UNC CHARLOTTE
The University of North Carolina at Charlotte
9201 University City Boulevard
Charlotte, NC 28223-0001

Office of the Chancellor
Telephone: 704/687-2201
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April 28, 2006

Dr. Alan Mabe
Interim Senior Vice President for Academic Affairs
and Vice President for Academic Planning
Office of the President
University of North Carolina
Post Office Box 2688
Chapel Hill, North Carolina 27515-2688

Dear Dr. Mabe:

Enclosed is UNC Charlotte's request for authorization to establish a Ph.D. program in Nanoscale Science.

The proposed Nanoscale Science program emerged from a feasibility study conducted by our Department of Chemistry, College of Arts and Sciences, and Graduate School. The proposed program will build on the UNC Charlotte's strengths in precision metrology, optics, biomedical engineering and biotechnology.

Thank you for your consideration of this request. Provost Joan Lorden or I would be pleased to respond to any questions that you may have regarding this request.

Cordially,

Philip L. Dubois
Chancellor

Enclosure (5 copies of the proposal)

cc: Provost Joan F. Lorden
Dr. Nancy Gutierrez

The University of North Carolina at Charlotte

Ph.D. in
Nanoscale Science

Request for Authorization to Plan

THE UNIVERSITY OF NORTH CAROLINA
Request for Authorization to Establish a New Degree Program

INSTRUCTIONS: Please submit five copies of the proposal to the Senior Vice President for Academic Affairs, UNC Office of the President. Each proposal should include a 2-3 page executive summary. The signature of the Chancellor is required.

Date April 25, 2005

Constituent Institution: The University of North Carolina at Charlotte

CIP Discipline Specialty Title: Business Administration and Management, General

CIP Discipline Specialty Number: 52.0201 Level: B ☐ M ☐ 1st Prof ☐ D ☒

Exact Title of Proposed Program: Ph.D. in Business Administration

Exact Degree Abbreviation (e.g. B.S., B.A., M.A., M.S., Ed.D., Ph.D.): Ph.D.

Does the proposed program constitute a substantive change as defined by SACS? Yes ☐ No ☒

a) Is it at a more advanced level than those previously authorized? Yes ☐ No ☒

b) Is the proposed program in a new discipline division? Yes ☐ No ☒

Proposed date to establish degree program (allow at least 3-6 months for proposal review):

month August *year* 2006

Do you plan to offer the proposed program away from campus *during the first year of operation*?

Yes ☐ No ☒

If so, complete the form to be used to request establishment of a distance learning program and submit it along with this request.

THE UNIVERSITY OF NORTH CAROLINA
Request for Authorization to Establish a New Degree Program

INSTRUCTIONS: Please submit five copies of the proposal to the Senior Vice President for Academic Affairs, UNC Office of the President. Each proposal should include a 2-3 page executive summary. The signature of the Chancellor is required.

Date April 27, 2006

Constituent Institution: The University of North Carolina at Charlotte

CIP Discipline Specialty Title: Physical Sciences, Other

CIP Discipline Specialty Number: 40.9999 Level: B ☐ M ☐ 1st Prof ☐ D ☒

Exact Title of Proposed Program: Nanoscale Science

Exact Degree Abbreviation (e.g. B.S., B.A., M.A., M.S., Ed.D., Ph.D.): Ph.D.

Does the proposed program constitute a substantive change as defined by SACS? Yes ☐ No ☒

a) Is it at a more advanced level than those previously authorized? Yes ☐ No ☒

b) Is the proposed program in a new discipline division? Yes ☐ No ☒

Proposed date to establish degree program (allow at least 3-6 months for proposal review):

month August *year* 2007

Do you plan to offer the proposed program away from campus *during the first year of operation*?

Yes ☐ No ☒

If so, complete the form to be used to request establishment of a distance learning program and submit it along with this request.

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Executive Summary

Nanoscale science is a field of scientific investigation that addresses the development, manipulation, and use of materials and devices on the scale of roughly 1-100 nanometers in length, and the study of phenomena that occur on this size scale. As the highest priority funded science and technology effort since the space race, nanoscale science offers great potential for applications in materials, medicine, optics, electronics, data storage, advanced manufacturing, environment, energy, and national security.

Collaborative, interdisciplinary approaches to research, particularly the integration of chemistry, physics, engineering, and biology, will be required to realize the promises and opportunities of nanoscale science. The proposed Ph.D. in Nanoscale Science will provide students trained in relevant science or engineering disciplines at the undergraduate or master's level with the knowledge breadth and analytical depth required to make advances in this exciting interdisciplinary and quickly advancing field.

As a relatively young but emerging institution, UNC Charlotte is uniquely poised to offer a highly interdisciplinary approach to graduate education in nanoscale science. The program, administered by the Department of Chemistry, will involve five departments (Chemistry, Physics and Optical Science, Mechanical Engineering and Engineering Science, Electrical and Computer Engineering, and Biology), and the Centers for Precision Metrology, Optoelectronics and Optical Communications, Biomedical Engineering Systems, and Bioinformatics. The program is designed to provide students with (1) breadth of knowledge in nanoscale science taught from the perspectives of scientists and engineers who contribute to the field from an array of disciplinary backgrounds; (2) in-depth knowledge of a selected science or engineering discipline (Chemistry, Electrical and Computer Engineering, Mechanical Engineering, Physics and Optical Science, or Biology); and (3) the skills needed to communicate and collaborate effectively with scientists and engineers across a broad range of disciplines. A unique feature of the program is that students will work with and learn from faculty members and researchers from each of the participating disciplines during the entire course of the program through coursework, research, colloquia, and seminars.

The Ph.D. in Nanoscale Science will serve the following purposes:

- It will provide students with knowledge and educational opportunities in pure and applied nanoscale science, culminating in an interdisciplinary, research-based Ph.D. degree in Nanoscale Science.

- It will produce a supply of doctoral-level scientists who will lead in (1) improving our understanding of the nanoscale regime and its many applications; (2) developing nanotechnology industrial initiatives in North Carolina and elsewhere; and (3) providing educational opportunities to train the workforce needed to sustain the growth of nanoscale science in North Carolina and the U.S.

- It will develop and train independent scientists and scholars who possess the critical thinking, methodological, and communication skills required to advance and disseminate knowledge of fundamental and applied nanoscale science.

- It will enhance the educational experience in science and engineering for all graduate and undergraduate students at UNC Charlotte.

Societal need for doctoral programs in nanoscale science is increasing in North Carolina, nationally, and worldwide. The National Science Foundation estimates that nanotechnology will be a $1 trillion global industry by 2015. This will require about 2 million workers in the field of nanoscale science, of which 800,000 – 900,000 will be in the United States. There is a pressing need to train workers who will contribute to this vital area by conducting scientific research, working in industry, and educating students in universities, colleges, community colleges, and elementary and secondary schools. The establishment of a Ph.D. program in Nanoscale Science at UNC Charlotte will help to bring employment opportunities of all levels to the greater Charlotte and surrounding areas, and will provide nanoscale science and nanotechnology training for workers that will be needed throughout North Carolina and elsewhere.

The Ph.D. in Nanoscale Science specifically supports UNC Charlotte's commitment to focus interdisciplinary resources to address a broad area of concern to the Charlotte region, namely Applied Sciences and Technologies. The proposed program will weave continuity between the pursuits of the baccalaureate and master's programs in Chemistry with those of the Ph.D. programs in Optical Science and Engineering, Mechanical Engineering, Electrical Engineering, and Biology, and their associated baccalaureate and master's programs. Graduate students in the Nanoscale Science Ph.D. program will interact with students and faculty members of other Ph.D. programs at UNC Charlotte by enrolling in elective courses offered by these programs, attending and presenting seminars on nanoscale science, and by working together on research projects. Most of the faculty members who will participate in the Nanoscale Science Ph.D. program are also members of the faculty of the Ph.D. programs listed above. Numerous ongoing interdisciplinary collaborations among these faculty members are resulting in externally funded projects and peer reviewed publications. The Ph.D. in Nanoscale Science will enhance these activities by offering courses that will better prepare students to engage in research in nanoscale science, and by providing a more focused forum for scientists at UNC Charlotte to conduct research in nanoscale science.

I. DESCRIPTION OF THE PROGRAM

A. Describe the proposed degree program (i.e., its nature, scope, and intended audience).

Nanoscale science is a field of scientific investigation that addresses the development, manipulation and use of materials and devices on the scale of roughly 1-100 nanometers in length, as well as the study of phenomena that occur at this size scale (one nanometer equals one billionth of a meter). This size range encompasses the smallest man-made and naturally derived devices known. One can gain a perspective of the nanometer scale by considering the sizes of some familiar objects. For example, a sheet of paper is roughly 100,000 nanometers thick, critical dimensions in integrated circuits are less than 10 nanometers, while large polymers and proteins are just a couple of nanometers in size.[1]

The field of nanoscale science was conceptually born out of Richard Feynman's famous 1959 lecture, "There's Plenty of Room at the Bottom."[2] In this presentation Feynman pondered radical notions such as writing an entire set of the Encyclopedia Britannica on the head of a pin through the manipulation of individual atoms. At that time, the tools required to fabricate materials and devices at the atomic/molecular scale and to measure their properties were not available. The advent of scanning probe microscopes and their ability to measure and manipulate matter at the nanoscale, microelectronic and optoelectronic device manufacturing technology, as well as developments in macro-scale molecular modeling and powerful computational capability, are all enabling the ideas of exploiting the benefits of nanoscale manufacturing to be realized. These tools allow scientists to observe objects at the nanoscale, to discover new phenomena at these small dimensions systematically rather than by accident, and to synthesize and manipulate nanoscopic particles by rational design rather than serendipity.

Nanoscale science offers many challenges and opportunities for scientific understanding and potential technological advances.[3] It is predicted that nanoscale science will change the nature of almost every human-made product this century. This field has great potential applications in materials, medicine, electronics, optics, data storage, advanced manufacturing, environment, energy, and national security. Some specific applications include: lightweight new materials with greatly improved strength and wear characteristics; ultradense computer memory; better drug design and better drug and gene delivery; sensing applications for agricultural, biological, chemical and homeland security applications; improved catalysts for the chemical and automotive industries; new materials to improve fuel economy and carbon dioxide emissions; and improved batteries and energy efficient processes for energy technologies. Nanoscale materials already find use in numerous pharmaceutical, catalytic, electronic, magnetic, optoelectronic, biomedical, cosmetic and energy applications. Specific applications reporting the highest revenues include sunscreens, automotive catalyst supports, chemical-mechanical polishing, magnetic recording tapes, biolabeling, electroconductive coatings, and optical fibers. Other applications include dental-bonding agents, protective and glare-reducing coatings for eyeglasses and cars, stain-free clothing and mattresses, paints and coatings to protect against corrosion, scratches and radiation, burn and wound dressings, and automobile catalytic converters.

The challenges and opportunities of nanoscale science cannot be addressed by a single science or engineering discipline alone; the world's realization of the full potential and benefits of nanoscale science will require *collaborative, interdisciplinary* approaches to research. The discipline of chemistry has reached a maturity such that it can design new molecular systems accurately with intent. Chemists typically work from the bottom of the nanometer length scale (less than one nanometer) and build up larger systems with specific properties and utility. Their understanding of bonding and intermolecular interactions is highly detailed, intricate and rich with complexity, but they cannot apply these concepts to molecular systems that extend into the nanometer regime. The disciplines of physics and engineering are well seasoned in their understanding of macroscopic and microscopic behavior, concepts that easily scale down to a regime that is hundreds of nanometers large. Observations of conductivity, magnetism and optical effects are well understood in bulk materials and devices. Upon scaling these systems into the sub-100 nm regime, however, quantum mechanical effects complicate the observed phenomena to the extent that the behavior of materials with nanoscale dimensions differs significantly from the same materials or devices of larger macroscale size. These size effects present challenges to engineers and physicists as they push technology from the top of the useful length scale down to the nanoscale. Although biologists often work on a scale that is significantly larger than a nanometer, an interdisciplinary nanoscale approach will be required to elucidate and replicate the phenomena of numerous cell membrane transport proteins, and vital mechanical responses of protein-protein complexes and other intracellular processes. Nanoscale research is already producing breakthroughs in drug and gene delivery methods that may revolutionize the practice of medicine and health care delivery.

To fully understand and develop efficiently the science and technology of the nanoscale regime, it will be vital to train and educate future scientists and engineers from both the molecular and macroscopic perspectives, and to ensure that they understand Nature's examples of working at the nanoscale. The proposed Ph.D. program will educate students about the field of nanoscale science from the perspectives of scientists and engineers of several disciplines, and will provide students with the skills needed to conduct collaborative research in nanoscale science. Students possessing an undergraduate or master's degree in a relevant science or engineering discipline will develop a broad, integrated perspective of the field of nanoscale science by working with scientists and engineers of several disciplines in classroom and research settings, and they will also develop depth of knowledge in a chosen science or engineering discipline. Graduates of the Ph.D. program in Nanoscale Science will be well-prepared to engage in cutting-edge research and development in academic, national laboratory, or industrial settings. They will possess the expertise needed to train future generations of scientists and educators in the field of nanoscale science.

B. List the education objectives of the program.

The educational objectives of the proposed Ph.D. program in Nanoscale Science are as follows:

- Provide students with knowledge and educational opportunities in pure and applied nanoscale science, culminating in an interdisciplinary, research-based Ph.D. degree in Nanoscale Science.

- Produce a supply of doctoral level scientists who will lead in (1) improving our understanding of the nanoscale regime and its many applications; (2) developing nanotechnology industrial initiatives in North Carolina and elsewhere; and (3) providing educational opportunities to train the workforce needed to sustain the growth of nanoscale science in North Carolina and the U.S.

- Develop and train independent scientists and scholars who possess the critical thinking, methodological, and communication skills required to advance and disseminate knowledge of fundamental and applied nanoscale science.

- Enhance the educational experience in science and engineering for all graduate and undergraduate students at UNC Charlotte.

Based on the combined strengths of faculty members in Chemistry, Physics and Optical Science, Mechanical Engineering and Engineering Science, Electrical and Computer Engineering, and Biology, the proposed program will focus on the following areas of research:

Theoretical Aspects of Nanoscale science

- Development of methods to model, synthesize, characterize, simulate and evaluate complex materials including photonic crystals, photonic devices and other complex materials such as high temperature superconductors and plasmonic devices.

- Modeling and predicting quantum effects that become significant in nanoscale materials, and utilizing these effects to develop new materials and applications (including quantum dots, quantum wires, nanotubes, and photon confined materials).

- Identification, understanding, and utilization of the concepts applicable to the controlled assembly of self-organizing nanomaterials, including polymers, dendrimers, nanotube-based materials, nanocatalysts at surfaces (including electrode surfaces), and assemblies of biopolymers.

Biomolecular Nanotechnology

- Design, fabrication, and optimization of biomaterials and devices for tissue growth and repair.

- Elucidation of structures of complex biomolecules and understanding interactions between biomolecules.

Building Nanoscale Materials

- Development and utilization of nanoscale lithographic processes.
- Synthesis of materials at the nanoscale, including: polymers, dendrimers, supramolecular complexes, quantum dots, quantum wells, carbon nanotubes, molecular material hybrids, high energy / high density compounds, and nanoporous materials.
- Development of synthetic methodology and mechanistic studies relevant to building nanomaterials.
- Fabrication of nanopatterned surfaces and nanostructured metal composites for chemical and biological sensing.

Instrumental Methods for Nanotechnology

- Development of instrumentation and procedures for the machining, manipulation, and replication of materials with nanometer precision.
- Intertwining material development with cutting-edge nanoscale analytical techniques, including surface probe techniques with atomic resolution and novel metrology methods. There is a significant relationship between form and function at the nanoscale. Rapid, high-precision analytical information will stimulate rational material design.

C. Describe the relationship of the program to other programs currently offered at the proposing institution, including the common use of: (1) courses, (2) faculty, (3) facilities, and (4) other resources.

The proposed Ph.D. program in Nanoscale Science will weave continuity between the pursuits of the baccalaureate and master's programs in Chemistry with those of the Ph.D. programs in Optical Science and Engineering, Mechanical Engineering and Engineering Science, Electrical Engineering, and Biology, and their associated baccalaureate and master's programs. Graduate students in the Nanoscale Science Ph.D. program will interact with students and faculty members of other Ph.D. programs at UNC Charlotte by enrolling in elective courses offered by these programs, attending and presenting seminars on nanoscale science, and by working together on research projects. Most of the faculty members who will participate in the Nanoscale Science Ph.D. program are also members of the faculty of the Ph.D. programs listed above. Numerous ongoing interdisciplinary collaborations among these faculty members are already resulting in externally funded projects and peer reviewed publications. The Ph.D. program in Nanoscale Science will enhance these activities by offering courses that will better prepare students to engage in research in nanoscale science, and by providing a more focused forum for scientists at UNC Charlotte to conduct research in nanoscale science.

The study of nanoscale science is an active research area within the Charlotte Research Institute's Center for Precision Metrology and Center for Optoelectronics and Optical

Communications. Current research activities of faculty who will be members of the Ph.D. program in Nanoscale Science are already enhancing the research activities of these centers. Establishment of a Ph.D. in Nanoscale Science will strengthen the activities of the Precision Metrology and Optics centers, as well as those of the Bioinformatics and Bioengineering centers.

Courses. The field of nanoscale science is relevant to virtually all science and engineering disciplines. It is expected that students pursuing graduate degrees in chemistry, physics, optoelectronics, mechanical engineering, electrical engineering, computer science or mathematics will elect to enroll in the interdisciplinary courses of the proposed program. Graduate courses offered in these other disciplines and programs will be available to students in the Nanoscale Science Ph.D. program as required electives. Thus, there will be extensive common use of courses between the Nanoscale Science Ph.D. program and other science, mathematics, and engineering programs at UNC Charlotte.

Faculty. All of the faculty members who plan to be involved in the proposed Ph.D. program in Nanoscale Science are members of the faculty of other master's and/or Ph.D. programs at UNC Charlotte. Many of these individuals are already involved in collaborative, interdisciplinary research with colleagues at UNC Charlotte and other institutions. The faculty members who will participate in the proposed program teach courses at the graduate level, and several have done so in a team-teaching environment. The critical mass of faculty required to launch the new program is already in place. Additional hires and future replacement hires will be targeted to support the Nanoscale Science Ph.D. program.

Facilities and other resources. Existing research and teaching equipment and space housed in the Center for Precision Metrology, the Burson building, Woodward Hall, and the new Optics Center that are used for existing science and engineering graduate programs will also be used for the proposed Nanoscale Science Ph.D. program. No new facilities will be required to launch the proposed program.

II. JUSTIFICATION FOR THE PROGRAM

A. Describe the proposed program as it relates to:

1. The institutional mission and strategic plan

The proposed Ph.D. program in Nanoscale Science is connected specifically to a range of University goals including: (a) to provide services that impact positively the many challenges facing the region, state, and nation; (b) to train graduate students who possess interdisciplinary skills and capacities that can be applied to a variety of situations and professions in an ever-changing world; (c) to increase the number of Ph.D. programs in high demand fields; and (d) to reach doctoral/research-extensive status by the year 2010. Increased demand for graduate-level offerings is intrinsic to these goals and meeting that demand will have multiple benefits for UNC Charlotte, North Carolina, and the region.

The Campus Academic Plan serves as the guiding force for decisions concerning the number and direction of academic programs, the work of faculty and support staffs, and the

allocation of resources. It is designed to capture the most important initiatives and priorities of the constituent units and programs of the University and to place them within the context of a set of overarching goals and values for the campus. Since the *Campus Academic Plan for 1998-2003*, each University initiative is scrutinized in relation to one or more of the seven themes for campus development that serve as guideposts for the creation of new degree programs and curricula at both the undergraduate and graduate levels. These include: 1) Liberal Education**;** 2) Business and Finance; 3) Urban and Regional Development; 4) Children, Families, and Schools; 5) Health Care and Health Policy; 6) International Understanding and Involvement; and 7) **Applied Sciences and Technologies**.

The *2004-2009 Academic Plan of UNC Charlotte* documents UNC Charlotte's interest in the development of a Ph.D. in Nanoscale Science, in support of the theme of Applied Sciences and Technologies:

> "The new degree program is proposed in response to the accelerating growth in nanoscale science and nanotechnology at the University and, indeed, around the world. This interdisciplinary program would be based in the Department of Chemistry. The proposed program will involve the Departments of Mechanical Engineering (Metrology), Electrical and Computer Engineering, Biology, Mathematics and Physics and Optical Science and will build upon existing and future collaborative educational and research efforts with existing graduate and undergraduate programs within these units."

2. Student demand

The growing number of graduate programs in nanoscale science nationwide indicates that demand for the proposed program will be high. Recently, the University of Albany began the world's first college of Nanoscale Science and Engineering and currently offers a Ph.D. in Nanoscale Science and Engineering. Several years ago, the University of Washington established the first Ph.D. program in nanotechnology. Their program is associated with the University's Center for Nanotechnology. Numerous NSF IGERT (Integrative Graduate Education, Research and Training) grants for nanoscale science have been awarded to Ph.D. programs throughout the country.[4] Several institutions, including Duke University, Georgia Tech, the University of Pennsylvania, and Drexel University offer Certificates in Nanotechnology. All of the above programs are growing, indicating that the student demand for graduate programs in Nanoscale Science will continue to increase. Another indicator that the demand for the proposed program will be high is evidenced by the relatively large number of undergraduate and master's students at UNC Charlotte who are engaged in faculty-directed laboratory research in nanoscale science, and the fact that many of these students apply to Ph.D. programs that offer opportunities to conduct research in nanoscale science.

3. Societal need (For graduate, first professional, and baccalaureate professional programs, cite manpower needs in North Carolina and elsewhere.)

There is a growing sense of urgency to scale up nanoscale science research efforts in the United States and worldwide. The establishment of the National Nanotechnology Initiative (NNI) articulates the deep commitment of the U.S. to research and development in nanoscale

science and engineering.[5] The NNI was announced by President Clinton in January, 2000, in a speech at the California Institute of Technology: "Imagine the possibilities: materials with ten times the strength of steel and only a small fraction (of the weight) – shrinking all the information housed in the Library of Congress into a device the size of a sugar cube – detecting cancerous tumors when they are only a few cells in size…Some of our research goals may take more than 20 years to achieve, but that is precisely why there is an important role for federal government."

