineering functional systems at atomic, molecular and super molecular level, and ranks third in the nation in nanotechnology education, Dr. Lvov adds:

"We are not making a new drug at Louisiana Tech. But just as important, we are the engineers working in nanotechnology to make new, more efficient formulations for existing drugs."

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