

EXECUTIVE SUMMARY

The Lead Campus Program in Nanotoxicology Research and Training officially began operating in the summer of 2006. After the formation of the Executive Committee (comprised of Andre Nel, Curt Eckhert, Eric Hoek from UCLA and Arturo Keller from UCSB) our first task was to prepare a solicitation for research grants based on the research themes that were outlined in the grant application. A list of the most important nanomaterials, based on volume of production and the likelihood of contact with humans and the environment, were nominated for study and used as the basis for soliciting the research applications looking for nanomaterial characterization from the perspective of biological interaction, cellular paradigms for toxicity, nanomaterial transport in water and soil, bacterial uptake and antimicrobial activity of nanoparticles, personal monitoring to detect nanotube spread via the air and economic forecasting in the use of nanomaterials. From the applications received, we funded 10 graduate students who began their research in the Fall of 2006. At the time of preparing this report, research in the first round of funding is still ongoing but considerable progress has been made in several projects. This has resulted in at least one publication with other submitted recently. The students presented posters showing their progress and participated in the annual TSR&TP retreat in April 2007 in Santa Cruz, California. Faculty and students also presented talks and posters highlighting research from this program at local (e.g., CNSI seminar series at UCLA), national (e.g., the Control Release Society Meeting in Long Beach, California, and the American Academy of Asthma, Allergy and Immunology) and international conventions (e.g., the Japanese Society for Medical and Biological Engineering). This also included a presentation by the Principal Investigator to Cal/EPA, members of the DTSC and the California Legislature in March 2007.

A seminar series for Year 1 for invited local and national speakers commenced in the Fall of 2007 and covered topics such as nanomaterial safety, nanomaterial toxicity, bacterial uptake mechanisms and toxicity, as well as eco-toxicity. The speakers and the topics that were covered appear in Section X. Because of the good attendance by the toxicological community, the seminars for Nanotoxicology and Molecular Toxicology will be integrated in the future and a combined seminar series is being offered in the Fall of 2007.

Graduate students who were recruited to the program in Year 1 attended the required "Fundamentals of Molecular Toxicology" course (ENV HLT 240) in March 2007 and successfully completed this training requirement. The lectures were video-conferenced to UCSB, where several faculty and students from a variety of different programs, including Nanotoxicology, were able to participate in or audit the course. Dr. Michael Collins, the course instructor, also traveled to UCSB to deliver some of his lectures there. The course received favorable comments from both institutions with specific mention of the value to UCSB faculty and students who do not have an official toxicology course on their campus. A nanotoxicology capstone course, "Principles of Nanobiological Interactions & Nanotoxicology (ENV HLT280)", was developed in the Fall of 2006 and submitted to UCLA for recent approval. Dr. Curt Eckhert from the Department of Environmental Health Sciences, who will serve as the Course Instructor, will coordinate the lectures in which more than 12 of our current faculty members will participate. The first capstone course will take place in October and November 2007. The course outline and the participating lecturers appear in Section X.

Faculty members of this TSR&TP program have planned two major workshops in the first year.

The first is the “Bio-physicochemical Interactions of Engineered Nanomaterials Workshop” that will be held in the new California NanoSystems Institute (CNSI) building at UCLA, September 9th - 11th, 2007. The goal for the workshop, which has been put together entirely by members of our nanotoxicology training program, is to define knowledge gaps and research goals regarding bio-physicochemical interactions of engineered nanomaterials and how such interactions define biocompatible and bio-adverse interactions at the cellular and molecular levels. The product of our workshop will be a summary report, including contributions from workshop participants that will be posted to the UC Nanotox Program website. The report will outline a roadmap for future research in this contemporary arena. The second workshop, which is being put together by Harvard Nano in Society; Santa Barbara Nano in Society, UCLA Center for Occupational and Environmental Health and the UC Lead Campus for Nanotoxicology Training and Research Program, is the “Nanotechnology and Occupational Health and Safety Conference” that will be held at UCSB on November 15-17, 2007. The conference will bring together union leaders, human resource managers, social scientists, media, public policy officials, and science experts to examine issues relating to potential risks involved for nanotechnology workers – both in laboratory settings and in industry – and ways to limit those risks. A major objective of the conference will be to initiate a conversation on these issues between specialists and practitioners.

The UC Lead Campus Program in Nanotoxicology has had a number of important impacts on both campuses, as well as on intercampus activities. The first is the research collaboration that was sparked between several faculty members at UCLA and UCSB in the areas of water, soil, bacterial and environmental toxicology. This includes newly established collaboration between the laboratories of Dr Arturo Keller, Eric Hoek, Trish Holden, Lutz Maedler (senior person in the laboratory of Dr. Sheldon Friedlander, who passed away) and Dr. Andre Nel. Moreover, new collaborative interactions were also fostered in studying biocompatible and bio-adverse interactions of nanoparticles with mammalian cells. This includes collaborative interactions between the laboratories of Dr. Jeffrey Zink, Fraser Stoddart, Fuyu Tamanoi, Andre Nel, Lutz Maedler and Eric Hoek and has led to important findings regarding material properties that lead to toxicity or how to use those properties to deliver toxic insults to cancer cells. The second area of impact regards the activities of the CNSI on the UCLA campus, where collaboration between faculty members has resulted in competition for modular research space in the newly completed CNSI building. Moreover, the capstone course has also led to new interactions between CNSI and non-CNSI faculty members in establishing lectures, seminars and workshops that integrate physicochemical with biological aspects of nanoscience. We have also mentioned the impact of video conferencing in enhancing toxicology education at UCSB. A third impact is the cooperation between the Nanotoxicology and Molecular Toxicology Programs in areas of education, research and seminars. We are fortunate to have attracted a Ph.D. student, Mike Kovoichich, who will join the Molecular Toxicology program for a thesis in toxicology with a major emphasis on studying nanoparticle toxicity. Finally, as a result of the interactions established in the Nanotoxicology Training program as well as the interactions with the CNSI, UCLA has decided to establish a Division of NanoMedicine in the Department of Medicine. A major goal of the new division will be to educate physicians in the School of Medicine about the foundations and use of nanotechnology.