The NNI "provides a multi-agency framework to ensure U.S. leadership in nanotechnology that will be essential to improved human health, economic well being and national security. The NNI invests in fundamental research for further understanding of nanoscale phenomena and facilitates technology transfer."[5] The goals of the NNI are as follows:

- Maintain a world-class research and development program aimed at realizing the full potential of nanotechnology
- Facilitate transfer of new technologies into products for economic growth, jobs, and other public benefit
- Develop educational resources, a skilled workforce, and the supporting infrastructure and tools to advance nanotechnology
- Support responsible development of nanotechnology

The NNI is one of the few Clinton-era programs strongly backed by the Bush administration. *The 21st Century Nanotechnology Research and Development Act*, signed into law in December, 2003, **makes nanotechnology the highest priority funded science and technology effort since the space race.** Federal investment in nanoscale science R&D increased from $116 million in FY 1997 to a over $1 billion for FY 2005 (nearly a 10-fold increase).[5] President Bush's 2007 budget provides over $1.2 billion for the National Nanotechnology Initiative, nearly tripling the annual investment since the first year of the Initiative and bringing the total investment since the NNI was established in 1991 to over $6.5 billion.

Plans to continue to support research in nanotechnology were articulated in the President's 2006 State of the Union address: "Tonight I announce an American Competitiveness Initiative, to encourage innovation throughout our economy, and to give our nation's children a firm grounding in math and science…First I propose to double the federal commitment to the most critical basic research programs in the physical sciences over the next 10 years. This funding will support the work of America's most creative minds as they explore promising areas such as **nanotechnology**, supercomputing, and alternative energy sources."

The urgency to increase research productivity in nanoscale science extends worldwide. At least 35 countries have initiated major nanoscale science activities at the national level.

Funding for research in nanoscale science and engineering is also prevalent in the industrial sector. A survey of R&D expenditures of U.S. industries in 2002 indicated that 2,418

companies with R&D in the technology areas of biotechnology, materials synthesis, and software development *attributed 50% or more of their R&D expenditures to nanotechnology*.[6] The funding level in industry for R&D in nanoscale science roughly matches that of the federal level.[7]

The National Science Foundation estimates that nanotechnology will be a $1 trillion global industry by 2010-2015.[8] This will require about 2 million workers in the field of nanoscale science and engineering,[8] of which 800,000 – 900,000 will be in the United States.[9] There is a pressing need to train workers who will contribute to this vital area by conducting scientific research, working in industry, and educating students in universities, colleges, community colleges, and elementary and secondary schools. M.C. Roco, Senior Advisor for Nanotechnology at the National Science Foundation, articulates **the great need for education in nanoscale science**:

> "The key goals of nanotechnology are advances in molecular medicine, increased working productivity, extension of the limits of sustainable development and increased human potential. **And yet, one of the "grand challenges" for nanotechnology is education, which is looming as a bottleneck for the development of the field, and particularly for its implementation.**"[9]

In December, 2003, the Chemical Industry Vision2020 Technology Partnership (Vision2020, an industry-led organization focused on accelerating innovation and technological development) issued the report *Chemical Industry R&D Roadmap for Nanomaterials By Design: From Fundamentals to Function*.[10] The report was based on scientific priorities developed at a workshop attended by top leaders in the chemical industry, universities, and government laboratories. The R&D priorities set forth in the report are in direct support of the National Nanotechnology Grand Challenges and are expected to produce products and processes that will significantly benefit the U.S. industry and society. A top priority of the Roadmap is to "implement strategies to attract and prepare a workforce for nanomaterial research and manufacturing."[10] The report states that, "The rapid progress in nanoscale science discovery and its transition into innovative nanotechnology will require a highly trained workforce, **especially innovative scientists and engineers with doctoral degrees**."[10] The report indicates that in order to produce the workers needed to maintain the dominance the U.S. has enjoyed during the past 50 years, it will be necessary for the United States to "implement an education and training strategy as soon as possible. **Moreover, because the nanoscale bridges various disciplines, science education will need to integrate biology, chemistry, physics, and engineering."**[10]

The report identified several **needs** that will be **critical** in order for the nation to attract and prepare a workforce for nanomaterial research and manufacturing. **These needs include, among others, providing interdisciplinary education for graduate students, and developing state-of-the art nanomaterial curricula.** The report also predicts that nanoscale science will develop into a full-fledged field by 2020, that undergraduate and graduate-level textbooks will include nanoscale fundamentals, and that specialized courses will be offered on most campuses. Faculty members with knowledge of nanoscale science will be needed to teach students and to develop educational materials.

Small Times, a business magazine that details technological advances, applications and investment opportunities in nanotechnology, reports that labor shortages of skilled workers in nanotechnology in industry, particularly at the Ph.D. level, are already beginning to show up. Start-up companies in particular seem to be "unaware of how few really experienced educated people there are in the various fields surrounding MEMS and nanotechnology."[11]

The establishment of a Ph.D. program in Nanoscale Science at UNC Charlotte could stimulate the development of additional start-up companies in the Charlotte and surrounding regions. Companies will be attracted to the region because of the research expertise the University will provide. In turn, the companies will provide employment opportunities for graduates of the program and less skilled workers. There are roughly 1,100 start-up companies in nanoscale science in the United States.

The emergence of several websites devoted to employment opportunities in nanoscale science also indicates that there is, and will continue to be, a demand for graduates of the proposed new degree program. *Small Times* lists open positions in nanoscale science. *Working in Nanotechnology* (http://www.workingin-nanotechnology.com/) is a Web-based bulletin board that provides information on careers, education and professional training in nanotechnology and related fields. The site typically has about 70 jobs posted, ranging from the academic marketplace to corporate and government labs. The Foresight Institute, a non-profit organization for promoting understanding of nanotechnology and its effects, supports this website. The National Nanotechnology Initiative website has a page devoted to nanotechnology careers (http://www.nano.gov/html/edu/careers.htm).

In addition to acquiring knowledge and skills to work in nanoscale science, students of the proposed Ph.D. program will acquire depth of knowledge in a core science or engineering discipline, positioning them for employment opportunities in more traditional science and engineering fields. For example, a student in the proposed program who chooses to study chemistry as a core discipline will have ample opportunities for employment as a chemist in chemical industry, academics, or government labs. Graduates of our program will have the added advantage of having the skills and experience of working with scientists and engineers from a range of disciplines. These skills are highly valued in industry (where much of the work is done in teams composed of scientists from an array of disciplines) and other research settings.

Nanoscale Science will be vital to the economic development of North Carolina. The North Carolina Economic Development Board's 2004 strategic plan charged the NC Board of Science and Technology with coordinating an emerging technologies initiative in the following action item:

> "Implement an initiative to promote economic growth in North Carolina through the identification and development of emerging technologies. For example, nanotechnology-the science of the very small-will fundamentally transform science, technology, and society, from microscopic computer chips to cancer-fighting vaccines. As such, it holds tremendous potential for North Carolina and the nation. Nanotechnology will be the basis of manufacturing technology in the future. Developing a coordinated response to the challenges and opportunities presented by emerging technologies will greatly expand the opportunity for all

> North Carolinians to obtain and retain challenging and economically rewarding employment. An initiative to coordinate efforts within the state will link its strengths to grow new industries, educate our workforce, capture federal funding, and maintain North Carolina's technology leadership while revitalizing its traditional industries around these new technologies."[12]

In response to this call, the NC Board of Science and Technology established the North Carolina Nanotechnology Initiative Planning Committee to make recommendations on how to increase North Carolina's stature in the nanotechnology arena. Dr. Bernadette Donovan-Merkert (Chair, Chemistry Department) serves as a member of the planning committee. The committee's report is expected to be published in late Spring 2006. Dr. Kenneth Gonsalves (Celanese Acetate Distinguished Professor, Chemistry) is working to involve UNC Charlotte in state-wide efforts in bio-nanotechnology. Currently, North Carolina ranks about 20th in nanotechnology in the nation. The establishment of a Ph.D. program in Nanoscale Science at UNC Charlotte will help to bring employment opportunities of all levels to the greater Charlotte and surrounding areas, and will provide nanoscale science and nanotechnology training for workers that will be needed throughout North Carolina.

A preliminary report by the Pappas Consulting Group indicated that UNC institutions do not presently have as many programs in nanotechnology available as do other states, such as New York, Texas and California. The establishment of the proposed Ph.D. program will help to keep North Carolina residents who seek graduate education in nanoscale science from leaving the state to pursue such opportunities. The proposed program will also attract out-of-state students to North Carolina; at least some graduates from out-of-state will undoubtedly choose to relocate to North Carolina permanently and will help to build our economy.

4. <u>Impact on existing undergraduate and/or graduate academic programs of your institution</u>. (e.g., Will the proposed program strengthen other programs? Will it stretch existing resources? How many of your programs at this level currently fail to meet Board of Governors' productivity criteria? Is there a danger of proliferation of low-productivity degree programs at the institution?)

The proposed program will impact undergraduate students and programs in positive ways. The Ph.D. program will bring increased opportunities for undergraduate students to participate in faculty/graduate student research teams. These activities not only provide excellent learning opportunities, but they increase personal contact with faculty members (which promotes student retention) and improves the academic credentials of undergraduate students interested in applying to graduate programs or seeking employment in technical fields. The proposed Ph.D. program in Nanoscale Science can serve as a potential graduate school outlet for students at UNC Charlotte pursuing majors and concentrations in relevant fields (for example, biology, chemistry, electrical engineering, mechanical engineering, or physics). Doctoral students will be positioned to provide mentoring to undergraduate students, helping to weave the continuity of undergraduate student → master's student → doctoral student → postdoctoral associate → professor.

Master's level students in the participating and other departments will have additional course and research opportunities as a result of the proposed program. Senior doctoral students

will be positioned to provide additional mentoring, teaching, and advising experiences to master's level students. Doctoral students in other programs will have the benefit of interacting and working with students in the proposed program, thereby enhancing their education experiences.

B. Discuss potential program duplication and program competitiveness

1. Identify similar programs offered elsewhere in North Carolina. Indicate the location and distance from the proposing institution. Include a) public and b) private institutions of higher education.

There are no other public or private institutions in North Carolina that offer a Ph.D. in Nanoscale Science. Duke University offers a Certificate in Nanotechnology.

2. Indicate how the proposed new degree program differs from other programs like it in the University. If the program duplicates other UNC programs, explain a) why is it necessary or justified and b) why demand (if limited) might not be met through a collaborative arrangement (perhaps using distance education). If the program is a first professional or doctoral degree, compare it with other similar programs in public and private universities in North Carolina, in the region, and in the nation.

There are no other programs at UNC Charlotte or within North Carolina that are similar to the proposed program.

C. Enrollment (baccalaureate programs should include only upper division majors, juniors, and seniors).

Headcount enrollment

Show a five-year history of enrollments and degrees awarded in similar programs offered at other UNC institutions (using the format below for each institution with a similar program); indicate which of these institutions you consulted regarding their experience with student demand and (in the case of professional programs) job placement. Indicate how their experiences influenced your enrollment projections.

There are no other institutions in North Carolina that offer a Ph.D. in Nanoscale Science.

Use the format in the chart below to project your enrollment in the proposed program for four years and explain the basis for the projections:

	Year 1 (2007-08)	Year 2 (2008-09)	Year 3 (2009-10)	Year 4 (2010-11)
Full-time	6	12	18	24
Part-time	0	0	0	0
TOTALS	**6**	**12**	**18**	**24**

Please indicate the anticipated steady-state headcount enrollment after four years:

Full-time 24 Part-time 0 Total 24

SCH production (upper division program majors, juniors and seniors *only*, for baccalaureate programs). Use the format in the chart below to project the SCH production for four years. Explain how projections were derived from enrollment projections (see UNC website for a list of disciplines comprising each of the four categories).

Year 1: 2007-08	**Student Credit Hours (SCH)**		
Program Category	**UG**	**Master's**	**Doctoral**
Category I			
Category II			
Category III			114
Category IV			

Year 2: 2008-09	**Student Credit Hours (SCH)**		
Program Category	**UG**	**Master's**	**Doctoral**
Category I			
Category II			
Category III			222
Category IV			

Year 3: 2009-10	**Student Credit Hours (SCH)**		
Program Category	**UG**	**Master's**	**Doctoral**
Category I			
Category II			
Category III			330
Category IV			

Year 4: 2010-11	**Student Credit Hours (SCH)**		
Program Category	**UG**	**Master's**	**Doctoral**
Category I			
Category II			
Category III			438
Category IV			

III. Program Requirements and Curriculum

A. Program Planning

1. List the names of institutions with similar offerings regarded as high quality programs by the developers of the proposed program.

University of Albany
University of Washington

2. List other institutions visited or consulted in developing this proposal. Also list any consultants' reports, committee findings, and simulations (cost, enrollment shift, induced course load matrix, etc.) generated in planning the proposed program.

University of Albany, University of Washington, Clemson University, Duke University, Penn State University, UNC Chapel Hill, NC State University, Georgia Tech, University of South Carolina, University of Pennsylvania.

B. Admission. List the following:

1. Admissions requirements for proposed program (indicate minimum requirements and general requirements).

- GRE, including analytical written section
- Completion of an undergraduate degree in a relevant science or engineering discipline
- Minimum undergraduate grade point average of 3.0

2. Documents to be submitted for admission (listing or sample).

- Graduate application
- Official transcripts of all academic work attempted after high school, including evidence of the completion of a bachelor's degree
- Official report of the score on the GRE
- A one to two page personal statement that discusses the candidate's interest in the program and objectives for pursuing the degree
- A current resume or curriculum vita
- International students (whose native language is not English) must submit official test scores on the Test of English as a Foreign Language (TOEFL) of at least 220 on the computer-based test, 83 on the internet-based test, or 557 on the written test
- Three letters of recommendation from individuals that support the applicant's potential to do graduate work

C. Degree requirements. List the following:

1. Total hours required.

72 hours (post baccalaureate) will be required.

2. Proportion of courses open only to graduate students to be required in program (graduate programs only).

Beyond the 30 hours that students with a master's degree can transfer into the program, all coursework that will count toward the Ph.D. will be at the 6000 level or above and unavailable to undergraduate students. The majority of the coursework will be at the 8000 level.

3. Grades required.

Graduate students must have a GPA of 3.2 or higher to graduate from the program. Two grades of *C* or one grade of *U* will result in termination from the program.

4. Amount of transfer credit accepted.

Students who have taken graduate coursework but have not earned a graduate degree may transfer up to six semester hours of coursework. Students who have earned a master's degree may transfer up to 30 semester hours.

5. Other requirements (e.g. residence, comprehensive exams, thesis, dissertation, clinical or field experience, second major, etc.)

- **General Science Proficiency Exam (GSPE).** The purpose of the GSPE is to ensure that students possess a *working knowledge* of material needed to master concepts in nanoscale science. The exam will cover introductory material in chemistry, physics and mathematics (including calculus). The web page for the Ph.D. in Nanoscale Science will contain detailed information about the exam, including a list of topics to be covered and sample questions so that students will know what to study to prepare for the exam. The exam will be administered three times per year, in August, January and May. Students are expected to take the GSPE each time it is offered until they pass it. Each student will discuss his/her performance on the GSPE with the Program Director regardless of whether he/she passes the exam. The student will be advised by the Program Director about any material he/she should study in greater detail and which faculty member the student should consult if he/she requires assistance in learning specific material. Students who do not pass the GSPE by the end of their first year enrolled in the program will be terminated from the program.

- **Cumulative exams.** Students must pass six exams (four if done during the first year) covering announced topics in nanoscale science. The exams require knowledge of basic principles of nanoscale science and current literature and will be administered monthly. Each student is expected to take the cumulative exam

each time it is offered until he/she passes the required number of exams. There is no time limit on when the required number of exams must be passed.

- **Directed graduate research.** Students conduct laboratory research for the thesis. Laboratory research is expected to begin by the first summer in residency.

- **Admission to candidacy.** Admission to candidacy consists of satisfactory completion of the following:
  - **NANO 8201 Research Group Rotations**
  - **NANO 8202 Interdisciplinary Team Project**
  - **NANO 8203 Collaborative Research Proposal**
  - **Qualifying Exam.** Prior to the sixth semester in the program, each student delivers and defends an oral presentation that addresses research completed or in progress, plus proposed research for completion of the dissertation. The presentation/defense is delivered to the student's dissertation committee. The student is questioned by the committee about his/her research, plus material from any relevant graduate level courses the student has completed. Students who fail the exam on the first attempt will be provided a second opportunity to pass it, and will be advised by the committee on how to better prepare for the second attempt. Students who do not pass on the second attempt will be offered the option of obtaining a master's degree in an appropriate discipline (depending on what electives the student has taken) but will not be allowed to continue on to the Ph.D. Under normal circumstances, students will be expected to make their first attempt at passing the qualifying exam prior to their sixth semester in residence.

- **Dissertation.** Each student completes a written research dissertation, delivers a public seminar on the research, and defends the dissertation to his/her dissertation committee.

6. Language and/or research requirements.

There are no language requirements for the Nanoscale Science Ph.D. degree. Students will each take a minimum of 24 credit hours of research.

7. Any time limits for completion.

We anticipate that most full-time students will complete the degree within 4-5 years. Students must complete all degree requirements, including dissertation, within eight years.

D. List existing courses by title and number and indicate (*) those that are required. Include an explanation of numbering system. List (under a heading marked "new") and describe new courses proposed.

All courses required for the Ph.D. in Nanoscale Science will be offered at the 8000 level because doctoral-level courses at UNC Charlotte are numbered at the 8000 level. Courses designed specifically for the Nanoscale Science Ph.D. program are designated with the prefix "NANO." A timetable for completion of courses is provided on page 26.

New courses: All students enrolled in the Nanoscale Science Ph.D. program will be required to complete the courses listed below (credit hours in parentheses). Courses designed specifically for the Nanoscale Science Ph.D. program are designated with the prefix "NANO." The course "ENGR 8104 Fabrication of Nanomaterials" is also designed specifically for the Nanoscale Science Ph.D. program. The prefix "ENGR" indicates that the course will be taught predominantly by faculty in the College of Engineering.

*NANO 8001 Perspectives at the Nanoscale (2)
*NANO 8101 Introduction to Instrumentation and Processing at the Nanoscale (3)
*NANO 8102 Nanoscale Phenomena (3)
*NANO 8201 Research Group Rotations (1)
*NANO 8681 Nanoscale Science Seminar (1)
*NANO 8103 Synthesis and Characterization of Nanomaterials (3)
*NANO 8202 Interdisciplinary Team Project (2)
*NANO 8682 Nanoscale Science Colloquium (1)
*ENGR 8104 Fabrication of Nanomaterials (3)
*NANO 8203 Collaborative Research Proposal (3)
*NANO 8900 Dissertation Research (1-4 credit hours)

Descriptions of New Courses (credit hours in parentheses)

NANO 8001 Perspectives at the Nanoscale (2)
Faculty members from across the UNC Charlotte campus present and discuss their research in nanoscale science to: (1) demonstrate how scientists from different disciplines approach problem-solving at the nanoscale, and (2) expose students to research opportunities for dissertation work. Students write a one-page summary of each presentation that is graded by the course instructor.

NANO 8101 Introduction to Instrumentation and Processing at the Nanoscale (3)
Methods for manipulating, engineering, and characterizing nanoscale materials are introduced; applications and principles of their operation are discussed. Students acquire hands-on experience with selected laboratory methods in preparation for dissertation research. Topics include, but are not limited to, scanning probe and electron microscopy methods, cleanroom technology, nanoscale optical and e-beam lithography, nuclear magnetic resonance, mass spectrometry, luminescence methods, interferometry, gel permeation chromatography, surface area analysis, and small-angle x-ray and neutron scattering.

NANO 8102 Nanoscale Phenomena (3)
Topics include, but are not limited to, scaling phenomena; nano-optics (near-field optics, limits of lithography masks, nano-dots and nanoscale optical interactions); nanoscale mechanics; nanotribology; biological and biologically-inspired machines.

NANO 8103 Synthesis and Characterization of Nanomaterials (3)
Topics include, but are not limited to, quantum dots, metallic nanoparticles, carbon nanostructured materials and nanotubes, zeolites, organic-inorganic polymers, composite materials, solution-phase colloids, sol-gel process, silica spheres, porous silicon, photonic crystals. Prerequisites: NANO 8101 and NANO 8102.

ENGR 8104 Fabrication of Nanomaterials (3)
Lithographic methods (CVD, PVD, e-beam, ion beam, magnetron, evaporation, spin coating, mask fabrication, developing resists); microelectromechanical systems and nanoelectromechanical systems; limits of conventional mechanical processing, electroforming, growth mechanisms (organic, inorganic, thermal); powders. Prerequisite: NANO 8101.

NANO 8201 Research Group Rotations (1)
Students interact on a regular basis with selected research groups in nanoscale science from at least three different departments at UNC Charlotte. Specific activities range from meeting with the group's professor and/or other group members, attending group meetings, and observing laboratory experiments and procedures. Research groups are chosen so that each student is exposed to an array of research activities of the Nanoscale Science faculty. At the end of each rotation, the visiting student delivers a presentation to the visited research group, describing what the student learned about the visited group's research activities.

NANO 8202 Interdisciplinary Team Project (2)
An encapsulated, semester-long research experience designed to introduce students to laboratory work in nanoscale science. Teams of 2-4 students, preferably from different disciplinary backgrounds, work on a short research project and present their results at the *Nanoscale Science Colloquium* (described below).

NANO 8203 Collaborative Research Proposal (3)
Effective strategies for designing and writing research proposals are presented by program faculty and staff from proposal development offices on campus. Students enrolled in the course work in teams of 2-3 to prepare an original, interdisciplinary research proposal on a topic in nanoscale science. The proposal conforms to regulations of a selected funding agency and must address a topic that is supported by that agency. Each team consults regularly with a panel of 2-3 faculty members who collectively approve the proposal topic, provide feedback during the development of the proposal, and ultimately evaluate the proposal. The course is designed to increase the ability of students to relate research ideas to fundamental concepts in science and engineering, to help students learn to develop effective methods of presenting ideas and defending them, to help students develop self confidence in their abilities to present and defend ideas, and to improve oral and written communication skills.

NANO 8681 Nanoscale Science Seminar (1)
Students attend weekly seminars of visiting speakers of the Nanoscale Science program or other approved programs on campus. Seminars are selected to best meet the educational needs of the individual student. Students write 1-page summaries of seminars attended. (May be repeated for credit.)

NANO 8682 Nanoscale Science Colloquium (1)
Students present seminars on current topics in nanoscale science to the faculty and student participants of the program. Presentations address dissertation research, the current literature, group projects, and special topics. The colloquium provides an opportunity for students to discuss topics in Nanoscale Science with faculty from all of the participating disciplines. (May be repeated for credit)

NANO 8900 Dissertation Research (1-4)
Research for the dissertation. (May be repeated for credit).

Existing Courses: In order to develop depth of knowledge in a specific discipline, students enrolled in the Nanoscale Science Ph.D. program will be required to complete a minimum of nine credit hours of elective courses in a chosen discipline. Some of the disciplinary courses will cover material solely or partly based on nanoscale science, while others will provide an excellent background for students studying like phenomena at nanometer scales.

As indicated by the list below, students will have the opportunity to choose from an extensive variety of graduate courses already offered at UNC Charlotte. Courses denoted with the prefix BIOL, ECGR, MEGR, or OPTI are from existing Ph.D. programs in Biology, Electrical Engineering, Mechanical Engineering, or Optical Science and Engineering. Courses with the prefix CHEM are taught by faculty in the Department of Chemistry (the Chemistry Department offers a Master of Science degree) and are in place to support the Ph.D. programs in Biology, Electrical Engineering, Mechanical Engineering, and Optical Science and Engineering. The 6000 level CHEM courses will also be offered at the 8000 level to accommodate the needs of students in the Nanoscale Science Ph.D. program; additional 8000 level courses in chemistry and other disciplines will be developed as needed. The list below contains over 100 courses; credit hours are indicated in parentheses.

BIOL 8000 Special Topics in Biology (1-4)
BIOL 8010 Special Topics in Microbiology (1-4)
BIOL 8030 Special Topics in Genetics (1-4)
BIOL 8040 Special Topics in Molecular Biology (1-4)
BIOL 8050 Special Topics in Physiology (1-4)
BIOL 8102 Cell and Molecular Biology (4)
BIOL 8103 Microbiology and Immunology (4)
BIOL 8104 Integrative Systems Biology (4)
CHEM 6060 Special Topics and Investigations (1-3)
CHEM 6069 Topics in Biochemistry (3)
CHEM 6082 Surfaces and Interfaces of Materials (3)
CHEM 8101 Biochemical Principles (3)

CHEM 6115 Advanced Analytical Chemistry (3)
CHEM 6125 Theoretical Inorganic Chemistry (3)
CHEM 6126 Organometallic Chemistry (3)
CHEM 6135 Advanced Organic Chemistry (3)
CHEM 6138 Stereochemistry (3)
CHEM 6145 Chemical Thermodynamics (3)
CHEM 6146 Rates and Mechanisms (3)
CHEM 8147 Molecular Photochemistry and Photophysics (3)
CHEM 8155 Polymer Synthesis (3)
CHEM 8165 Advanced Biochemistry (3)
ECGR 8021 Advanced Topics in EM Applications (3)
ECGR 8101 Advanced Computer Graphics (3)
ECGR 8102 Optimization of Engineering Design (3)
ECGR 8111 Systems Theory (3)
ECGR 8112 Digital Control Systems (3)
ECGR 8114 Digital Signal Processing II (3)
ECGR 8115 Optimal Control Theory I (3)
ECGR 8116 Optimal Control Theory II (3)
ECGR 8117 Applied Artificial Intelligence
ECGR 8118 Applied Digital Image Processing
ECGR 8121 Advanced Theory of Communications I (3)
ECGR 8122 Advanced Theory of Communications II (3)
ECGR 8125 Advanced Topics in Optical Engineering (3)
ECGR 8127 Medical Ultrasonics (3)
ECGR 8131 Hybrid Microelectronics (3)
ECGR 8132 Advanced Semiconductor Device Physics (3)
ECGR 8133 MOS Physics and Technology (3)
ECGR 8138 Physical Design of VSLI Systems (3)
ECGR 8141 Power System Relaying (3)
ECGR 8142 Voltage Transients and Surge Protection (3)
ECGR 8143 Power System Control (3)
ECGR 8146 Advanced VHDL (3)
ECGR 8151 Advanced Microelectronics Projects (3)
ECGR 8156 Application Specific Integrated Circuit Design (3)
ECGR 8171 Simulation of Electronic Materials (3)
ECGR 8183 Multiprocessor System Design (3)
ECGR 8184 Computer System Engineering (3)
ECGR 8185 Advanced Microprocessor-Based Design (3)
ECGR 8186 Design for Testability (3)
ECGR 8187 Modeling and Analysis of Communication Networks (3)
ECGR 8261 Advanced Topics in Laser Electronics (3)
MEGR 8090 Special Topics (1-6)
MEGR 8101 Transport Processes (3)
MEGR 8102 Intro to Continua (3)
MEGR 8108 Finite Element Analysis and Applications (3)
MEGR 8110 Advanced Conductive Heat Transfer (3)

MEGR 8111 Advanced Engineering Thermodynamics (3)
MEGR 8112 Radiative Heat Transfer (3)
MEGR 8113 Dynamics and Thermodynamics of Compressive Flow (3)
MEGR 8114 Advanced Fluid Mechanics (3)
MEGR 8115 Convective Heat Transfer (3)
MEGR 8116 Fundamentals of Heat Transfer in Fluid Flow (3)
MEGR 8118 Thermal Environmental Engineering (3)
MEGR 8119 Thermal Applications in Biomedical Engineering (3)
MEGR 8120 Bearing Design and Lubrication (3)
MEGR 8121 Mechanism Analysis (3)
MEGR 8122 Mechanism Synthesis (3)
MEGR 8123 Mechanism Design (3)
MEGR 8124 Introduction to Automatic Controls (3)
MEGR 8125 Vibrations of Continuous Systems (3)
MEGR 8126 Dynamics of Machinery (3)
MEGR 8127 Computer-aided Manufacturing (3)
MEGR 8128 Control of Robotic Manipulators (3)
MEGR 8129 Structural Dynamics Production (3)
MEGR 8141 Theory of Elasticity I (3)
MEGR 8142 Theory of Elasticity II (3)
MEGR 8143 Inelastic Behavior of Materials (3)
MEGR 8145 Advances Topics in Dynamics (3)
MEGR 8146 Experimental Stress Analysis (3)
MEGR 8161 Atomic Processes in Solids (3)
MEGR 8164 Diffraction/Spectroscopic Studies of Matter (3)
MEGR 8165 Diffraction and NDE Methods in Materials Science (3)
MEGR 8166 Mechanical Behavior of Materials I (3)
MEGR 8167 Mechanical Behavior of Materials II (3)
MEGR 8168 Deformation and Fracture of Materials
MEGR 8172 Computational Methods in Engineering
MEGR 8182 Machine Tool Metrology (3)
MEGR 8183 Design of Precision Machines and Instrument I (3)
MEGR 8184 Design of Precision Machines and Instrument II (3)
MEGR 8281 Theory and Application of Computer-Aided Tolerancing (3)
MEGR 8282 Computer-Aided Process Planning (3)
MEGR 8283 Advanced Coordinate Metrology
MEGR 8284 Advanced Surface Metrology (3)
MEGR 8380 Tribology (3)
MEGR 8480 Advanced Manufacturing Processes and Equipment (3)
MEGR 8893 Advanced Topics in Precision Engineering (3)
OPTI 8000 Selected Topics in Optics (3)
OPTI 8101 Mathematical Methods in Optical Science and Engineering (3)
OPTI 8102 Principles of Geometrical and Physical Optics (3)
OPTI 8103 Light Sources and Detectors (3)
OPTI 8104 Electromagnetic Waves (3)
OPTI 8105 Optical Properties of Materials (3)

OPTI 8201 Fourier Optics and Holography (3)
OPTI 8205 Advanced Optical Materials (3)
OPTI 8211 Introduction to Modern Optics (3)
OPTI 8212 Integrated Photonics (3)
OPTI 8221 Optical Communications (3)
OPTI 8222 Optical Communication Networks (3)
OPTI 8241 Optical System Function and Design (3)
OPTI 8242 Optical Propagation in Inhomogeneous Media (3)
OPTI 8244 High Speed Photonics and Optical Instrumentation (3)
OPTI 8261 Modern Coherence Theory (3)
OPTI 8271 Advanced Physical Optics (3)

Interdisciplinary Ph.D. Program in Nanoscale Science
Timetable for Completion of Courses

Year 1

First Semester

NANO 8001	Perspectives in Nanoscale Science	2 credits
NANO 8101	Introduction to Instrumentation and Processing at the Nanoscale	3 credits
NANO 8102	Nanoscale Phenomena	3 credits
NANO 8201	Research Group Rotations	1 credit
NANO 8681	Nanoscale Science Seminar	1 credit

Second Semester

NANO 8103	Synthesis and Characterization of Nanomaterials	3 credits
DEPT 8XXX	Elective Ph.D. course	3 credits
NANO 8202	Interdisciplinary Team Project	2 credits
NANO 8682	Nanoscale Science Colloquium	1 credit
NANO 8681	Nanoscale Science Seminar	1 credit

(General science proficiency exam passed before Year 2)

Year 2

First Semester

ENGR 8104	Fabrication of Nanomaterials	3 credits
DEPT 8XXX	Elective Ph.D. course	3 credits
NANO 8682	Nanoscale Science Colloquium	1 credit
NANO 8681	Nanoscale Science Seminar	1 credit
NANO 8900	Dissertation Research	1 credit

Second Semester

DEPT 8XXX	Elective Ph.D. course	3 credits
NANO 8682	Nanoscale Science Colloquium	1 credit
NANO 8681	Nanoscale Science Seminar	1 credit
NANO 8203	Collaborative Research Proposal	3 credits
NANO 8900	Dissertation Research	1 credit

Years 3-4

(Admission to Candidacy requirements completed prior to sixth semester)

NANO 8682	Nanoscale Science Colloquium	1 credit/semester
NANO 8681	Nanoscale Science Seminar	1 credit/semester
NANO 8900	Dissertation Research	7 credits/semester

IV. FACULTY

A. List the names of persons on the faculty who will be directly involved in the proposed program. Provide complete information on each faculty member's education, teaching experience, research experience, publications, and experience in directing student research, including the number of theses and dissertations directed for graduate programs. The official roster forms approved by SACS can be submitted rather than actual faculty vita.

Approximately 40 faculty members from five departments have been identified as qualified and interested in serving as faculty for the proposed program. Many of these are junior faculty members, reflecting UNC Charlotte's interest in supporting nanoscale science activities in the future. In recent years, all of the participating departments have hired faculty with research interests and expertise in nanoscale science or engineering.

The faculty members affiliated with the proposed program have obtained substantial external funding in support of their research from agencies such as the National Science Foundation, the National Institutes of Health, the Department of Defense, the Department of Energy, the National Institute of Standards and Technology, NASA, the American Chemical Society-Petroleum Research Foundation, Intel, SEMATECH, the Whitaker Foundation, the Camille and Henry Dreyfus Foundation, and Research Corporation. Sustaining external funding will be a high priority for the program, thus faculty members of the program will continue activities to secure external research grants and contracts from federal agencies, industries, and other sources.

Nanoscale Science is a high priority funding area for the National Science Foundation, which has established several initiatives devoted to this area. UNC Charlotte faculty members receive competitive federal funding specifically targeted for research in nanoscale science and engineering. For example, Drs. Robert Hocken (Norvin K. Dickerson, Jr. Distinguished Professor of Precision Engineering) and Stuart Smith (Professor of Mechanical Engineering and Engineering Science) have been granted prestigious NSF-NIRT (Nanoscale Integrative Research Team) awards, totaling over $2 million, in collaboration with colleagues from the Massachusetts Institute of Technology. Drs. Jordan Poler (Chemistry) and Thomas DuBois (Charles H. Stone Professor, Chemistry) recently received an NSR NER (Nanoscale Exploratory Research) grant.

UNC Charlotte's Center for Precision Metrology (CPM) is a national leader in nanoscale metrology. Directed by Dr. Robert Hocken, the CPM is associated with many industry and government affiliates, including Boeing Corporation, BWXT Y-12, Caterpillar Corporation, Corning Tropel Corp., Intel Corporation, Lawrence Livermore National Laboratory, Mitutoyo America Corp., The Timken Company, the National Institute of Science and Technology, and Veeco Instruments, Inc. The CPM is a member of SINAM (Center for Scalable and Integrated Nano Manufacturing), an NSF Nanoscale Science and Engineering Center. The goal of SINAM is to establish a new manufacturing paradigm that integrates an array of new nano-manufacturing technologies. The members of SINAM include UCLA, UC Berkeley, Stanford University, UC San Diego, UNC Charlotte, and Hewlett Packard Labs.

High-tech, small businesses in the Charlotte area have emerged from the instrument development group of CPM. Albany Instruments, Inc. (for the development of high sensitivity GMR probes) and Insitutec (for manufacturing nano-positioning and probing systems) were co-founded by Dr. Stuart Smith. These companies are actively involved in nanoscale process development for industrial applications.

The Center for Optoelectronics and Optical Communications, directed by Dr. Michael Fiddy, has a number of faculty members with research interests in nanoscale science and houses numerous tools that can support advanced nanofabrication, including an electron beam lithography tool, a nanoimprint tool, and several etching systems.

Small Business Innovation Research (SBIR) programs have been executed through collaboration with Dot Metrics Technologies to develop nanoscale-active layers for light-emitting devices. Dr. Ed Stokes (Electrical and Computer Engineering) is Principal Investigator on a Phase 2 DARPA SBIR for green light emitting diodes, and Dr. Tom Schmedake (Chemistry) is Principal Investigator on a Phase 1 SBIR for the synthesis of novel quantum dots.

In October, 2005 UNC Charlotte hosted its first conference on nanotechnology (Nanoscale Science and Engineering Conference: Convergence of the Top-down and Bottom-up Approaches). Organized by Dr. Kenneth Gonsalves (Chemistry) and co-organized by Dr. Thomas Schmedake (Chemistry), the conference was attended by more than 250 researchers, policy makers, and students from North Carolina, South Carolina, Virginia, Tennessee and Georgia. The conference focused on national initiatives in nanotechnology, novel materials and theory, nanotechnology in medicine, and metrology and instrumentation for nanoscale science, and featured an impressive group of speakers, as listed in Appendix H.

Several special topics graduate level courses in nanoscale science and engineering have already been taught by faculty members at UNC Charlotte. For several years, Dr. Stuart Smith (Mechanical Engineering) has taught MEGR 8893 Advanced Topics: Mechanical Systems for Nanotechnology. Dr. Kenneth Gonsalves (Chemistry) coordinated an interdisciplinary course in nanotechnology in Spring 2004. The course featured weekly lectures delivered by faculty from the UNC Charlotte campus (Ken Gonsalves, Mahnaz El-Kouedi, Joanna Krueger, Jordan Poler and Thomas Schmedake from Chemistry; Mohamed-Ali Hasan from Electrical and Computer Engineering; and Vasily Astratov and Tsinghua Her from Physics and Optical Science) and from other institutions (Oak Ridge National Laboratory, Vanderbilt University, Georgia Tech). Dr. Gonsalves is currently teaching another special topics course on nanoscale science and nanotechnology.

A listing of individuals willing to serve as program faculty is provided below. Faculty curriculum vitae can be found in Appendix D.

Dr. Vasily N. Astratov (Physics and Optical Science). The Astratov group focuses on all-opticalcircuits based on evanescent optical coupling between spherical and cylindrical microresonatorspositioned with nanometer scale precision on a single chip.

Dr. Kenneth Bost (Belk Distinguished Professor, Biology). The Bost group works in the area of immunology. Specific research efforts relevant to nanoscale science include biomodification of nanostructured surfaces for tissue engineering.

Dr. Robin Coger (Mechanical Engineering and Engineering Science, Director of the Center for Biomedical Engineering Systems). Dr. Coger's research focuses on applying device design, computational modeling, and material testing to solve biomedical engineering problems in tissue engineering and cryopreservation. Areas of interest related to nanotechnology include investigating the interactions of cells with micropatterned surfaces, and the use of nanoparticles in tissue engineering applications.

Dr. Brian T. Cooper (Chemistry). The Cooper group is investigating a novel capillary electrophoretic technique, based on differential surfactant binding, for characterizing conformational isoforms of proteins. The group is also interested in the potential application of microfabricated devices with nanoscale features to new modes of protein separation or detection.

Dr. James Cuttino (Mechanical Engineering and Engineering Science). Dr. Cuttino has been involved in the development of precision actuators and instrumentation. His research has spanned the range of precision fast tool servos to the development of a portable Josephson junction voltage standard based on an active cryogenic system. Principal areas of interest include dynamics, mechatronics, instrumentation, and machining.

Dr. Kasra Daneshvar (Electrical and Computer Engineering). Research in the Daneshvar group focuses on the application of nanoparticles for all-optical devices. A typical quantum dot (QD) with diameter of 3 nm contains only a few hundred atoms. Therefore, saturation in optical absorption can take place, in threshold power density of photons several orders of magnitude below the typical values for most solids, ~ MW/cm2 range. This low value of threshold opens the door for a wide range of optoelectronic applications. Among these is the all-optical Analog to Digital converter (ADC). An absorber with low saturation intensity can be used in series or in parallel to set the threshold for the significant bits in a sampled analog signal.

Dr. Angela D. Davies (Physics and Optical Science). The Davies group focuses on research metrology advances for precision micro-optics components to assess dimensional form with nanometer scale uncertainty.

Dr. Matthew Davies (Mechanical Engineering and Engineering Science). Dr. Davies came to UNC Charlotte from NIST where his research focused on measurement of the dynamic and plastic phenomena in high-speed machining. He continues research in precision manufacturing and dynamics as well as biomechanics and micro-optics.

Dr. Bernadette T. Donovan-Merkert (Chair, Chemistry). The Donovan-Merkert group is interested in electrochemically-promoted reactions of organometallic complexes. The group is exploring the use of nanostructured electrode materials for applications in catalysis.

Dr. Thomas D. DuBois (Charles H. Stone Professor, Chemistry). Dr. DuBois' research addresses modeling of molecular and nanomaterials using mechanics, electronic and dynamic computational methods. Work with Dr. Jordan Poler focuses on the interaction of carbon nanotubes with transition metal complexes and transition metal clusters formed from a variety of ligand assemblies.

Dr. Mahnaz El-Kouedi (Chemistry). Research in the El-Kouedi group focuses on the construction and use of nanoparticulate substrates for biological and chemical sensing applications. These new nanomaterials have unique electronic and optical properties that can be tuned to enhance detection limits. The group is also exploring the use of nanoscale surfaces for catalysis applications.

Dr. Horacio Estrada (Mechanical Engineering and Engineering Science). Research in the Estrada group focuses on MEMS-based sensors and actuator developments.

Dr. Markus Etzkorn (Chemistry). The broader context of Dr. Etzkorn's research program is the synthesis of conformationally flexible fluorohydrocarbons that display new physicochemcial properties on the intra- and intermolecular levels. Novel fluoroarene systems are being investigated toward their potential as supramolecular building blocks (crystal engineering), their host guest chemistry (sensing) and electron- and energy transfer processes (optoelectronic specifications). The overall concept exploits the structural versatility of hydrocarbon chemistry and the "extreme" property-altering effect of fluorine substituents on the nanoscale regime.

Dr. Michael A. Fiddy (Physics and Optical Science and Electrical and Computer Engineering, Director of the Center for Optoelectronics and Optical Communications). Dr. Fiddy's research focuses on the development of theoretical and numerical techniques for determining optical structures with refractive index variations having sub-wavelength (tens of nm) scales and which guide and scatter light in a prescribed fashion. Co-operative enhancements of optical nonlinearites in nanocomposites are also addressed.

Dr. Greg Gbur (Physics and Optical Science). The Gbur group is interested in the understanding and use of classical coherence theory. Through exact numerical simulations, light interactions at sub-wavelength scales are being investigated with the goal of developing novel nano-scale devices.

Dr. Kenneth E. Gonsalves (Celanese Acetate Distinguished Professor, Chemistry). New initiatives for developing novel resist materials for nanolithography (EUV, EB and X-ray) are underway in the Gonsalves group. Concepts of nanostructured materials technology developed in the Gonsalves laboratory are now being applied to submicron and nano- (below 100 nm) structures for microelectronics and biotechnology.

Dr. Mohamed-Ali Hasan (Electrical and Computer Engineering). The Hasan group focuses on molecular beam epitaxy (MBE) for the construction of nanoscale materials, including (1) growth of single crystalline cubic SiC on Si using compliant nanoscale seed crystals employing an economical, environmentally friendly method that utilizes a non-toxic gas, trimethylsilane, and (2) growth of single crystalline hexagonal AlN(001) and GaN on Si(111) using surfacereconstruction induced epitaxy. These materials are useful substrates for nanoscale optoelectronic devices, and also can be used for HFETs.

Dr. Tsing-Hua Her (Department of Physics and Optical Science). The Her group focuses on multiphoton-initiated processes for micron/submicron/nanofabrication.

Dr. Robert J. Hocken (Mechanical Engineering, Norman K. Dickerson, Jr. Distinguished Professor of Precision Engineering, Director of the Center for Precision Metrology). Dr. Hocken's research interests include precision machine design, dimensional metrology and scanning probe microscopy. In addition to directing UNC Charlotte's Center for Precision Metrology (an NSF IUCRC center incorporating an affiliates consortium comprising major U.S. manufacturing industries), he is also involved in SINAM, an NSEC, funded by NSF and partnering with UCLA, UCSD, Stanford, Berkeley and HP labs.

Dr. Michael Hudson (Chair, Biology). Research in the Hudson group investigates the interaction of *Staphylococcus aureus*, the most common organism associated with osteomyelitis (infection of the bone) with mouse and human osteoblasts (cells involved in bone formation). Research efforts in nanoscale science include the use of nanomachined polymer surfaces for promoting osteoblast cell adhesion.

Dr. Daniel S. Jones (Chemistry). Dr. Jones' research focuses on X-ray crystal structure determination of inorganic, organic, and organometallic molecules.

Dr. Joanna K. Krueger (Chemistry). The Krueger group works in the area of biophysical chemistry. Probing of the nanostructural features of proteins using small-angle X-ray and neutron scattering with a contrast variation technique was instrumental in assembling a more global picture of how signals are transduced between Ca^{2+}-activated calmodulin and its kinase target, myosin light chain kinase.

Dr. Patrick Moyer (Physics and Optical Science). Dr. Moyer's research includes integrated optics and nanoscale optical spectroscopy. Recent research has involved the role of quantum confinement vs. that of surface molecules in determining the light emission mechanism of porous silicon. In addition, he has studied the time-dependence (on a millisecond time scale) of surface enhanced Raman scattering of single carbon domains on single silver nanoparticles. Dr. Moyer has worked in industry as a scientist and engineer designing and developing scanning probe microscopes for the study of nanoscale properties of materials and biological samples.

Dr. Arindam Mukherjee (Electrical and Computer Engineering). Dr. Mukherjee's research focuses on bio-inspired electronic design and design automation for inherently faulty nanoscale circuits.

Dr. Brigid Mullany (Mechanical Engineering and Engineering Science). Dr. Mullany's group is concerned with the generation and measurement of precision engineered surfaces. Ultra-smooth surfaces have average roughness values of less than 0.2 nm and the generation of such surfaces depends on the type and size of abrasive particles used in the polishing processes. Research is concerned with determining how nano abrasive particles and their surface charges interact with the workpiece in removing material and generating these ultra smooth surfaces.

Dr. Craig A. Ogle (Chemistry). Dr. Ogle is an organic chemist with ongoing interests in macromolecular chemistry. He has interests in controlling microstructure in vinyl polymers and uses NMR extensively in these studies. Dr. Ogle's group is also generating functional initiators which can then be used to make functional polymers or polyfunctional polymers and eventually dendritic structures.

Dr. James D. Oliver (Cone Distinguished Professor, Biology). Research in the Oliver lab involves the human pathogen, *Vibrio vulnificus*, which causes 95 percent of all seafood-borne deaths in this country. The lab studies its ecology, genetics, physiology and metabolism. It also studies the "viable but nonculturable" state in bacteria, where cells lose the ability to be cultured in response to environmental stress. The 35+ years of experience with the culture and characterization of a wide variety of bacteria will likely assist in the University's nanotechnology efforts, with bacterial cells potentially being employed as nanotechnology agents. Collaborations with engineers (e.g. use of quantum dots with Dr. Ed Stokes) and optical physicists (e.g. development of biowarfare detection equipment with Dr. Michael Fiddy) are examples of such interactions.

Dr. Jordan C. Poler (Chemistry). Nanoscale molecular assemblies enable the design and manipulation of matter with unprecedented fidelity. With these novel assemblies, the Poler group is working towards tailoring the properties of new materials and developing new devices. Supramolecular assemblies are being investigated for potential applications in 3D nanostructuring, optical switching, and sensors.

Dr. Daniel Rabinovich (Chemistry). The Rabinovich group is interested in synthetic and structural inorganic chemistry, with applications to bioinorganic chemistry. Research relevant to nanoscale science focuses on the synthesis and use of multidentate thioethers to control the size and shape of gold nanoparticle assemblies with potential applications as sensors and in catalysis, information storage and microelectronics.

Dr. Jay Raja (Chair, Mechanical Engineering and Engineering Science). Dr. Raja's research is in the field of surface fine feature measurement and characterization, commonly referred to as surface metrology. His recent work concentrates on the development of web-based surface metrology analysis software for industry use as well as addressing emerging issues in 3 dimensional analysis and identification and characterization of structured surfaces.

Dr. Arun Ravindran (Electrical and Computer Engineering). Dr. Ravindran's research addresses opportunities and challenges of nanoscale electronics through new circuit design paradigms. His group investigates current design techniques to control leakage in nanoscale CMOS transistors; realization of analog signal processing blocks using carbon nanotubes, single electron transistors, quantum dots, and bio-tissue devices; and the use of digitally assisted and bio-inspired techniques for fault-tolerant nanoscale circuits systems.

Dr. John M. Risley (Chemistry). The Risley group works in the area of bioorganic/biochemistry. The focus of the research is a detailed understanding of the reaction/mechanism of glycosylasparaginase, an enzyme in the pathway of the catabolism of N-linked glycoproteins, and a deficiency in the activity of which gives rise to the most common disorder of glycoprotein metabolism. Organic synthesis and characterization of new, novel substrates are developed for particular kinetic and mechanistic studies of the enzyme.

Dr. Thomas A. Schmedake (Chemistry). The Schmedake group explores the remarkable effects that are manifested when light is confined to a volume approaching the wavelength of light (<500 nm). At this size certain frequencies of light become resonant with the optical cavity. The group is attempting to exploit this phenomenon for the rational design of better sensors, photocatalysts, and optical devices.

Dr. Wade Sisk (Chemistry). The Sisk group investigates the photostability, photoluminescence, and photoconductivity of dyes dispersed in polymer matrices. One goal is to understand the mechanisms of photodegradation and to employ methods to decrease the rate of photodegradation. Applications of this research include: solid-state dye lasers, waveguides, organic light emitting devices (OLEDs), read/write disks (DVDs), and photofading of dyed fabrics.

Dr. Inna Sokolova (Biology). The Sokolova group investigates how environmental stressors such as temperature and heavy metal pollution may limit survival and distribution of marine invertebrates. Understanding of the physiological mechanisms and limitations of stress tolerance is crucial for the understanding of the fate of populations of poikilotherms, which comprise >95% of marine animal biodiversity, in the face of the global environmental change. Dr. Sokolova's group is interested in toxicity testing of nanomaterials, particularly, in a study of their effects on cellular oxidative stress.

Dr. Stuart T. Smith (Mechanical Engineering). Dr. Smith's research focuses on the development of instrumentation and sensor technologies, including advanced signal processing techniques, for measurement of surface profile, micro-geometry and displacements, primarily aimed towards the challenge of atomic scale discrimination and modifications. As a consequence of these efforts many investigations in the fields of instrument and sensor design, surface contact phenomena, flexure mechanisms and slideway design have been undertaken.

Dr. Ed Stokes (Electrical and Computer Engineering). The Stokes group is working to develop brighter and more efficient solid-state light sources for application general illumination, spectroscopy, displays, and communications. In current-generation epitaxial III-nitride semiconductor light emitting materials, nanostructure plays a key role in maximizing light emitting device efficiency. Wavelength tunability is achieved by the quantum size effect, and quantum confinement serves to minimize non-radiative recombination through crystal defects. The Stokes group is expanding on these concepts by developing new nanostructured materials with II-VI semiconductor quantum dots, synthesized in liquid phase, and integrated through novel processing into III-nitride semiconductor epitaxial materials.

Dr. Thomas J. Suleski (Physics and Optical Science). The Suleski group focuses on the development of novel nanofabrication techniques. Simulation, design, fabrication, and characterization of micro- and nano-optical devices and systems are explored.

Dr. Raphael Tsu (Distinguished Professor of Electrical and Computer Engineering). Dr. Tsu is an international expert on nanoscale electronics and optoelectronics. His research incorporates theoretical and experimental studies on the quantum nature of properties of nanoscale materials, such as the dielectric function and capacitance. The Tsu group reported some of the pioneering work on quantum wells and quantum well superlattices.

Dr. Qiuming Wei (Mechanical Engineering and Engineering Science). Dr. Wei's research focuses on processing, characterization and testing of advanced materials such as superhard thin coatings, nano-particulate materials, and nanostructured metals in both thin coating form and bulk form.

Dr. Robert Wilhelm (Mechanical Engineering and Engineering Science and Director, Charlotte Research Institute). Dr. Wilhelm's research interests include metrology, signal processing, and computer automation for synthesis, analysis, and fabrication. Current research interests include metrology techniques at the nano-scale based on self-assembling lattices and chirality.

Dr. Terri Xu (Mechanical Engineering and Engineering Science). Dr. Xu's research focuses on the synthesis and characterization of nanomaterials and nanostructures; the fabrication of nanocomposites and investigations of their properties; and nano-material based devices for sensor applications.

Dr. Christopher Yengo (Biology). The Yengo group focuses on understanding the molecular basis of cell motility.

B. Estimate the need for new faculty for the proposed program for the first four years. If the teaching responsibilities for the proposed program will be absorbed in part or in whole by the present faculty, explain how this will be done without weakening existing programs.

Over the past several years, the Department of Chemistry has focused its recruiting efforts on tenure-track faculty who will support the proposed Ph.D. program in Nanoscale Science through teaching and research. The other participating departments have also recently hired new faculty who will be actively engaged in the proposed Ph.D. program in Nanoscale Science. These trends are expected to continue in the future.

In order to develop the new Ph.D. program and sustain its undergraduate and master's programs at their current levels of excellence, the Department of Chemistry will add two new tenure track faculty positions, one in each of the first two years of the program. The first position, to be recruited during the 2006-07 academic year, will be a senior faculty member (associate or full professor) with experience in Ph.D. programs and a record of successful and substantial grant and publication activity. The second new position, to be recruited during the 2007-08 academic year, will be at the assistant professor level. All new tenure track positions will require teaching and research contributions to the proposed doctoral program.

To sustain the undergraduate programming at the current levels, the Chemistry Department will also recruit two Ph.D.-level, non-tenure track permanent lecturers. These positions will help sustain the Department's growing Introductory Chemistry and Organic Chemistry programs that serve students of many different majors, and the Department's commitment to the University's General Education program (tenure-track faculty members currently teach in the above courses). The Chemistry Department will need to shift some of its tenure-track faculty resources to the Ph.D. program; the permanent lecturer positions will help to accomplish this without adversely affecting the quality of undergraduate programming. Tenure-track faculty members will continue to teach these courses, but on a less frequent basis.

C. If acquisition of new faculty requires additional funds, please explain where and how these funds will be obtained.

Funding to hire faculty in the Department of Chemistry will come from the Dean of the College of Arts and Sciences. Funding for any new hires in the Departments of Physics and Optical Science or Biology will also come from the Dean of the College of Arts and Sciences. Funding for new positions in the Departments of Mechanical Engineering or Electrical Engineering will come from the Dean of the College of Engineering.

D. Explain how the program will affect faculty activity including course load, public service and scholarly research.

Given the plans to hire new tenure-track faculty members and lecturers, the proposed Ph.D. program should not adversely affect faculty teaching loads, public service or scholarly research. The addition of new teaching assistants should help to reduce the teaching load of the faculty (the teaching assistants will instruct laboratory classes and run tutoring and problem sessions), allowing the faculty time to develop and teach new courses. The research activities of the program's graduate students will boost productivity in research, particularly after the graduate students have completed much of their formal coursework and have become familiar with research procedures.

V. LIBRARY

In the text for section V, the assessment made by the UNC Charlotte Library Staff appears in italics. The full text of the Library Assessment is included in Appendix F.

A. Provide a general statement as to the adequacy of present library holdings for the proposed program.

Library Assessment

Science Liaison Librarian Barbara Tierney has completed a thorough search of the Atkins Library's online catalog to evaluate the extent and currency of library holdings that support the proposed new interdisciplinary Ph.D program in Nanoscale Science. Ms. Tierney finds that the Library has sufficient resources to support this new program.

Ms. Tierney does recommend, however, that the participating academic departments designate a total of approximately $25,000.00 of their program funding for the purchase of new relevant library materials to further support and update library collections in this subject area.

B. State how the library will be improved to meet program requirements for the next five years. The explanation should discuss the need for books, periodicals, reference materials, primary source materials, etc. What additional library support must be added to areas supporting the proposed program?

UNC Charlotte will budget $25,000 during the first three years of the program for the purchase of books on nanoscale science. Some of the participating departments are already making requests for the library to order needed books on nanoscale science.

C. Discuss the use of other institutional libraries

The Library provides access to those materials not owned by the Library through a national Inter-Library Loan Network. Additional online resources offer faculty and student access to full text resources not available within Atkins Library.

VI. FACILITIES AND EQUIPMENT

A. Describe facilities available for the proposed program.

The Department of Chemistry will acquire roughly 10,400 square feet of space in the Burson Building when the Department of Physics and Optical Science moves in summer 2006 to the new building that will also house the Center for Optoelectronics and Optical Communications. The Departments of Biology, Mechanical Engineering and Engineering Science, and Electrical and Computer Engineering recently moved to the new Woodward Hall and the new building for the Center for Precision Metrology. Thus, no new space will be required to launch the proposed Ph.D. program. Additional space will be available in Woodward Hall and the Burson Building when some faculty members from the College of Information Technology and other departments move to the Optics Center or to the planned Bioinformatics Building (a $35 million building scheduled to be completed by 2009).

The participating departments and centers house a significant amount of equipment that will support the research efforts of the proposed program. A listing of equipment is provided in Appendix G.

B. Describe the effect of this new program on existing facilities and indicate whether they will be adequate, both at the commencement of the program and during the next decade.

The current space plus the additional space that will become available during the next several years should adequately meet the needs of the new program.

C. Discuss any information technology services needed and/or available.

The IT equipment and support available through the core departments and colleges are sufficient.

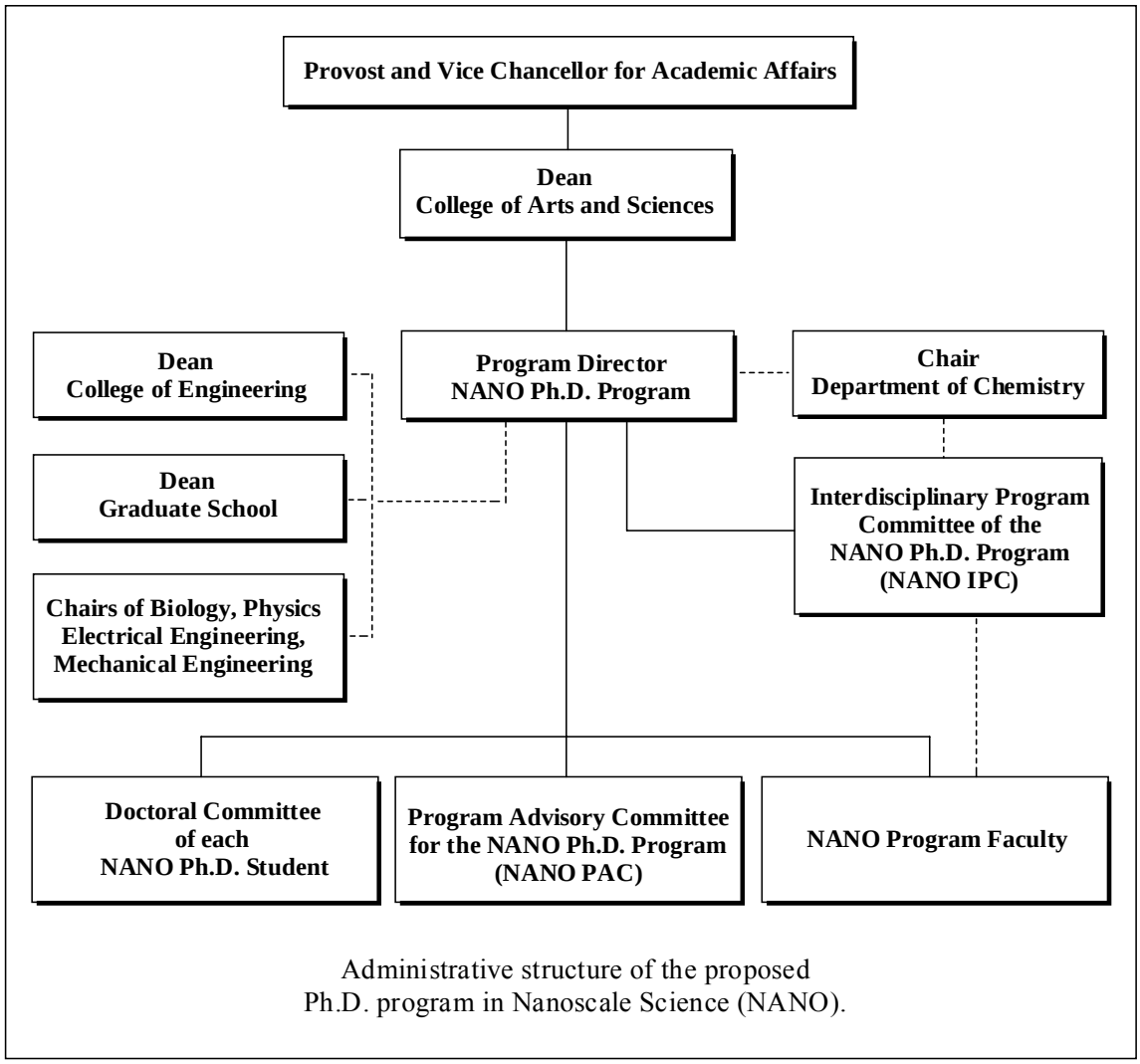
D. Discuss sources of financial support for any new facilities and equipment.

No new facilities or equipment will be required to launch the proposed Ph.D. program. Faculty in the participating departments and centers will continue to secure external grants to bring new equipment to UNC Charlotte. For example, the Chemistry Department was recently successful in securing an NSF-MRI grant for the purchase of a 500 MHz NMR spectrometer. An NSF-MRI proposal was recently submitted by a group of faculty from the College of Engineering and the College of Arts and Sciences (Terry Xu, PI, Department of Mechanical Engineering and Engineering Science) for the purchase of a high resolution TEM instrument.

VII. ADMINISTRATION

Describe how the proposed program will be administered giving the responsibilities of each department, division, school, or college. Explain any inter-disciplinary or inter-unit administrative plans. Include an organizational chart showing the "location" of the proposed program.

The Ph.D. in Nanoscale Science will involve the Departments of Chemistry, Biology, Electrical and Computer Engineering, Mechanical Engineering and Engineering Science, and Physics and Optical Science. An organizational chart showing the "location" of the proposed program is provided below. Solid lines indicate reporting relationships, dotted lines indicate consultative relationships.



Administrative structure of the proposed
Ph.D. program in Nanoscale Science (NANO).

The Department of Chemistry will serve as the administrative department as it is the only one of the five participating departments that does not currently serve as the lead department of an interdisciplinary or discipline-specific Ph.D. program (the Department has a productive, successful master's program). For many years, the Chemistry Department has targeted its new hires to support the Nanoscale Science Ph.D. program.

The Director of the Nanoscale Science Ph.D. program will report directly to the Dean of the College of Arts and Sciences. A consultative reporting relationship will exist with the Dean of the College of Engineering and the Dean of the Graduate School. The Director will meet regularly with the chairs of the five core departments about program matters. When necessary, the entire program faculty will be convened to review and develop policies and procedures for the program.

The program advisory committee (NANO PAC), composed of UNC Charlotte faculty members, external professionals, and current and former graduate students, will provide input on program matters to the faculty and Director of the program.

The Dean of the Graduate School is responsible for monitoring the quality of the graduate program, the final admission of graduate students, and appointments to the Graduate Faculty. The Graduate Dean acts in collaboration with the Dean of the College of Arts and Sciences, who is responsible for personnel, resource allocation and evaluation, and other issues related to the administration of the academic program.

The Interdisciplinary Program Committee of the NANO Ph.D. program (NANO IPC) will be composed of faculty members from each of the participating departments plus graduate student representatives. The NANO IPC will work with the Director on graduate student recruitment and evaluation; developing and amending policies and procedures of the program; and program evaluation and monitoring.

The Director of the program will assume day-to-day responsibilities of the graduate program. In consultation with the department chairs, the NANO IPC, the Program Advisory Committee, and the doctoral faculty, the Director will be responsible for:

- Oversight of program administration, activities and materials
- Graduate student recruitment and evaluation; assigning assistantships to students
- Curriculum and course scheduling
- Recommending operating budgets and supervising expenditures
- Communicating assessment of the program and personnel to the chairs of the participating departments and the Deans of the College of Arts and Sciences and Engineering
- Chairing meetings with the NANO IPC, the Program Advisory Committee and the program faculty
- Student services (advising, special requests, graduation checks, routine student forms, miscellaneous student problems)
- Overseeing admission to candidacy exam and dissertation
- Creation of subcommittees (i.e., Curriculum Committee, Graduate Student Selection Committee) on an as needed basis to effectively administer the program
- Representing the graduate program outside the core departments and University
- Program evaluation and monitoring
- Alumni relations and development
- Promoting scholarship in the program

VIII. ACCREDITATION

Indicate the names of all accrediting agencies normally concerned with programs similar to the one proposed. Describe plans to request professional accreditation. If the proposed new degree program is at a more advanced level than those previously authorized or if it is in a new discipline division, was SACS notified of a potential "substantive change" during the planning process? If so, describe the response from SACS and the steps that have been taken to date with reference to the applicable procedure.

There is no agency/organization that accredits Nanoscale Science Ph.D. programs.

IX. SUPPORTING FIELDS

Are other subject-matter fields at the proposing institution necessary or valuable in support of the proposed program? Is there needed improvement or expansion of these fields? To what extent will such improvement or expansion be necessary for the proposed program?

No improvement or expansion is needed.

X. ADDITIONAL INFORMATION

Include any additional information deemed pertinent to the review of this new degree program proposal.

The primary faculty members affiliated with the proposed program have received substantial external funding in support of scholarship. External funding will be a high priority for the proposed program.

Besides government funding for specific faculty research initiatives, we will pursue funding through NSF's IGERT (Integrative Graduate Education and Research Training) program to support the establishment and implementation of the Nanoscale Science Ph.D. program. Central to IGERT grants is supporting "new models for graduate education and training in a fertile environment for collaborative research that transcends disciplinary boundaries."

XI. BUDGET

Provide estimates (using the attached form) of the <u>additional costs</u> required to implement the program and identify the proposed sources of the additional required funds. *Use SCH projections (section II.C.) to estimate new state appropriations through enrollment increase funds.* Prepare a budget schedule for each of the first three years of the program, indicating the account number and name for all additional amounts required. Identify EPA and SPA positions immediately below the account listing. New SPA positions should be listed at the first step in the salary range using the SPA classification rates currently in effect. Identify any larger or specialized equipment and any <u>unusual</u> supplies requirements.

For the purposes of the second and third year estimates, project faculty and SPA position rates and fringe benefits rates at first year levels. ***Include the continuation of previous year(s) costs in second and third year estimates.***

Additional state-appropriated funds for new programs may be limited. Except in exceptional circumstances, institutions should request such funds for no more than three years (e.g., for start-up equipment, new faculty positions, etc.), at which time enrollment increase funds should be adequate to support the new program. Therefore it will be assumed that requests (in the "New Allocations" columns of the following worksheet) are for one, two, or three years unless the institution indicates a continuing need and attaches a compelling justification. However, funds for new programs are more likely to be allocated for limited periods of time.

Please see Appendix A for a summary of estimated additional costs in the first three years of the program.

XII. EVALUATION PLANS

All new degree program proposals and degree program track descriptions must include an evaluation plan which includes: (a) the criteria to be used to evaluate the quality and effectiveness of the program, (b) measures to be used to evaluate the program, (c) expected levels of productivity of the proposed program/track for the first four years of the program (numbers of graduates), (d) the names, addresses, and telephone numbers of at least three persons…qualified to review this proposal and to evaluate the program once operational, and (e) the plan and schedule to evaluate the proposed new degree program prior to the completion of its fifth year of operation once fully established.

A. Criteria to be used to evaluate the proposed program (not in an order of priority).

(1) Success in extending educational opportunities and recruiting high quality students

(2) Success in helping students to achieve high academic performance and professional development

(3) Success in promoting productive work relationships between students and faculty

(4) Success in retaining students with satisfactory performance

(5) Success in placing students in appropriate employment

B. Measures to be used to evaluate the program:

(1) Measures to evaluate the program's success in extending educational opportunities and recruiting high quality students include:

a. Total number of applications received

b. Quality of applicants in terms of standardized test scores (GRE) and undergraduate grade point averages

c. Diversity of applicants in terms of geographic regions and demographics relative to other related disciplines

d. Number of students enrolled
e. Quality of students enrolled in terms of standardized test scores (GRE) and undergraduate grade point averages
f. Diversity of students enrolled in terms of geographic regions and demographics

(2) Measures to evaluate the program's success in helping students to achieve high academic performance and professional improvement include:

a. Funding levels for students
b. Grades achieved in coursework
c. Timely completions of courses, exams, and other required progresses as specified by program curriculum
d. Individualized annual performance evaluations based on inputs from all faculty who have contact with the student
e. Student participation in professional organizations and presentations at professional conferences
f. Student participation in professional publication and proposal development
g. Annual student satisfaction survey and other feedback on program design, academic support, and quality of mentoring

(3) Measures to evaluate the program's success in promoting productive work relationships between students and faculty include:

a. Student participation in faculty research projects
b. Student participation in grant proposal development
c. Co-authored research papers, conference presentations, and publications between students and faculty

(4) Measures to evaluate the program's success in retaining students with satisfactory performance include:

- Student retention rate among those with satisfactory performance

(5) Measures to evaluate the program's success in placing students in appropriate employment include:

a. Average time to obtain relevant employment
b. Type of employment, with special emphasis on percentage of graduates who obtain academic employment
c. Quality of employment (degree to which employment is appropriate for degree and degree level)
d. Employer feedback

C. Projected productivity levels (numbers of graduates):

	Year 1 (2007-2008)	Year 2 (2008-2009)	Year 3 (2009-2010)	Year 4 (2010-2011)	TOTALS
B					
M					
I/P					
D	**0**	**0**	**0**	**1**	**1**

D. Recommended consultants/reviewers: Names, titles, addresses, e-mail addresses, and telephone numbers. May not be employees of the University of North Carolina.

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E. Plan for evaluation prior to sixth operational year.

The Program Advisory Committee (NANO PAC) will conduct periodic systematic reviews of the program's goals, objectives and curriculum to ensure their appropriateness in relation to:

- UNC Charlotte's mission and goals
- Local, regional, and national needs
- The evolving body of scientific knowledge in nanoscale science
- Job placements and career paths of the program's graduates

As part of the review, students will be formally surveyed on a yearly basis to identify their perceptions of program strengths and growth areas in relation to the curriculum implemented. The results of all reviews will be shared with the faculty and the student body of the program.

Year One: Evaluation efforts will focus on quality of applicants, admission procedures, and student qualifications. At the end of the first semester, the faculty will review the outcome of the first round of admissions and student progress to date to determine if changes are needed in recruitment and screening for the next round of admissions. Faculty will also obtain student and faculty feedback on the courses implemented to date. Any changes will be developed through faculty planning and included in a revised doctoral handbook.

Year Two: The NANO IPC will collect and review information on student quality, performance and participation in research, satisfaction, retention, and proposal development. Admission procedures and results will continue to be monitored.

Year Three. The evaluation will focus on student academic performance and professional development. The faculty will consider performance on the Qualifying exam, participation in faculty research, performance in seminars, and other professional activities. Information on student achievement will be reviewed to determine if faculty mentoring is providing mutual benefit to students and faculty.

Year Four. Evaluation of students in the dissertation stage will be the primary focus. The main issues will include progress in dissertation research, active participation in research, publication, and employment preparation.

Year Five. A report will be prepared to evaluate program effectiveness, summarize new measures implemented during the first four years and their results, and to recommend changes for further improvement.

XIII. REPORTING REQUIREMENTS

Institutions will be expected to report on program productivity after one year and three years of operation. This information will be solicited as a part of the biennial long-range planning revision.

Proposed date of initiation of proposed degree program: August, 2007

This proposal to establish a new program has been reviewed and approved by the appropriate campus committees and authorities.

Chancellor Philip Rubin **Date** 4/28/06

Works Cited

1. For a comparative view of commonly known items and nano-sized entities, see www.nano.gov/html/facts/The_scale_of_things.html.

2. For the text of Feynman's address, see http://www.zyvex.com/nanotech/feynman.html.

3. For congressional addresses on this topic delivered by leaders in the field of nanoscale science and technology, see addresses delivered by: (a) Eugene Wong, assistant director of Engineering of the National Science Foundation (www.house.gov/science/wong_062299.htm); (b) Richard Smalley, Nobel Laureate and Professor of Chemistry at Rice University (www.house.gov/science/smalley_062299.htm), and (3) Ralph Merkle, Research Scientist (Xerox) and Senior Research Associate, Institute for Molecular Manufacturing (www.house.gov/science/merkle_062299.htm).

4. See www.nsf.gov/igert.

5. Web page for the National Nanotechnology Initiative: (http://www.nano.gov).

6. See http://www.nsf.gov/sbe/srs/infbrief/nsf04320/nsf04320.pdf

7. Roco, M.C. *The US Nanotechnology Initiative after 3 years (2001-2003)*(*Journal of Nanoparticle Research* **2004**, *6*(1), 1-9).

8. Roco, M.C.; Bainbridge, W. (eds) *Societal Implications of Nanoscience and Nanotechnology* (National Science Foundation, Arlington, VA, 2001).

9. Roco, M.C. *Converging science and technology at the nanoscale: opportunities for education and training* (Nature Biotechnology, 2003, 21(10), 1-3).

10. See www.ChemicalVision2020.org/nanomaterials roadmap.html.

11. http://www.smalltimes.com/document_display.cfm?document_id=7817

12. For the 2004 Strategic Plan of the NC Economic Development Board, see http://149.168.102/Upload/assets/EDBStrategicPlan 2004 final.pdf. The quoted action item may be found on page 18.

Appendix A

Budget Projections for the First Three Years of Program Operation

Projected Funding for New Degree Program
Doctoral of Philosophy in Nanoscale Science
Regular Term 2007-2008
(Based on 2006-2007 Change in Student Credit Hours)

Program Category	Change in Student Credit Hours			Instructional - Position Funding Factors			Instructional Positions Required		
	Undergrad	Masters	Doctoral	Undergrad	Masters	Doctoral	Undergrad	Masters	Doctoral
Category I				708.64	169.52	115.56	0.000	0.000	0.000
Category II				535.74	303.93	110.16	0.000	0.000	0.000
Category III				406.24	186.23	109.86	0.000	0.000	0.000
Category IV				232.25	90.17	80.91	0.000	0.000	0.000

Fringe rates for staff
FICA @ 7.65%
Retirement @ 06.82%
Medical @ $3,748

Fringes for faculty salaries

FICA @ 7.65%	*$0*
Retirement @ 11.16%	*$0*
Medical @ $3,748	*$0*
	$0

	Total Positions Required		**0.000**
	Instructional - Position Salary Rate	(FY 02)	$67,481
101-1310	Instructional Salary Amount		$0
	Other Academic Costs	44.89300%	0
Purpose 101	Total Academic Requirements		$0
Purpose 151	Library	11.48462%	0
Purposes 152, 160, 170 180	General Instit Support	54.04980%	0
	Neg Adj Factor	50.00000%	n/a
	In-state SCHs	0	
	Financial Aid (in-state)	67.99800%	0
	Total Requirements		**$0**

SUMMARY OF ESTIMATED ADDITIONAL COSTS FOR PROPOSED PROGRAM/TRACK

Institution **UNC Charlotte** *Date* **April 28, 2006**

Program (API#, Name, Level) **40.9999 Nanoscale Science**

Degree(s) to be Granted **Ph.D.** *Program Year* **2007-08**

	ADDITIONAL FUNDING REQUIRED - BY SOURCE				
	Reallocation of Present Institutional Resources	Enrollment Increase Funds	Federal/State or Other Non-state Funds (Identify)	New Allocations	Total
101 Regular Term Instruction					
1210 SPA Regular Salaries					$0
1110 EPA Non-teaching Salaries					0
1310 EPA Academic Salaries	251,000	0	0		251,000
Director Stipend	25,000				
New Associate/Full Professor	100,000				
Graduate Assistants (6 @ $21K)	126,000				
1810 Social Security	19,202		0		19,202
1820 State Retirement	8,525				8,525
1830 Medical Insurance (3432*X)	6,864				6,864
2000 Supplies and Materials	3,000				3,000
2300 Educational Supplies	2,000				2,000
2600 Office Supplies	1,000				1,000
3000 Current Services	12,000				12,000
3100 Travel	10,000				
3200 Communications	1,000				
3400 Printing & Binding	1,000				
5000 Capital Outlay (Equipment)	3,000				3,000
5100 Office Equipment	500				
5200 EDP Equipment	2,500				
TOTAL Regular Term Instruction	**$303,591**	**$0**	**$0**	**$0**	**$303,591**
151 Libraries					
5000 Capital Outlay (Equipment)		0			0
5600 Library Book/Journal					
TOTAL Libraries	**$0**	**$0**	**$0**	**$0**	**$0**
189 General Institutional Support					
2000 Supplies and Materials					0
2600 Office Supplies					
3000 Current Services					0
3200 Communications					
3400 Printing & Binding					
5000 Capital Outlay (Equipment)					0
5100 Office Equipment					
5200 EDP Equipment					
TOTAL General Inst. Support	**$0**	**$0**	**$0**	**$0**	**$0**
999 Multiactivity					
TOTAL ADDITIONAL COSTS	**$303,591**	**$0**	**$0**	**$0**	**$303,591**

NOTE: Accounts may be added or deleted as required.

Projected Funding for New Degree Program
Doctoral of Philosophy in Nanoscale Science
Regular Term 2008-2009
(Based on 2007-2008 Change in Student Credit Hours)

Program Category	Change in Student Credit Hours			Instructional - Position Funding Factors			Instructional Positions Required		
	Undergrad	Masters	Doctoral	Undergrad	Masters	Doctoral	Undergrad	Masters	Doctoral
Category I				708.64	169.52	115.56	0.000	0.000	0.000
Category II				535.74	303.93	110.16	0.000	0.000	0.000
Category III			114	406.24	186.23	109.86	0.000	0.000	1.038
Category IV				232.25	90.17	80.91	0.000	0.000	0.000

	Total Positions Required		**1.038**
	Instructional - Position Salary Rate	(FY 02)	$65,191
101-1310	Instructional Salary Amount		$67,648
	Other Academic Costs	44.89300%	30,369
Purpose 101	Total Academic Requirements		$98,017
Purpose 151	Library	11.48462%	11,257
Purposes 152, 160, 170 180	General Instit Support	54.04980%	52,978
	Neg Adj Factor	50.00000%	n/a
	In-state SCHs	0	
	Financial Aid (in-state)	67.99800%	0
	Total Requirements		**$162,252**

Fringe rates for staff
FICA @ 7.65%
Retirement @ 06.82%
Medical @ $3,748

Fringes for faculty salaries

FICA @ 7.65%	*$5,175*
Retirement @ 11.16%	*$7,549*
Medical @ $3,748	*$3,889*
	$16,614

SUMMARY OF ESTIMATED ADDITIONAL COSTS FOR PROPOSED PROGRAM/TRACK

Institution **UNC Charlotte** *Date* **April 28, 2006**

Program (API#, Name, Level) **40.9999 Nanoscale Science**

Degree(s) to be Granted **Ph.D.** *Program Year* **2008-09**

	ADDITIONAL FUNDING REQUIRED - BY SOURCE				
	Reallocation of Present Institutional Resources	Enrollment Increase Funds	Federal/State or Other Non-state Funds (Identify)	New Allocations	Total
101 Regular Term Instruction					
1210 SPA Regular Salaries					$0
1110 EPA Non-teaching Salaries					0
1310 EPA Academic Salaries	126,000	67,648	0		193,648
New Assistant Professor		67,648			
Graduate Assistants (6@ $21,000)	126,000				
1810 Social Security	9,639	5,175	0		14,814
1820 State Retirement		7,549			7,549
1830 Medical Insurance		3,889			3,889
2000 Supplies and Materials	0	6,400			6,400
2300 Educational Supplies		2,200			
2600 Office Supplies		4,200			
3000 Current Services		2,200			2,200
3100 Travel	11,000	0			
3200 Communications	0	1,100			
3400 Printing & Binding	0	1,100			
5000 Capital Outlay (Equipment)		5,156			5,156
5100 Office Equipment		1,156			
5200 EDP Equipment		4,000			
TOTAL Regular Term Instruction	**$135,639**	**$98,017**	**$0**	**$0**	**$233,656**
151 Libraries					
5000 Capital Outlay (Equipment)		11,257			11,257
5600 Library Book/Journal		11,257			
TOTAL Libraries	**$0**	**$11,257**	**$0**	**$0**	**$11,257**
189 General Institutional Support					
2000 Supplies and Materials		17,700			17,700
2600 Office Supplies		17,700			
3000 Current Services		17,700			17,700
3200 Communications		8,850			
3400 Printing & Binding		8,850			
5000 Capital Outlay (Equipment)		17,578			17,578
5100 Office Equipment		8,800			
5200 EDP Equipment		8,778			
TOTAL General Inst. Support	**$0**	**$52,978**	**$0**	**$0**	**$52,978**
TOTAL ADDITIONAL COSTS	**$135,639**	**$162,252**	**$0**	**$0**	**$297,891**

NOTE: Accounts may be added or deleted as required.

Projected Funding for New Degree Program
Doctoral of Philosophy in Nanoscale Science
Regular Term 2009-2010
(Based on 2009-2010 Change in Student Credit Hours)

Program Category	Change in Student Credit Hours			Instructional - Position Funding Factors			Instructional Positions Required		
	Undergrad	Masters	Doctoral	Undergrad	Masters	Doctoral	Undergrad	Masters	Doctoral
Category I				708.64	169.52	115.56	0.000	0.000	0.000
Category II				535.74	303.93	110.16	0.000	0.000	0.000
Category III			108	406.24	186.23	109.86	0.000	0.000	0.983
Category IV				232.25	90.17	80.91	0.000	0.000	0.000

Total Positions Required			**0.983**
Instructional - Position Salary Rate	(FY 02)		$65,191
101-1310 Instructional Salary Amount			$64,087
Other Academic Costs	44.89300%		28,771
Purpose 101 Total Academic Requirements			$92,858
Purpose 151 Library	11.48462%		10,664
Purposes 152, 160, 170 180 General Instit Support	54.04980%		50,190
Neg Adj Factor	50.00000%		n/a
In-state SCHs	0		
Financial Aid (in-state)	67.99800%		0
Total Requirements			**$153,712**

Fringe rates for staff
FICA @ 7.65%
Retirement @ 06.82%
Medical @ $3,748

Fringes for faculty salaries

FICA @ 7.65%	*$4,903*
Retirement @ 11.16%	*$7,152*
Medical @ $3,748	*$3,685*
	$15,739

SUMMARY OF ESTIMATED ADDITIONAL COSTS FOR PROPOSED PROGRAM/TRACK

Institution **UNC Charlotte** *Date* **April 28, 2006**

Program (API#, Name, Level) **40.9999 Nanoscale Science**

Degree(s) to be Granted **Ph.D.** *Program Year* **2009-10**

ADDITIONAL FUNDING REQUIRED - BY SOURCE

	Reallocation of Present Institutional Resources	Enrollment Increase Funds	Federal/State or Other Non-state Funds (Identify)	New Allocations	Total
101 Regular Term Instruction					
1210 SPA Regular Salaries					$0
1110 EPA Non-teaching Salaries					0
1310 EPA Academic Salaries	0	64,087	0		64,087
New faculty salaries		22,087			
Graduate Assistant (2 @ 21,000)		42,000			
1810 Social Security	0	4,903	0		4,903
1820 State Retirement	0	7,152			7,152
1830 Medical Insurance		3,685			3,685
2000 Supplies and Materials		6,700			6,700
2300 Educational Supplies		2,300			
2600 Office Supplies		4,400			
3000 Current Services		2,200			2,200
3100 Travel	12,000				
3200 Communications		1,100			
3400 Printing & Binding		1,100			
5000 Capital Outlay (Equipment)		4,131			4,131
5100 Office Equipment		1,131			
5200 EDP Equipment		3,000			
TOTAL Regular Term Instruction	**$0**	**$92,858**	**$0**	**$0**	**$92,858**
151 Libraries					
5000 Capital Outlay (Equipment)		10,664			10,664
5600 Library Book/Journal		10,664			
TOTAL Libraries	**$0**	**$10,664**	**$0**	**$0**	**$10,664**
189 General Institutional Support					
2000 Supplies and Materials		16,700			16,700
2600 Office Supplies		16,700			
3000 Current Services		16,700			16,700
3200 Communications		8,350			
3400 Printing & Binding		8,350			
5000 Capital Outlay (Equipment)		16,790			16,790
5100 Office Equipment		500			
5200 EDP Equipment		16,290			
TOTAL General Inst. Support	**$0**	**$50,190**	**$0**	**$0**	**$50,190**
TOTAL ADDITIONAL COSTS	**$0**	**$153,712**	**$0**	**$0**	**$153,712**

NOTE: Accounts may be added or deleted as required.

Appendix B

Internal Letters of Support

Lee Casperson (Chair, Department of Electrical and Computer Engineering)
Robin Coger (Director, Center for Biomedical Engineering Systems)
Faramarz Farahi (Chair, Department of Physics and Optical Science)
Michael Fiddy (Director, Center for Optoelectronics and Optical Communications)
Robert Hocken (Director, Center for Precision Metrology)
Michael Hudson (Chair, Department of Biology)
Robert Johnson (Dean, The William States Lee College of Engineering)
Larry Mays (Director, Bioinformatics Research Center)
Jay Raja (Chair, Department of Mechanical Engineering and Engineering Science)

Note: Bernadette Donovan-Merkert (Chair, Department of Chemistry) is the lead writer of the proposal and Chair of the Planning Committee; a letter of support from the Chemistry Department is therefore not included.

28 March 2006

Dear Bernadette,

The Department of Electrical and Computer Engineering is pleased to endorse your proposal to establish a Ph.D. program in Nanoscale Science. This is an increasingly important subject area, and I am confident that the program will bring credit to our university. The ECE department has several faculty members with research and teaching interests in areas that can be identified as nanophotonics and nanoelectronic materials, and interactions between these faculty members and the new Nanoscale Science program will be mutually beneficial. The new courses associated with the program will also provide valuable opportunities for ECE students. We are looking forward to such interactions, and we wish you every success.

Sincerely,

Lee Casperson

UNC CHARLOTTE
The University of North Carolina at Charlotte
9201 University City Boulevard
Charlotte, NC 28223-001

Center for Biomedical Engineering Systems
www.cbes.uncc.edu
TEL: 704/687-8366
FAX: 704/687-8345

February 28, 2006

Dr. Bernadette T. Donovan-Merkert, Professor and Chair
Department of Chemistry
UNC Charlotte
9201 University City Blvd.
Charlotte, NC 28223-0001

Dear Bernadette:

The Center for Biomedical Engineering Systems (CBES) is very supportive of the initiative to plan a doctorate program in Nanoscale Science at UNC Charlotte. Establishment of this program is expected to immediately contribute to the *Biomedical Instrumentation* and the *Biomedical Support Systems* Focus Areas of CBES by providing the educational framework that is critical to training UNC Charlotte students in the Nanotechnology field. The Nanoscale Science Program's inclusion of the areas of Biomolecular Nanotechnology, Nanoscale Materials, and Instrumental Methods are all of particular interest to CBES' research agenda. I certainly anticipate a high degree of interaction between the CBES and the future Nanoscale Science program.

Sincerely,

Dr. Robin N. Coger, Director

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UNC CHARLOTTE
The University of North Carolina at Charlotte
9201 University City Boulevard
Charlotte, NC 28223-0001

Department of Physics and Optical Science
704/687-2536
FAX 704/687-3160

April 3, 2006

Dr. Bernadette T. Donovan-Merkert
Professor and Chair
Department of Chemistry UNC Charlotte
9201 University City Blvd.
Charlotte, NC 28223

Dear Bernadette:

The Department of Physics and Optical Science is very pleased to support your efforts to establish a Ph.D. program in Nano-scale Science. This program would be very beneficial to our programs in Optics and Biomedical Physics. I am sure there are many resources that our departments could share.

Wish you all the best,

Faramarz Farahi
Professor and Chair

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UNCCHARLOTTE
The University of North Carolina at Charlotte
9201 University City Boulevard
Charlotte, NC 28223-0001

Center for Optoelectronics
and Optical Communications
704/687-6078
FAX 704/687-6077
http://opticscenter.uncc.edu

February 20th 2006

Dr. Bernadette Donovan-Merkert
Chair, Department of Chemistry
The University of North Carolina at Charlotte

Dear Bernadette,

I am very excited at the initiative you have for a doctoral degree program in Nanoscale Sciences. This will complement extremely well the recent developments taking place in the Optics Center. At this time, there is a rapid convergence taking place between electronics and photonics at the nanoscale. The dramatic new breakthroughs in artificial optical materials consisting of nanoscale or subwavelength patterns can impart negative refractive index, slow light and fast light properties. We are only just beginning to think about the consequences of optical nonlinearities in these materials for potential new components and devices. Also at the nanoscale, plasmonic effects couple photons to the electrical properties of metals, which in turn are revealing new physical phenomena to be exploited in a number of applications, including photonic circuits and chem-bio sensors. To this end, recent optics faculty hires have been recruited because of their expertise in nanoprecise machining and fabrication of photonic crystal circuits and waveguides and nano and microfabrication of active and passive optical elements. In addition, the fabrication challenge of extracting light from silicon appears to be one of bandgap engineering through making nanostructural features and/or embedding nanoparticles or quantum dots into host material. The Center has purchased a number of tools which can support advances nanofabrication including an electron beam lithography tool, a nanoimprint tool and several etching systems. Together we can make a significant contribution to this emerging field and be part of the tremendous economic impact it will have on society.

Yours sincerely,

Mike Fiddy
Center Director

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UNC CHARLOTTE
The University of North Carolina at Charlotte
9201 University City Boulevard
Charlotte, NC 28223-0001

THE WILLIAM STATES LEE
COLLEGE OF ENGINEERING

Department of Mechanical Engineering
and Engineering Science
Center for Precision Metrology
704/687-4371
FAX: 704/687-3246

March 21, 2006

Bernadette T. Donovan-Merkert
Professor and Chair
Department of Chemistry
UNC Charlotte
9201 University City Blvd.
Charlotte, NC 28223-0001

Dear Dr. Donovan-Merkert:

I wish to express my strong support for the establishment of an interdisciplinary Ph.D. Program in Molecular and Nanoscale Science and Technology. As you know I have been working in the area of nanotechnology for more than 15 years and have been a participant in the accelerated growth of this field in the past several years with significant NSF funding. Here at UNC Charlotte we have the ingredients to become a national leader in this important discipline with participants from the departments of Mechanical Engineering, Mathematics, Electrical Engineering, Physics, Chemistry, Biology, and Computer Science as well as my Center and the Center for Optoelectronics and Optical Communications. Research challenges range from new materials to molecular manipulation and are inherently interdisciplinary in nature.

Experience already gathered shows us that UNC Charlotte has the necessary infrastructure to construct such programs; in fact our lack of long established traditional programs positions us perfectly to take advantage of emerging technologies. Many intellectual challenges and funding opportunities exist in the world of the nanometer and we definitely should take advantage of this field's new popularity. We in Precision Engineering would certainly be active participants.

Sincerely:

Robert J. Hocken, Ph.D., FSME
Norvin Kennedy Dickerson Jr., Distinguished
Professor of Precision Engineering and
Director, Center for Precision Metrology

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UNCCHARLOTTE
The University of North Carolina at Charlotte
9201 University City Boulevard
Charlotte, NC 28223-0001

Department of Biology
704/687-8686

March 21, 2006

Bernadette T. Donovan-Merkert, Ph.D.
Professor and Chair of Chemistry
The University of North Carolina at Charlotte

Dear Bernadette:

The Department of Biology is most pleased to support the proposed Interdisciplinary Ph.D. Program in Nanoscale Science and Engineering. There is a critical need for such a program in our region, and this would be very helpful in fostering further collaborative efforts in nanoscale science between our departments. As you know, we are just beginning to interact productively together in this area (e.g. W. He, K. E. Gonsalves, N. Batina, D. B. Poker, E. Alexander, and M. Hudson. 2003. Micro/Nanomachining of Polymer Surface for Promoting Osteoblast Cell Adhesion. Biomed. Microdevices 5: 101-108.). Participation in the Nanoscale Science and Engineering Colloquium would provide several of our faculty with an opportunity to learn more about this interdisciplinary field, resulting in more research collaborations between our faculty and those in departments most active in your proposed program. Some of our faculty could also serve as guest lecturers and consultants in courses, as well as participate in the proposed interdisciplinary seminar program. Again, we are most excited about this proposal.

Sincerely,

Michael C. Hudson, Ph.D.
Professor and Chair of Biology
The University of North Carolina at Charlotte
9201 University City Blvd.
Charlotte, NC 28223
704-687-8694
704-687-3128 (fax)
mail to: mchudson@email.uncc.edu
http://www.bioweb.uncc.edu/Faculty/Hudson/

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/o=UNC Charlotte/ou=UNCCHARLOTTE-NT/cn=Recipients/cn=bdonovan

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From: Johnson, Robert E.
Sent: Monday, April 03, 2006 4:09 PM
To: Donovan-Merkert, Bernadette
Subject: COE support

Dear Professor Donovan-Merkert,

The William States Lee College of Engineering enthusiastically supports the proposed Ph.D. program in nanoscale science. We envision being active participants in this program at several levels from providing nanoscale engineering courses to participating on thesis committees and collaborating on research projects. The college has numerous faculty members who are active in nanoscale science and engineering and the proposed program will enhance our efforts in that area. The proposed program has excellent potential to positively impact the economic development of the region and the State of North Carolina. The college looks forward to working with the faculty, staff and students of the nanoscale science program.

Sincerely,

Robert E. Johnson

==========

Robert E. Johnson
Professor & Dean
The William States Lee College of Engineering
UNC Charlotte
704-687-2614

==========

We turn students into engineers and ideas into reality!

UNC CHARLOTTE
The University of North Carolina at Charlotte
9201 University City Boulevard
Charlotte, NC 28223-0001

Bioinformatics Research Center
Woodward Hall

Office of the Director
Telephone: 704/687-8541
Fax: 704/687-6065

April 9, 2006

Bernadette Donovan-Merkert
Chair, Department of Chemistry
University of North Carolina at Charlotte
9201 University City Blvd.
Charlotte, NC 28223

Dear Dr. Donovan-Merkert

I am writing to express my enthusiastic support for the proposed Nanoscale Science Ph.D. program. I have reviewed your proposal and I believe that this new degree program will fill a critical need in our graduate research efforts at UNC Charlotte and in the State of North Carolina. Few fields have the enormous potential of nanoscale science and its applications in nanotechnology. UNC Charlotte has assembled an outstanding group of scientists to direct this program and I am sure it will grow rapidly.

The Nanoscale Science program will complement a number of programs on campus, including our growing Bioinformatics Research Center. We look forward to working with the students and faculty in this exciting new field.

Congratulations on developing an outstanding proposal for a much-needed new program. We stand ready to assist your efforts helping to develop your program to its fullest potential.

Sincerely,

Lawrence Mays, Ph.D.
Professor and Director

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/o=UNC Charlotte/ou=UNCCHARLOTTE-NT/cn=Recipients/cn=bdonovan

From: Raja, Jayaraman
Sent: Tuesday, March 21, 2006 3:33 PM
To: Donovan-Merkert, Bernadette; Casperson, Lee; Raja, Jayaraman
Cc: SMITH, STUART T; STOKES, EDWARD B; Johnson, Robert E.
Subject: RE: Nanoscale Science Ph.D.

Bernadette:

Mechanical Engineering and Engineering Science department enthusiastically supports the Ph.D program in Nanoscale Science. Dr. Stuart Smith has taught courses in the area of nanotechnology (as a special topics course) in the Mechanical Engineering department. The department will encourage him to teach courses in nanotechnology area that will attract students from the nanoscale Ph.D program and other departments. I wish you success with the proposal. Please do not hesitate to contact me if you need any help with the program.

Jay Raja, Professor and Chairman
Mechanical Engineering and Engineering Science Dept.
University of North Carolina at Charlotte
9201 University City Blvd.
Charlotte, NC 28223
Phone: 704 687 8348
Fax: 704 687 8345
"Try not to become a man of success but rather to become a man of value" - **Albert Einstein**

Appendix C

External Letters of Support

National Research Council Canada
National Institute for Nanotechnology

Conseil national de recherches Canada
Institut national de nanotechnologie

UNIVERSITY OF ALBERTA

Jillian M. Buriak
Professor
Department of Chemistry
University of Alberta
Edmonton, AB
T6G 2G2 Canada
TEL: (780) 492-1821
FAX: (780) 492-8231
E-Mail: jburiak@ualberta.ca

Senior Research Officer
National Institute for Nanotechnology
University of Alberta
ECERF: 9107–116 Street
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T6G 2V4 Canada
TEL: (780) 492-8890
FAX: (780) 492-8632

April 23, 2006

Dr. Bernadette T. Donovan-Merkert
Professor and Chair
Department of Chemistry UNC Charlotte
9201 University City Blvd.
Charlotte, NC 28223-0001
Phone: 704-687-4436
Fax: 704-687-3151
E-Mail: bdonovan@email.uncc.edu

Re: UNC Charlotte Nanoscale Science Ph.D. Proposal

Dear Dr. Donovan-Merkert,

It is with great pleasure that I write to indicate how impressed I am with the proposal from the University of North Carolina, Charlotte, for a Nanoscale Science Ph.D. Program. As you so correctly state, nanoscience is, by its very definition, highly interdisciplinary and the program you propose clearly and ambitiously brings together five departments (Chemistry, Physics and Optical Science, Mechanical Engineering and Engineering Science, Electrical and Computer Engineering, and Biology), as well as several centers, to achieve this challenging requirement. I strongly believe that in addition to the astounding economic impact nanotechnology promises to have, a quiet revolution has recently begun that is equally profound. By quiet revolution, I refer to the fact that nanoscience is serving as a catalyst to bring together biology, chemistry, physics, and engineering in a way that has never before been realized. For the first time, researchers from these disparate and previously separated areas are now aligning their goals, speaking similar scientific languages, and collaborating in ways unimaginable even a few years ago. It is by working at and across these increasingly fuzzy boundaries that nanoscience is truly starting to live up to its potential - fruitful and imaginative discussions between researchers of different backgrounds is seeding the area with rich ideas. It is still not easy, however, to find the ideal collaborator outside of one's area, and therefore progress has been hindered. In addition, collaborations involving graduate students are inevitably difficult due to differing departmental requirements. Nanoscience does not easily fit within the traditional university framework.

The Nanoscale Science Ph.D. Program you propose beautifully addresses the challenges of cutting edge cross-disciplinary research in nanoscience by transcending the traditional boundaries between disciplines. By providing a highly supportive framework within which researchers and their students can interact as never before, you facilitate these collaborations and discussions across traditional boundaries; in fact, they become inevitable and essential, within the environment you will provide. The organizational structure you provide erases the obstacles that could stymie highly interdisciplinary research in many ways. For instance, relevant courses from all across campus, some new, and many already in place, are recognized and fit within the framework of your Nanoscale Science Ph.D. Program. These same courses will bring together students from many disciplines, enriching the classroom environment and enhancing learning for students not only in the Nanoscale Science Program, but all those in the class. The effects will be felt by M.Sc. and undergraduates in these courses as well. The Nanoscale Science Ph.D. students will have been exposed to a range of areas, and this will enable them to quickly understand and better grasp the context of their research project; the area of nanoscience is rapidly enlarging, but is highly interconnected, and so the 'big picture' is so critical. There is no question that the unique training received by these new Ph.D.'s will render them highly sought after by industry, academia, and government.

To summarize, I am very excited by the concept of your Nanoscale Science Ph.D. Program. This program will accelerate new interdisciplinary nanoscience, and will produce research that will certainly have a large impact internationally. Perhaps more important, however, are the people who will have passed through your program - they will be equipped with breadth thanks to the collaborative environment, and depth due to their doctoral research project. This is a highly valuable combination of expertise, and I am convinced that your program will be a huge success as a result of the human capital aspects, in addition to cutting edge research value. Please do not hesitate to contact me if I can be of any assistance.

Sincerely,

Jillian M. Buriak
Professor of Chemistry

PENNSTATE

Thomas E. Mallouk, DuPont Professor of Materials Chemistry and Physics

Departments of Chemistry and Physics

Eberly College of Science
The Pennsylvania State University
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April 24, 2006

Professor Bernadette T. Donovan-Merkert
Chair, Department of Chemistry
University of North Carolina, Charlotte
9201 University City Blvd.
Charlotte, NC 28223-0001

Dear Bernadette:

I am writing to provide comments on your proposal to establish a new Ph.D. degree program in Nanoscale Science at UNCC. Overall, I believe this is a very strong and well thought out proposal. The creation of this new degree program is both timely and forward-looking. This program will be a strategic, sound investment in the future for UNCC.

As the proposal points out, Nanoscale Science is one of the most exciting emerging fields in the landscape of science and engineering. Research in nanoscience enjoys strong Federal support under the National Nanotechnology Initiative (NNI). NNI funding continues to increase as research in the field leads to new scientific discoveries, technological applications, and commercial oppportunities. It is becoming very clear that this field will continue to grow and will directly impact some of the most pressing technological challenges of the 21st century, particularly in the areas of energy and medicine.

Because Nanoscience is an interdisciplinary field, there is a need for innovative programs that provide training at the Ph.D. level. This need cannot be completely met by existing programs in the allied fields of Chemistry, Physics, Materials Science, and Engineering. Already, several universities in the U.S., including the University of Washington, a major research instution with strong Ph.D. programs in the traditional fields, are creating Nanoscience Ph.D. programs. Your proposal makes a very good case that UNCC's establishment of such a program will help it establish an early lead. I think we are going to see many more Nanoscience Ph.D. programs springing up as the field matures.

Strategically, it makes very good sense to do this at UNCC and to do it now. The program will complement but not compete directly with more traditional Ph.D. programs at UNC Chapel Hill, NC State, and Duke. The goals of the program fit well with UNCC's institutional mission and strategic plan. Perhaps most importantly, there is a core of really outstanding faculty at UNCC who will work together to make this program a success. The Ph.D. program will help them continue to build excellence in this area.

I believe that the proposed courses in nanoscale phenomena, synthesis, characterization, and fabrication will form the core of an excellent program for students doing experimental research in the program. These interdisciplinary graduate courses are in general not offered at other institutions in North Carolina and I think this cohesive new nanoscience curriculum will be attractive to students. The proposed rotations are also a good idea, given the interdisciplinary and dynamic character of the field. I would recommend that the program evaluate the question of the number and type of required courses after 2-3 years to see if the proposed number is too few or too many. It might be beneficial for theoretically oriented students, for example, to have the option to substitute graduate courses in quantum mechanics, statistical mechanics, or solid state physics for some of the required courses in synthesis and fabrication. You may also find that you need to fine tune the number of required courses in order to be competitive in recruiting Ph.D. students who are considering more traditional programs elsewhere.

In summary, I strongly support this proposal as a very strategic and timely step forward for UNCC.

Sincerely yours,

Thomas E. Mallouk

Appendix D

Faculty Curriculum Vitae (abbreviated)

Vasily N. Astratov

Assistant Professor
Department of Physics and Optical Science
The University of North Carolina at Charlotte
9201 University City Blvd.
Charlotte, NC 28223-0001
Phone: 704-687-4513; FAX: 704-687-3160; email: astratov@uncc.edu
web page: http://www.physics.uncc.edu/PhysStaff/Astratov/Astratov.htm

Education

Candidate of sciences – 1986 (Ph.D. in Physics)	From A. F. Ioffe Physico-Technical Institute, Russian Academy of Sciences, St.-Petersburg, Russia
Thesis:	"Spatial and Temporal Evolution of Distribution of Electric Field in $Bi_{12}SiO_{20}$ and $Bi_{12}GeO_{20}$ Crystals"
Supervisor:	Prof. A. A. Kaplyanskii, Academician of the Russian Academy of Sciences
Diploma – 1981 (M.S. in Physics)	From Leningrad State University, Department of Physics

Employment history

07/2002 - Present	Department of Physics and Optical Science, UNC-Charlotte
Position:	**Assistant Professor**
Major field:	Teaching of physics and research in the area of optics
01/02 - 07/02	Department of Physics and Optical Science, UNC-Charlotte
Position:	**Visiting Assistant Professor**
Major field:	Teaching of physics and research in the area of optics
06/97 – 12/01	Department of Physics and Astronomy, University of Sheffield, UK
Position:	**Postdoctoral Research Fellow**
Major field:	Research in the areas of optics and semiconductor physics
02/81 – 06/97	Solid State Optics Department, A.F. Ioffe Physical-Technical Institute, St. Peterburg, Russia
Position:	**Senior Member of Research Staff** (1997) **Member of Research Staff** (1987-1997) **Junior Member of Research Staff** (1981-1987)
Major field:	Research in the area of optoelectronics and semiconductor physics
1992 – 06/97	Department of Industrial Electronics, Northwestern Polytechnic Institute, St. Peterburg, Russia
Position:	**Docent (part time)**
Major field:	Teaching courses on optoelectronic and electronic devices

Honors and Awards

Senior Visiting EPSRC Fellow Award it the UK, University of Sheffield, May-July 2006

Award of Royal Society and Russian Academy of Sciences, Program of Exchange Visits, Oct.-Dec. 1996
Award in the Annual Competition, A.F. Ioffe Physical-Technical Institute 1993
First Prize in the Annual Competition, A.F. Ioffe Physical-Technical Institute 1985

Service

1. International journal "Optics Express", Associate Editor
2. CLEO/QELS 2006 subcommittee "Fundamentals of Metamaterials, Periodic and Random Media", alternate chair and member
3. National Science Foundation Review Panel 2004 and 2006
4. International Expert Panel on Priority DFG Program "Photonic Crystals" in Germany, 2000-present
5. Frequent Reviewer for *Applied Physics Letters*, *Advanced Materials*, *Physical Review* B, *J. of Applied Physics*, *J. of Quantum Electronics*, *Langmuir*, *Chemistry of Materials*, *European Physics Journal* B.

Major Research Interests

Novel structures and materials:
Microcavities and photonic crystals, coupled resonator optical waveguides, opals.
Quantum optics:
Light-matter interaction, optical coupling between high-*Q* cavities, localization of light, polaritons.
Optoelectronics applications:
Itegrated optical circuits, delay lines, sensors and microspectrometers.

Professional Experience

a)) Graduate students
At A.F. Ioffe Institute: Yurii Vlasov (IBM, Ph.D. 1995, advisee in 1991-97), Oleg Karimov (Toshiba Cambridge, UK, Ph.D. 2000, advisee in 1993-97)
At *the University of Sheffield*: Alan Bristow (University of Toronto, Ph.D. 2003), Ali Adawi (Jordan, Ph.D. 2002), Mohammed Emam-Ismail (Egypt, Ph.D. 2002), Mark Stevenson (Toshiba Cambridge, UK, Ph.D. 2000). I acted as a co-supervisor of their Ph.D. thesis in 1998-01.
At UNC-Charlotte: Jason Franchak (M.S.2004), Shashanka Ashili (Ph.D. student).
e) Postdocs
Dr. Andrey Kapitonov

Research Grants

2005 *Resonant Optical Circuits Based on Coupling Between Whispering Gallery Modes in Dielectric Microresonators*
ARO Grant No. W911NF-05-1-0529
PI, 100% effort, Total $85,000

2005 *High Order Numerical Methods for Light Propagation in Micro-Photonics*
NSF Grant No. CCF-0513179
Co-PI, 100% effort, Total $180,000

2004 *Synthetic Opals for Multimodal Spectroscopy of Diffusive Sources of Light*
Duke University
PI, 100% effort, Total $20,000

2004 *Optical Transport Properties of Circuits Formed by Coupled Microresonators*
UNCC Faculty Research Grant
PI, 100% effort, Total $6,000

2002-04 *Coupled Microspheres Waveguides*
UNCC Faculty Research Grant
PI, 100% effort, Total $6,000

2000-01 *EM Properties, Band Structure and Light Matter Interaction in Semiconductor Photonic Crystals*
EPSRC grant No. GR/M72951 (in the UK)
Major contributions to this proposal, Total £162,000

10-12/96 Award of the Program of Exchange Visits, Royal Society, Total £3,000

1995-97 *Photonic Band Gaps in Opals*
Russian Fund for Basic Research grant No. 960217928-a
PI, 100% effort, Total $20,000

Teaching Experience

1. At UNC-Charlotte:
- ***Quantum Theory I***, graduate course PHYS6141.
- ***Light Sources and Detectors***, graduate course PHYS6000C03/PHYS6241.
- ***Optical Materials I***, graduate course OPTI6105/8105
- ***Physics for Science and Engineering***, undergraduate course PHYS2102.
- ***Physics for Science and Engineering II Laboratory***, PHYS2102-L12.
- ***Introductory lecture on photonic crystals***, CHEM 6090/8090, Spring 2004.

2. First year physics tutorials at the University of Sheffield in 1997-2001.

3. Undergraduate lecture courses at Northwestern Polytechnic Institute, St.-Peterburg, Russia, in 1992-1997:
- ***Optoelectronics***.
- ***Microwave and Quantum devices***.
- ***Principles of Electronic Devices***.

.

Publications (selected) (More than 70 refereed journal articles and 8 patents):

1. Optical Coupling in Dielectric Bispheres with Gap Sizes Controlled by Stretchable Substrate S.P. Ashili, V.N. Astratov, and C. Sykes, *Opt. Lett.* (submitted, 2006).

2. Optical Coupling at a Distance Between Detuned Spherical Cavities
A.V. Kanaev, V.N. Astratov, and W. Cai, accepted to *Appl. Phys. Lett*. (2006).

3. Optical Coupling and Transport Phenomena in Chains of Spherical Dielectric Microresonators with Size Disorder
V.N. Astratov, J.P. Franchak, and S.P. Ashili, *Appl. Phys. Lett*. v. **85**, 5508-5510 (2004).

4. Numerical Study of Light Propagation via Whispering Gallery Modes in Microcylinder Coupled Resonator Optical Waveguides,
S. Deng, W. Cai, and V.N. Astratov, *Optics Express* **12**, 6468-6480 (2004).

5. Interplay of Order and Disorder in the Optical Properties of Opal Photonic Crystals
V.N. Astratov, A.M. Adawi, S. Fricker, M.S. Skolnick, D.M. Whittaker, and P.N. Pusey
Phys. Rev. **B66**, art.165215 (2002)

6. Opal Photonic Crystals Infiltrated with Chalcogenide Glasses
V.N. Astratov, A.M. Adawi, M.S. Skolnick, V.K. Tikhomirov, V. Lyubin, D.G. Lidzey, M. Ariu, and A.L. Reynolds
Appl. Phys. Lett., v.**78**, No.26, 4094-4096 (2001)

31. Uncoupled Excitons in Semiconductor Microcavities Detected in Resonant Raman Scattering
R.M. Stevenson, V.N. Astratov, M.S. Skolnick, J.S. Roberts, and G. Hill
*Phys.Rev.***B67**, No.8, art. no. 081301(R), 2003

32. Transition from Strong to Weak Coupling and the Onset of Lasing in Semiconductor Microcavities
R. Butte, G. Delalleau, A.I. Tartakovskii, M.S. Skolnick, V.N. Astratov, J.J. Baumberg, G. Malpuech, A. Di Carlo, A.V. Kavokin, and J.S. Roberts
*Phys.Rev.***B65**, No.20, art. no. 205310, 2002

33. Polariton-Polariton Interactions and Stimulated Scattering in Semiconductor Microcavities
M.S. Skolnick, R.M. Stevenson, A.I. Tartakovskii, R. Butte, M. Emam-Ismail, D.M. Whittaker, P.G. Savvidis, J.J. Baumberg, A. Lemaitre, V.N. Astratov, J.S. Roberts
Mat. Sci. Eng.C-Biomimetic and Supramolecular Systems, v.19, No.1-2, 407-416 Sp. Iss. SI, 2002

7. Manifestation of Intrinsic Defects in Optical Properties of Self-Organized Opal Photonic Crystal
Y.A. Vlasov, V.N. Astratov, A.V. Baryshev, A.A. Kaplyanskii, O.Z. Karimov, and M.F. Limonov *Phys. Rev.* **E61**, No.5, 5784-5793 (2000)

8. Optical Gain of CdS quantum dots embedded in a 3D photonic crystals
Y.A. Vlasov, K. Luterova, I. Pelant, B. Honerlage, and V.N. Astratov
Thin Solid Films, v.**318**, No.1-2, pp.93-95 (1998)

9. Optical Gain and Lasing in a Semiconductor Embedded in a Three-Dimensional Photonic Crystal
Y.A. Vlasov, K. Luterova, I. Pelant, B. Honerlage, and V.N. Astratov
Journal of Crystal Growth, v.**185**, pp.650-653 (1998)

11. Enhancement of optical gain of semiconductors embedded in three-dimensional photonic crystals
Y.A. Vlasov, K. Luterova, I. Pelant, B. Honerlage, and V.N. Astratov
Appl. Phys. Lett., v.**71**, No.12, pp.1616-1618 (1997)

12. Existence of a photonic pseudogap for visible light in synthetic opals
Y.A. Vlasov, V.N. Astratov, O.Z. Karimov, A.A. Kaplyanskii, V.N. Bogomolov, and A.V. Prokofiev
Phys. Rev. **B 55**, No.20, R13357-13360 (1997)

13. Electron Microscopy and Optical Characterization of Lattices of Photonic Crystals

Y.G. Musikhin, V.N. Astratov, N.A. Bert, V.N. Bogomolov, A.A. Kaplyanskii, O.Z. Karimov, and Y.A. Vlasov
Proc. of 23rd Int. Symp. on Compound Semicond., St.-Petersburg, September 23-27 (1996) Inst. of Phys. Conf. .Series, IOP Publishing, No.155, pp.161-164 (1997).

14. **Influence of Refractive Index Contrast on Photonic Band Gap in 3D Periodic SiO_2 Matrices Filled with a Semiconductor**
V.N. Astratov, Yu.A. Vlasov, V.N. Bogomolov, A.A. Kaplyanskii, O.Z. Karimov, D.A. Kurdjukov, and A.V. Prokofiev
Proc. of 23rd Int.Symp.on Compound Semicond., St.-Petersburg, September 23-27 (1996) Inst. Phys. Conf. Series, IOP Publishing No.155, pp.73-76 (1997).

23. **Heavy Photon Dispersions in Photonic Crystal Waveguides**
V.N. Astratov, R.M. Stevenson, I.S. Culshaw, D.M. Whittaker, M.S. Skolnick, T.F. Krauss, and R.M. De La Rue
Appl. Phys. Lett., v.77, No.2, 178-180 (2000)
24. **Photonic Band Structure Effects in the Reflectivity of Periodically Patterned Waveguides**
V.N. Astratov, D.M. Whittaker, I.S. Culshaw, R.M. Stevenson, M.S. Skolnick, T.F. Krauss, and R.M. DeLaRue
Phys. Rev. **B60**, No.24, R16255-16258 (1999)
25. **Resonant Coupling of Near-Infrared Radiation to Photonic Band Structure Waveguides**
V.N. Astratov, I.S. Culshaw, R.M. Stevenson, D.M. Whittaker, M.S. Skolnick, T.F. Krauss, and R.M. DeLaRue
J. of Lightwave Technology, v.17, No.11, 2050-2057 (1999)
26. **Reflectivity Studies of Photonic Band Structure Effects in Two-Dimensianal Air/Semiconductor Lattices**
V.N. Astratov, R.M. Stevenson, I.S. Culshaw, D.M. Whittaker, M.S. Skolnick, T.F. Krauss, and R. M. De La Rue
Phys. Status Solidi (a) **178**, No.1, 565-569 (2000)
27. **Determination of the Band Structure of Photonic Crystal Waveguides**
I.S. Culshaw, V.N. Astratov, R.M. Stevenson, D.M. Whittaker, M.S. Skolnick, T.F. Krauss, and R.M. De La Rue
*Physica **E***, v.7, No.3-4, 650-655 (2000)
28. **Experimental Technique to Determine the Band Structure of Two-Dimensional Photonic Lattices**
V.N. Astratov, R.M. Stevenson, M.S. Skolnick, D.M. Whittaker, S. Brand, I.S. Culshaw, T.F. Krauss, R.M. DeLaRue, and O.Z. Karimov
IEE Proceedings-Optoelectronics, vol.145, 398-402 (1998)
29. **Experimental Measurement of Dispersion Curves of Semiconductor Two Dimensional Photonic Lattices**
V.N. Astratov, R.M. Stevenson, O.Z. Karimov, M.S. Skolnick, D.M. Whittaker, S. Brand, I. Culshaw, T.F. Krauss, and R.M. De La Rue, Proc. of ICPS-24, Jerusalem, August 2-7, 4pp., 1998
30. **Waveguide Photonic Crystals and Microstructures**
R.M. De La Rue, C.J.M. Smith, C.D.W. Wilkinson, T.F. Krauss, H. Benisty, C. Weisbuch, D. Labilloy, U. Oesterle, M. Illegems, R. Houdre, V.N. Astratov, and M.S. Skolnick
Proc. of ACOFT'99, Hilsons Point, NSW, Australia, 8pp., 1999

Semiconductor Quantum Microcavities

31. Uncoupled Excitons in Semiconductor Microcavities Detected in Resonant Raman Scattering
R.M. Stevenson, V.N. Astratov, M.S. Skolnick, J.S. Roberts, and G. Hill
*Phys.Rev.***B67**, No.8, art. no. 081301(R), 2003

32. Transition from Strong to Weak Coupling and the Onset of Lasing in Semiconductor Microcavities
R. Butte, G. Delalleau, A.I. Tartakovskii, M.S. Skolnick, V.N. Astratov, J.J. Baumberg, G. Malpuech, A. Di Carlo, A.V. Kavokin, and J.S. Roberts
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33. Polariton-Polariton Interactions and Stimulated Scattering in Semiconductor Microcavities
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Mat. Sci. Eng.C-Biomimetic and Supramolecular Systems, v.19, No.1-2, 407-416 Sp. Iss. SI, 2002

34. Continuous Wave Observation of Massive Polariton Redistribution by Stimulated Scattering in Semiconductor Microcavities
R.M. Stevenson, V.N. Astratov, M.S. Skolnick, D.M. Whittaker, M. Emam-Ismail, A.I. Tartakovskii, P.G. Savvidis, J.J. Baumberg, and J.S. Roberts
Phys. Rev. Lett. **85**, No.17, 3680-3683 (2000)

35. Asymmetric Photoluminescence Spectra from Excitons in a Coupled Microcavity
M. Emam-Ismail, V.N. Astratov, M.S. Skolnick, D.M. Whittaker, and J.S. Roberts
Phys. Rev. **B62**, No.3, 1552-1555 (2000)

36. Exiton-Polaritons in Single and Coupled Microcavities
M.S. Skolnick, V.N. Astratov, D.M. Whittaker, A. Armitage, M. Emam-Ismail, R.M. Stevenson, J.J. Baumberg, J.S. Roberts, D.G. Lidzey, T. Virgili, and D.D.C. Bradley
J. of Luminescence, v.87-89, 25-29 (2000)

37. Spatial Coherence of Polaritons in Semiconductor Microcavities
A.I. Tartakovskii, D.N. Krizhanovskii, V.D. Kulakovskii, N.A. Gippius, S.G. Tikhodeev, M.S. Skolnick, V.N. Astratov, and J.S. Roberts
Phys.Status Solidi (b), v.221, No.1, 163-167 (2000)

38. Nonlinearities in Emission from the Lower Polariton Branch of Semiconductor Micricavities
A.I. Tartakovskii, V.D. Kulakovskii, D.N. Krizhanovskii, M.S. Skolnick, V.N. Astratov, A. Armitage, and J.S. Roberts
Phys. Rev. **B60**, No.16, R11293-11296 (1999)

39. Nonlinear Effects in Semiconductor Microcavity Polariton Emission
V.D. Kulakovskii, A.I. Tartakovskii, D.N. Krizhanovskii, A. Armitage, J.S. Roberts, V.N. Astratov, and M.S. Skolnick
Phys.Status Solidi (a), v.178, No.1, 381-384 (2000)

40. Exciton-Light Coupling in Single and Coupled Microcavities: Polariton Dispersion and Polarisation Splitting
G. Panzarini, L.C. Andreani, A. Armitage, D. Baxter, M.S. Skolnick, V.N. Astratov, J.S. Roberts, A.V. Kavokin, M.V. Vladimirova, and M.A. Kaliteevski
Phys. Rev. **B59**, No.7, 5082-5089 (1999)

41. Cavity-Polariton Dispersion and Polarisation Splitting in Single and Coupled Semiconductor Microcavities

G. Panzarini, L.C. Andreani, A. Armitage, D. Baxter, M.S. Skolnick, V.N. Astratov, J.S. Roberts, A.V. Kavokin, M.V. Vladimirova, and M.A. Kaliteevski
Physics of the Solid State, v.41, No.8, 1223-38 (1999)

42. Optically Induced Splitting of Bright Excitonic States in Coupled Quantum Microcavities
A. Armitage, M.S. Skolnick, V.N. Astratov, D.M. Whittaker, G. Panzarini, L.C. Andreani, T.A. Fisher, J.S. Roberts, A.V. Kavokin, M.A. Kaliteevski, and M.R. Vladimirova
Phys. Rev. **B57**, No.23, 14877-14881 (1998)

43. Polariton-Induced Optical Asymmetry in Semiconductor Microcavities
A. Armitage, M.S. Skolnick, A.V. Kavokin, D.M. Whittaker, V.N. Astratov, G.A. Gehring, and J.S. Roberts
Phys. Rev. **B58**, 15367-15370 (1998)

44. Photo-Induced Lifting of the Degeneracy of Excitonic States in Coupled Quantum Microcavities
A. Armitage, M.S. Skolnick, V.N. Astratov, D.M. Whittaker, T.A. Fisher, J.S. Roberts, G. Panzarini, L.C. Andreani, A.V. Kavokin, M.A. Kaliteevski, and M.R. Vladimirova
*Physica **E***, v.2, No.1-4, 54-58 (1998)

45. Polarization-Dependent Phenomena in the Reflectivity Spectra of Semiconductor Quantum Microcavities
D. Baxter, M.S. Skolnick, A. Armitage, V.N. Astratov, D.M. Whittaker, T.A. Fisher, J.S. Roberts, D.J. Mowbray, and M.A. Kaliteevskii
Phys. Rev. **B 56**, No.16, R10032-10035 (1997)

46. Exciton-Polaritons in Semiconductor Microcavities
M.S. Skolnick, D.M. Whittaker, D. Baxter, W.R. Tribe, J.J. Baumberg, V.N. Astratov, R.M. Stevenson, A. Armitage, D.J. Mowbray, and J.S. Roberts
Proc. of ICPS-24, Jerusalem, August 2-7 (1998), World Scientific, Singapore, 25-32 (1999)

47. Angle Resolved Spectroscopy of Two- and One-Dimensional Microcavity Polaritons
V.D. Kulakovskii, A.I. Tartakovskii, J.P. Reithmaier, A. Forchel, N.A. Gippius, A. Armitage, M.S. Skolnick, V.N. Astratov, and J.S. Roberts
Proc. of EXCON'98, Electrochemical Society Inc, Pennington, NJ, USA, 20-27 (1998)

48. Excitons and Polaritons in Semiconductor Microcavities
D.M. Whittaker, M.S. Skolnick, T.A. Fisher, A. Armitage, D. Baxter, and V.N. Astratov
Proc. of OECS-5, Goettingen, Germany, August 11-14 (1997)
*Phys.Stat.Sol.**A***, v.164, No.1, pp.13-17 (1997)

49. Polariton Dispersion and Polarisation Splitting for Quantum Well Excitons in Single and Coupled Microcavities
G. Panzarini, L.C. Andreani, A. Armitage, D. Baxter, M.S. Skolnick, J.S. Roberts, V.N. Astratov, M.A. Kaliteevski, A.V. Kavokin, and M.R. Vladimirova
Proc. of OECS-5, Goettingen, Germany, August 11-14 (1997)
Phys.Stat.Sol.**A**, v.164, No.1, pp.91-94 (1997)

Kenneth L. Bost, Ph.D.
Belk Distinguished Professor of Biology
Department of Biology
The University of North Carolina at Charlotte
9201 University City Blvd.
Charlotte, NC 28223-0001
Phone: 704-687-8677; FAX: (704) 687-3128; email: klbost@email.uncc.edu
web page: http://www.bioweb.uncc.edu/Faculty/Bost/index.htm

A. EDUCATION:

1975 - 1979: University of North Carolina at Chapel Hill
Bachelor's Degree 1979.
Major: Zoology

1979 - 1984: University of Mississippi Medical Center
Doctor of Philosophy 1984
Microbiology and Immunology

1984 - 1985: University of Texas Medical Branch
McLaughlin Postdoctoral Fellowship

B. PROFESSIONAL AND TEACHING EXPERIENCE:

1985 - 1986: Research Assistant Professor, University of Texas Medical Branch, Galveston, Texas

1985 - 1988: Consultant, Triton Biosciences, Inc., Alameda, California

1986 - 1990: Assistant Professor (Tenure track), Department of Physiology, University of Alabama, Birmingham, Alabama

1986 - 1990: Associate Scientist, University of Alabama at Birmingham, Comprehensive Cancer Center

1987: Lecturer in Physiology Graduate Seminar Course, "Endocrinology, and Immunology", University of Alabama at Birmingham.

1988:Co-director and Lecturer, Department of Physiology, Advanced Graduate Student Course, "Neuroimmunology", University of Alabama at Birmingham

1988 - 1990: Joint appointment in the Department of Cell Biology, University of Alabama at Birmingham

1989: Lecturer in Physiology for Dental Students, University of Alabama at Birmingham

1990 - 1992: Assistant Professor (Tenure track), Department of Microbiology and Immunology, Tulane University Medical Center, New Orleans, Louisiana

1990: Lecturer, Medical Microbiology for Medical Students, Tulane University Medical Center

1990-1992: Instructor, Medical Microbiology Laboratory for Medical Students, Tulane University Medical Center

1991 – 1998: Course Director and principal lecturer, Advanced Graduate Immunology, Department of Microbiology and Immunology, Tulane University Medical Center

1991 – 1998: Course Director and principal lecturer, Immunology for Medical Students, Department of Microbiology and Immunology, Tulane University Medical Center

1992 – 1997: Associate Professor (Tenured) and Member of the Graduate Faculty, Department of Microbiology and Immunology, Tulane University Medical Center

1992 – 1998: Member, Cell & Molecular Biology Graduate Program, Tulane University Medical Center

1993 – 1995: Lecturer in Cell & Molecular Biology course, "Cell & Molecular Biology" entitled "Immunology", Tulane University Medical Center

1993 – 1998: Lecturer in Pharmacology course "Principles of Pharmacology" entitled "Immunopharmacology", Tulane University Medical Center

1993 – 1998: Lecturer in Pharmacology course, "Cellular Control Mechanisms", entitled "Control of the immune response"Tulane University Medical Center

1993 – 1998: Contributing Member, Tulane Cancer Center, Tulane University Medical Center

1994: Lecturer in Anatomy course, "Neuroendocrinology", entitled "Neuroendocrine Immunology", Tulane University Medical Center

1997 – 1998: Professor, Department of Microbiology and Immunology, Tulane University Medical Center

1998 – present: Belk Distinguished Professor of Biology, University of North Carolina at Charlotte, Charlotte, North Carolina

1998- 2000: Course director and Principal Lecturer, ‘Host-Pathogen Interactions’ UNC-Charlotte

1999-2000: Lecturer in course for Ph.D. students, ‘Advanced Immunology’, UNC-Charlotte

2000, 2001: Course Director and Principal Lecturer, ‘Immunology’, UNC-Charlotte

2001, 2003: Course Director and Principal Lecturer, ‘Immunology Laboratory’, UNC-Charlotte

2001-present: Course Director and Principal Lecturer, ‘Virology’, UNC-Charlotte

2002-2004: Course Director and Principal Lecturer, ‘Advanced Immunological Techniques’, UNC-Charlotte

2005: Course Director and Principal Lecturer, “Reviewing NIH Grants”, UNC-Charlotte.

2006: Course Director and Principal Lecturer, “How to be a Professional Scientist”, UNC-Charlotte.

C. CURRENT RESEARCH SUPPORT:
Project Period 8/01/2005 - 7/31/2008: "Efficacy of soybean-based vaccines using a model antigen" NIH R01AI061123. Total costs $827,951. Kenneth J. Piller, Principal Investigator, Kenneth L. Bost, Co-Investigator

Project period 9/30/2004 – 8/31/2006: "An edible adjuvant expressed in transgenic soybeans", NIH RO3AI061102. Total costs $132,500. Kenneth L. Bost, Principal Investigator, Kenneth J. Piller, Co-Investigator.

Project period July 2002 - June 2007: "Macrophage activation and substance P receptor expression", NIH, RO1 AI32976. Total costs $1,112,056. Kenneth L. Bost, Principal Investigator, Ian Marriott, Co-Investigator.

Project period July 2005-May 2006: "MDMA-altered immune response and gammaherpesvirus pathogenesis". Senior Faculty Research Grant, UNC-C. Total costs $6,000. Kenneth L. Bost, Principal Investigator.

D. RECENT PREVIOUS RESEARCH SUPPORT:
Project period: 07/01/00 - 06/30/03: 'Exacerbation of EAE following murine gammaherpesvirus infection', NIH RO1 AI30407. Total costs; $593,745 Kenneth L. Bost, Principal Investigator, William Hickey, Co-Investigator.

Project Period June 1, 2001- May 30, 2004, Limited IL-12RB2 receptor expression during salmonellosis, NIH RO1 AI47181. Total Costs $487,500. Kenneth L. Bost, Principal Investigator, Ian Marriott and Michael Hudson, Co-investigators.

Project period: 07/01/01 - 06/30/03: Supplement to RO1 grant AI30407:'Exacerbation of EAE following murine gammaherpesvirus infection', NIH RO1 AI30407S. Total costs $139,516. Kenneth L. Bost, Principal Investigator, Yvette Huet-Hudson, Co-investigator.

Project period July 1997 - June 2002: "Macrophage activation and substance P receptor expression", NIH, RO1 AI32976. Total costs $957,043. Kenneth L. Bost, Principal Investigator, Michael Mason and Ian Marriott, Co-Investigators.

Project Period: December 01, 2000-November 30, 2002. Staphylococcus aureus-infected osteoblasts initiate an inflammatory response. Aircast Foundation for Medical Research: Total costs $100,000. Principal Investigator: Michael Hudson, Co-investigator, Kenneth L. Bost.

E. SYNERGISTIC ACTIVITIES (selected)
1. Ad Hoc Reviewer, Endocrinology, Journal of Neuroimmunology, American Journal of Physiology, Peptide Research, Peptides, Journal of Immunological Methods, Infection and Immunity, Biochemical Pharmacology, Journal of Immunology, Biotechniques, Regional Immunology, NeuroImmunoModulation, American Journal of Respiratory Cell and Molecular Biology, Biotechniques, Shock, Journal of Clinical Investigation, Journal of Experimental Medicine, Journal of Leukocyte Biology, Microbiology, Journal of Infectious Disease, Molecular Microbiology

2. Editorial Board Member, Infection and Immunity, 1995 - present.

3. Managing Editor, Frontiers in Bioscience, 2004- present.

4. Chairman, NIH Study Section, Brain Disorders and Clinical Neuroscience-4 Study Section Special Emphasis Panel ZRG1-BDCN-4, December 2000.

5. Chairman, NIH Study Section, Novel HIV Therapies Special Emphasis Panel, ZAI1 TS-A, March 31, 2005.

F. PAST AND PRESENT GRADUATE STUDENTS

Nancy Gasper, 2003-present, predoctoral student investigating murine gammaherpesvirus pathogenesis.

Tian Lin, 2001- 2005, as a predoctoral student investigating the initiation of mucosal immune responses. Postdoctoral Fellow, Tufts University, Department of Microbiology, Boston Massachusetts.

Sherine Elsawa, Ph.D. 1999-2003, as a predoctoral student investigated the immune response against murine gammaherpesvirus 68. Present position: Postdoctoral Fellow, Department of Microbiology and Immunology, Mayo Clinic, Rochester, Minnesota.

James Peacock, Ph.D., 1996-2000, as a predoctoral student investigated host-pathogen response to murine gammaherpesvirus-68. Present Position: Postdoctoral Fellow, Duke University Medical Center, Durham, North Carolina.

Adam Elhofy,Ph.D., 1996-2000, as a predoctoral student investigated the expression of IL-12 beta 2 chain receptor expression during salmonellosis. Present position: Research Associate, Northwestern University Medical Center, Chicago, Illinois.

G. PAST AND PRESENT POST-DOCTORAL FELLOWS

David W. Pascual, Ph.D., 1987-1990. University of Alabama at Birmingham. Present position: Tenured Associate Professor Department of Veterinary Molecular Biology, Montana State University.

Benjamin L. Clarke, Ph.D., 1988-1990. University of Alabama at Brmingham. Present position: Tenured Associate Professor, Department of Cell Biology, University of Minnesota-Duluth.

Sam Bieligk, M.D., 1993-1995. Tulane University Medical Center. Surgical Resident, Department of Surgery, Tulane University Medical Center. Awarded position in Surgical Oncology Research Program at Sloan-Kettering Cancer Research Insitute, June 1995.

Dippon Sidiqqui, M.D., 1993-1994. Tulane University Medical Center. Completed residency program in Internal Medicine, University of Arkansas Medical Center.

Tammy Kincy-Cain, Ph.D., 1995-1996. Tulane University Medical Center. Present position: High School Biology Teacher, Dallas, Texas.

Ian Marriott, Ph.D., 1996-1998. Tulane University Medical Center. Present position: Tenured Associate Professor, Department of Biology, University of North Carolina at Charlotte.

Christal Bowman, Ph.D., 2001-2004, University of North Carolina at Charlotte. Present position: Research Associate NIEHS, Research Triangle Park, North Carolina.

H. PUBLICATIONS (selected, 135 total):

1. Bost, K.L., Bento, J.L., Petty, C.C., Schrum, L.W., Hudson, M.C., and Marriott, I. Monocyte chemoattractant protein-1 expression by osteoblasts following infection with Staphylococcus aureus or Salmonella. J. Interferon Cyto. Res. 21:297-304, 2001.

2. Alexander, E.H., Bento, J.L., Hughes, F.M., Marriott, I., Hudson, M.C., and Bost, K.L. Staphylococcus aureus and Salmonella enterica serovar Dublin induce tumor necrosis factor-related apoptosis-inducing ligand expression by normal mouse and human osteoblasts. Infect. Immun. 69:1581-1586, 2001.

3. Peacock, J.W., and Bost, K.L. Murine gammaherpesvirus-68 induced IL-10 increases viral burden but limits viral-induced splenomegaly and leukocytosis. Immunology, 104:109-117, 2001.

4. Marriott I., Hughes, F.M. Jr, and Bost, K.L. Bacterial infection of osteoblasts induces interleukin-1beta and interleukin-18 transcription but not protein synthesis. J. Inter. Cytokine Res. 22:1049-1055, 2002.

5. McConnell N.A., Yunus R.S., Gross S.A., Bost K.L., Clemens M.G., and Hughes F.M. Jr. Water permeability of an ovarian antral follicle is predominantly transcellular and mediated by aquaporins. Endocrinol. 143: 2905-2912, 2002.

6. Gasper N.A., Petty C.C., Schrum L.W., Marriott I., and Bost K.L. Bacterium-induced CXCL10 secretion by osteoblasts can be mediated in part through toll-like receptor 4. Infect. Immun. 70: 4075-4082, 2002.

7. Schrum, L.W., Marriott, I., Patel, D.R., Thomas, E.K., Hudson, M.C., and Bost, K.L. Functional CD40 expression induced following bacterial infection of mouse and human osteoblasts. Infect. Immun. 71:1209-1216, 2003.

8. Elsawa, S.F., Taylor, W., Petty C. C., Marriott, I., Weinstock, J.V., and Bost, K.L. Reduced CTL response and increased viral burden in substance P receptor deficient mice infected with murine gammaherpesvirus 68. J. Immunol. 170:2605-2612, 2003.

9. Alexander, E. H., Rivera, F. A., Marriott, I., Anguita, J., Bost, K. L. and Hudson, M. C. *Staphylococcus aureus*-Induced Tumor Necrosis Factor-Related Apoptosis-Inducing Ligand Expression Mediates Apoptosis and Caspase-8 Activation in Infected Osteoblasts. BMC Microbiol. 3:5-15, 2003.

10. Peacock, J.W., Elsawa, S.F., Petty, C.C., Hickey, W.F., and Bost, K.L. Exacerbation of experimental autoimmune encephalomyelitis in rodents infected with murine gammaherpesvirus-68. Eur J Immunol. 33:1849-58, 2003.

11. Schrum, L.W., Bost, K.L., Hudson, M.C., and Marriott, I. Bacterial infection induces expression of functional MHC class II molecules in murine and human osteoblasts. Bone 33:812-21, 2003.

12. Pascual, D.W., and Bost, K.L. Neuropeptides for mucosal immunity. In:Handbook of Mucosal Immunology, 3rd edition (P.L. Ogra, M.E. Lamm, J. R. McGhee, J. Mestecky, W. Strober, and J. Bienenstock, eds), Academic Press, N.Y. 2004, Chapter 38.

13. Elsawa, S.F., and Bost, K.L. Murine gammaherpesvirus induces IL-12 which limits viral burden and contributes to viral-induced leukocytosis. J. Immunol. 172:516-524, 2004.

14. Bowman, C.C., and Bost, K.L. Cyclooxygenase-2 mediated prostaglandin E_2 production in mesenteric lymph nodes and in cultured macrophages and dendritic cells following infection with Salmonella. J. Immunol., 172:2469-2475, 2004.

15. Marriott, I., Gray, D.L., Tranguch, S.L., Fowler, V.G., Stryjewski, M., Levin S.L , Hudson, M.C., and Bost, K.L. Osteoblasts express the inflammatory cytokine IL-6 in a murine model of Staphylococcus aureus osteomyelitis and infected human bone tissue. Am. J. Pathol. 164:1399-406, 2004.

16. Lin, T., and Bost, K.L. STAT3 activation in macrophages following in vivo or in vitro infection with Salmonella. Biochem. Biophys. Res. Comm. 321:828-834, 2004.

17. Nelson, D.A., Marriott, I., and Bost, K.L. Expression of hemokinin 1 mRNA by murine dendritic cells. J. Neuroimmunol., 155: 94-102, 2004.

18. Rasley, A., Bost, K.L., and Marriott, I. Murine gammaherpesvirus-68 elicits robust levels of interleukin 12p40 but not interleukin 12 p70 production by murine microglia and astrocytes. J. Neurovirol. 10: 171-180, 2004.

19. Bost, K.L. Tachykinin-mediated modulation of the immune response. Front. Biosci. 9, 3331-3332, 2004.

20. Gasper-Smith, N. and Bost, K.L. Initiation of the host response against murine gammaherpesvirus infection in immunocompetent mice. Viral Immunol. 17: 473-480, 2004.

21. Marriott, I., Gray, D.L., Rati, D.M., Fowler, V.G., Stryjewski, M.E., Levin, L.S., Hudson, M.C., and Bost, K.L. Osteoblasts produce monocyte chemotractant protein-1 in a murine model of Staphylococcus aureus osteomyelitis and infected human bone tissue. Bone 37: 504-512, 2005.

22. Nelson, D.A., and Bost, K.L. Quantification of hemokinin-1 peptide production and secretion from mouse B cells. Cell. Immunol., in press, 2006.

BIOGRAPHICAL SKETCH

NAME: **Robin N. Coger, Ph.D.**	POSITION TITLE: **Associate Professor**

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, and include postdoctoral training.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	YEAR(s)	FIELD OF STUDY
Cornell University, Ithaca, NY	B. S.	1988	Mechanical Engineering
Univ. of California, Berkeley, Berkeley, CA	M.S.	1990	Mechanical Engineering
Univ. of California - Berkeley, Berkeley, CA	Ph. D.	1993	Mechanical Engineering
Harvard Medical School, Boston, MA	Post-doc	1993-1996	Liver Tissue Engineering

RESEARCH AND PROFESSIONAL EXPERIENCE: Concluding with present position, list, in chronological order, previous employment, experience, and honors. Include present membership on any Federal Government public advisory committee. List, in chronological order, the titles, all authors, and complete references to all publications during the past three years and to representative earlier publications pertinent to this application. If the list of publications in the last three years exceeds two pages, select the most pertinent publications. **DO NOT EXCEED THREE PAGES.**

Professional Experience

1993 - 1996 Postdoctoral Research Fellow, Department of Surgery
Harvard Medical School/ Massachusetts General Hospital/ Shriners Burns, Boston, MA

2/96 - 6/96 Visiting Professor, University of North Carolina - Charlotte

7/96 – present Faculty (Assistant and now Associate Professor) in Mechanical Engineering and Engineering Science Department, University of North Carolina – Charlotte, North Carolina and Director of the Engineering of Biological Materials and Devices Laboratory.

5/05 – present Director, Center for Biomedical Engineering Systems, UNC-Charlotte Charlotte, NC

1996 – present Reviewer for journals and books (*ASME J Biomechanical Engineering,Biotechnology and Bioengineering, Tissue Eng, J Biochem and Biophys Meth*, etc.. *)*

1997 – present Reviewer for NSF study sections (Bioengineering and Environmental Systems)

Honors and Awards

1997-1998 Curriculum/Instructional Development Award - UNC-Charlotte

1999 NSF New Century Scholar, Stanford University, Palo Alto, CA

2001 Graduate Student – Joseph Lambert awarded 2001 Recipient of Cameron Research Award, Charlotte, NC

2002 Awarded Undergraduate Teaching Excellence Award, College of Engineering, UNC Charlotte

Research Interests Liver Tissue Engineering; Cryopreservation; Heat and Mass Transfer

Representative Refereed Publications (*partial listing)*

Coger R, Rubinsky B, and Pegg DE, "Dependence of Probability of Vitrification on Time and Volume", Cryo-Letters, 11: 359 - 372, 1990

Rubinsky B, **Coger R**, and Pegg D, " Dependence of Probability of Vitrification on Time and Volume", Royal Microscopical Proceedings, 4th International Meeting on Low Temperature Biological Microscopy and Analysis, Vol. 25, Pt. 2 Supplement,1990.

Coger R, Rubinsky B, and Fletcher G, "Comparative Study of the Two Phase Interface of Several Thermal Hysteresis Proteins", Cryobiology, 29: 729, 1992

Coger R., Rubinsky B., and Pegg DE, "Thermodynamics of Nucleation During Preservation of Biological Tissue By Vitrification", Advances in Bioengineering , BED- Vol. 17, ed. S.A. Goldstein, ASME Press, New York, NY, pp. 299 - 301, 1990

Coger R, Rubinsky B, and Fletcher G, "Comparative Study of the Two Phase Interface of Several Thermal Hysteresis Proteins", Cryobiology, 29: 729, 1992

Rubinsky B, **Coger R**, Ewart KV, Fletcher GL, "Ice-Crystal Growth and Lectins", Nature, 360:113-114, 1992

Coger R, Rubinsky B, and Fletcher G., "Microscopic Pattern of Ice Crystal Growth in the Presence of Thermal Hysteresis Proteins" , J Offshore Mechanics and Arctic Engineering, 116:173 - 179, 1994

Coger RN, Moghe PV, Yarmush ML, Toner M, Biophysical Affects of ECM on Cell Organization", **Annals of** Biomedical Engineering , 24:S-52, 1996

Coger RN, Moghe PV, Ezzell RE, Toner M, Yarmush M, "The Relationship Between Cell and Matrix Movements as Hepatocytes Aggregate on EHS Matrix Gel", Tissue Engineering Society Inaugural Meeting, Orlando FL, December 1996

Moghe PV, **Coger RN,** Toner M., and Yarmush ML, "Cell Seeding Density is a Key Parameter in the Long-Term Function of Hepatocytes Cultured on Matrigel and in a Collagen Sandwich", Biotechnology and Bioengineering, 50: 706-711,1997

Coger RN, Moghe PV, Ezzell R., Yarmush ML, and Toner M. "Hepatocyte Aggregation and the Reorganization of EHS Matrix Gel", Tissue Engineering, 3(4): 375-390,1997

Namperumal R and **Coger R,** A Novel Biosensor for Measuring Cell Traction Forces in a Tissue Engineering System, Tissue Engineering, 4: 495, 1998

Namperumal R and **Coger R**, A New Cryostage Design for Cryomicroscopy, **J of Microscopy**, 192 (2): 202 -211, 1998

McClelland R. and **Coger R**, "Use of Micropathways to Improve Oxygen Transport in a Hepatic System"**, J** Biomechanical Engineering , 122:268 - 273, 2000

Lee CY, Zhang JX, DeSilva H, **Coger RN**, Clemens MG, "Heterogeneous flow patterns during hypothermic machine perfusion preservation of livers", Transplantation, 70: 1797 – 1811, 2000

Parsons JW and **Coger RN**, "A New Device for Measuring the Viscoelastic Properties of Hydrated Matrix Gels"**, J. Biomechanical Engineering,** 124: 145 – 154, 2002

McClelland, RE, MacDonald JM, and **Coger RN**, "A Predictive Model of O_2 Transport in Hepatic Devices", Biotechnology and Bioengineering, 82(1): 12-27, 2003

McClelland RM and **Coger RN**, "Effects of Enhanced O_2 Transport on Hepatocytes Packed Within a Bioartificial Liver Device", Tissue Engineering, 10(1): 253 - 266, 2004

Zinchenko YS, Laureano EB, and **Coger RN,** "Use of Directional Solidification to Determine the Thermophysical Properties of DMSO-Based Cryoprotectant Solutions", *Cell Preservation Technology*, 2(4), 2004

Balsubramanian SK and **Coger RN,** "Heat and Mass Transfer during the Cryopreservation of a Bioartificial Liver Device: A Computational Model", *ASAIO*, 51 (3): 184 – 193, 2005

Zinchenko YS and **Coger RN**, Engineering Micropatterned Surfaces for the Co-culture of Hepatocytes and Kupffer Cells, *Journal of Biomedical Materials Research,* 75A: 242-248, 2005

Zinchenko YS, Schrum LW, Clemens MG, and **Coger RN**, Co-cultures of Hepatocytes and Kuppfer cells on Micropatterned Surfaces to Optimize Hepatocyte Function, *Tissue Engineering*, 2006 *(in press)*

Lee Sang Ho, **Coger RN**, and Clemens MG, Improved Reactive Oxygen Species (ROS) Scavenging Ability of Hepatocytes in O_2 Enhanced Collagen Gel, *Tissue Engineering*, 2006 *(in press)*

Book Chapters

Coger R., Toner M., "Preservation Techniques for Biomaterials". in *The Biomedical Handbook* (ed J.D. Bronzino) CRC Press, Inc. , pp. 1567 – 1577 (1995); and in *The Biomedical Handbook – 2nd edition* (ed. J. D. Bronzino) CRC Press, pp. 45-1–45 –11 (2000)

Coger R and Toner M, *Biomaterials Principles and Applications* (ed. JB Park and JD Bronzino), CRC Press, pp. 207 -217, 2002

Representative Refereed Conference Papers over the last 3 years:

Gidwani P, Miller A, King K, Thompson K, Asher J, Xu H, **Coger R**, Clemens M, Zhang J, "Possible Link Between Chronic Hypercholesterolemia and Fibrotic Liver Disease, Experimental Biology Annual Meeting, New Orleans, LA , April 20 – 24, 2002.

McClelland RE and **Coger RN**, "Computational Model For Improving Oxygen Transport Within Bioartificial liver Devices", ASAIO Journal, 48(2): 193 , 2002

Balasubramanian SK and **Coger RN**, " Finite Element Modeling of the Cryopreservation Protocols for a Bioartificial Liver Assist Device", Proceedings of IMECE 2002-32560, BED Vol 54 (2003)

Zinchenko YZ and **Coger RN**, "Use of Directional Solidification to Determine Characteristics of Hepatic Systems during Low Temperature Cooling", Proceedings of IMECE 2002-32559, BED Vol 54 (2003)

Zinchenko Y.S. and Coger R.N., "Improving Hepatocyte Function by Kupffer Cell Interaction in Controlled Arrangements", *Biomedical Engineering Society*, Philadelphia, PA, 2004

Lee, SH, Coger RN and Clemens MG – "Improved preservation of antioxidant functionality using enhanced-collagen system under different O2 tensions in rat hepatocytes", FASEB Meeting - Experimental Biology 2005, April 2-6, 2005

Zinchenko Y.S. and Coger R.N., "Contribution of Non-Parenchymal Cells to the Performance of Micropatterned Hepatocytes", *ASME Summer Bioengineering Conference*, Vail, CO, 2005

Patents: *(pending)*

Patent Application #60/216,945: "Apparatus and Methods for Determining the Viscoelastic Properties of Materials," Date of Deposit: July 10, 2001

Current Support:

NIH Bioengineering Research Partnership (R01 DK58503-01A1), "Engineering Aspects of Liver Support Systems", Role: Co-PI and Director or Co-Director on 66% of the Proposed Research (PI: Clemens), Award Period: 10/01 – 7/06 Amount: $ 2,225,373 This grant uses an interdisciplinary approach to develop strategies for liver replacement. Its projects are focused on bioartificial liver development and liver transplantation.

Whitaker Foundation, "Improving the Performance of Engineered Liver Systems", Role:PI Award Period: 7/05 – 6/06, Amount: $76,000 This grant is focused on using additives on 2 unique methods of improving the performance and successfully storage of bioartificial liver devices

Grants that have expired within the last 5 years:

National Science Foundation, BES 9984648: "CAREER: Understanding the Role of Matrix in the Cryopreservation of Liver Systems" Role: PI, Award Period: 4/00 - 9/05 Amount: $218,000
The major goal of this grant is to investigate the effects of cell-ECM interactions on the viability of hepatocytes after storage at low temperature.

The Whitaker Foundation, "A Model for Enhanced Transport in Densely Packed Liver Systems", Role: PI, Award Period: 1/01/02 – 6/30/05 Amount: $188,000
This project uses experimental and computational approaches to evaluate the effects of adding micropathways for O_2 flow within the cellular space of bioartificial liver devices in order to improve overall performance.

Whitaker Foundation , "Machine Perfusion Preservation of Livers for Transplantation, Role: Co-PI (PI: Charles Lee), Award Period: 5/01/01- 4/30/04 Amount: $192,652 This grant investigates the use of the MPP technique in extending the time for which donor livers remain viable and suitable for transplantation.

National Science Foundation, CHE-9871160: "Acquisition of Mass Spectrometry Equipment for the Regional Analytical Chemistry Laboratory" Award Period: 9/98 - 8/01 Role: Co-PI Amount: $139,340

This MRI grant was dedicated to the acquisition of mass spectrometry equipment for use in a several interdisciplinary research projects at UNC Charlotte.

NC Space Grant Consortium, 97-1160-53: "Method of Survival of Subsurface Bacteria in Frozen Environments" Award Period: 3/00- 2/01 Role: PI Amount: $5000
The major goal of this project was to obtain results regarding the preservation of bacteria in extreme environments.

RECENT COLLABORATORS

1. Dr. Mark G. Clemens and Dr. Laura Schrum -Dept of Biology, UNC – Charlotte
2. Dr. Lola Reid and Dr. Jeffrey MacDonald, UNC-Chapel Hill

GRADUATE COMMITTEE ACTIVITIES

DOCTORAL LEVEL:

• Committee Chair:

Randall McClelland, "Experimental and Computational Analysis of Technique for Enhancing Nutrient Transport of a Tissue Engineered Liver System", UNC-Charlotte - Dept. of Mechanical Engineering, Completion Date: August 2002

Yekaterina Zinchenko, "Engineering of Micropatterned Surfaces for Bioartificial Liver Development", UNC-Charlotte, Department of Mechanical Engineering and Engineering Science, Expected Completion Date: August 2005

Mei Niu, "Improving the Functionality of Bioartificial Liver Devices", UNC-Charlotte - Dept. of Mechanical Engineering and Engineering Sciences, Expected Ph.D. Completion Date: Dec 2007

Sireesha Khambhammettu**,** "Engineering Transport Solutions within Tissue Engineered Systems", UNC- Charlotte, Dept. of Mechanical Engineering and Engineering Sciences, Expected Completion Date: Dec 2009

• Committee Member:

Rajiv Baveja,. Department of Biology, Ph. D Completed: August 2001 (Advisor: Dr. Mark Clemens)

Yukihiro Yokoyama, Dept. of Biology, Ph. D. Completed - August 2001 (Advisor: Dr. Mark Clemens)

Bhavini Desai, Dept. of Biology, Expected Ph. D. Completion Date: May 2002 (Advisor: Dr. Harshini deSilva/Dr. Mark Clemens)

Shailendra Jain, Department of Mechanical Engineering, Expected Ph. D. Completion Date: December 2006 (Advisor: Dr. Charles Lee)

Jaideep Joneja, Department of Mechanical Engineering, Expected Ph. D. Completion Date: May 2007 (Advisor: Dr. Charles Lee)

MASTERS LEVEL:

• Committee Chair:

Ramesh Namperumal, "Instrumentation for Characterizing the Thermal and Physical Stresses of Biomaterials", M.S. of Mechanical Engineering. Completed: August 1998

John Snyder, "A New Instrument for Evaluating the Stresses Hepatocytes Produce During Aggregation", M.S. of Mechanical Engineering. Completed: May 1999

Jeffrey Parsons, "Design and Testing of a Piezoelectrically Actuated Linear Rheometer for determining the properties of viscoelastic biomaterials with a thin fluid film coating" , M.S. of Mechanical Engineering. Completed: Dec 1999

Joseph Lambert, "Temperature Dependent Permeability of a Model Biological Membrane", Thesis Defense Completed: 8/09/01, M.S. of Mechanical Engineering. Completed: December 2001

Saravana Balasubramanian, "Predictive Model of Cryopreservation of Bioartificial Liver Devices", MS of Mechanical Engineering. Completed: August 2003

Yekaterina Zinchenko, "Experimental Determination of Storage and Culture Considerations for Bioartificial Liver Devices", MS of Mechanical Engineering. Completed: May 2003

Sravan Gudi, " 2D Model of O_2 Transport in BAL devices", MS in Mechanical Engineering. Exp. Compl: May 2004

Mayur Patel, "Development of A Micro-model for Predicting IIF Within Bioartificial Liver Devices", MS in Mechanical Engineering. Expected Completion: May 2005

Thomas Koshy, "The Effects of Temperature and Solutes on ECM Gels", MS in Mechanical Engineering. Expected Completion: August 2005

Committee Member:

Robert J. Schweikert, MS of Mechanical Engineering Completed: 1998 (Advisor: Dr. Russell Keanini, MEES)

Bhadri Chakravarthy, MS of Mechanical Engineering Completed: 1999 (Advisors: Dr. Harish Cherukuri and Dr. Bob Wilhelm)

Tuan Huu Bui, Masters of ECE Completed: 1999 (Advisor: Tom Weldon, Electrical and Computer Engineering)

Dean W. Pennell Masters in Mechanical Engineering Completed: 2000 (Advisor: Dr. Russell Keanini,)

Wanda Holmes , Masters of Science in Chemistry, Completed: Aug 2002 (Advisor: Dr. Dan Rabinovitch, Chemistry)

Murugesan Venkatapathi, MS in Mechanical Engineering, Completed: Aug 2002 (Advisor: Dr. Charles Lee, MEES)

Kara Cetto, MS in Chemistry, Completion Date: Aug 2004 (Advisor: Dr. Bernadette Donovan-Merkert)

Shailendra Jain, MS in Mechanical Engineering, Completed: November 2004 (Advisor: Dr. Charles Lee)

Kimry S. Taylor, MS in Chemistry, Completed: February 2005 (Advisor: Dr. Banita Brown)

Brian T. Cooper

Associate Professor, Bioanalytical Chemistry
Department of Chemistry
University of North Carolina at Charlotte
Charlotte, NC 28223
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http://www.chem.uncc.edu/faculty/cooper

Academic Degrees

1994	Ph.D.	University of Arizona, Tucson, AZ (Analytical Chemistry)
1989	B.S.	Purdue University, West Lafayette, IN (Chemistry) (Undergraduate Research Advisor: Dale W. Margerum)

Employment/Research History

2003–	Associate Professor of Analytical Chemistry, UNC Charlotte
1997–2003	Assistant Professor of Analytical Chemistry, UNC Charlotte
1996–1997	Postdoctoral Research Associate, Iowa State University, Ames, IA (Advisor: Cheng S. Lee)
1994–1996	NIH Postdoctoral Research Fellow, Iowa State University, Ames, IA (Advisor: Therese M. Cotton)
1993	Graduate Research Assistant, Naval Research Laboratory, Washington, DC
1989–1993	Graduate Teaching/Research Associate, University of Arizona
1988–1989	Undergraduate Research Assistant, Purdue University

Honors

2000–2004	NSF Faculty Early Career Development (CAREER) Award
1999	Oak Ridge Associated Universities Junior Faculty Enhancement Award, UNC Charlotte
1994–1996	National Institutes of Health (NIH) Postdoctoral Fellowship, Iowa State University *Conformational Change Upon Channel Protein Gating*
1990	Honorable Mention, NSF Graduate Fellowship competition, University of Arizona

Professional Society Memberships

1989–	American Chemical Society (ACS); Division of Analytical Chemistry (DAC): 1992–
1992–	Society for Applied Spectroscopy (SAS)
1998–	American Society for Mass Spectrometry (ASMS); also 1990–1994

External Grants (past five years)

2001–2003	Research Corporation: “Capillary Electrophoretic Investigations of Conformational Isomerism in Monoclonal Antibodies”
2000–2004	NSF: “CAREER: Rapid Ultrasensitive Protein Mapping and Bioanalytical Extension Activities”
1999–2000	ORAU Ralph E. Powe Junior Faculty Award: “Protein Charge States in Aqueous Solution”
1998–2001	NSF: “Acquisition of Liquid Chromatography-Mass Spectrometry Instrumentation for the Regional Analytical Chemistry Laboratory”

Scholarship Highlights (past five years)

Sanzgiri, R. D.; McKinnon, T. A.; Cooper, B. T. “Intrinsic Charge Ladders of a Monoclonal Antibody,” *Analyst* **2006**, *131*, submitted.

Sullivan, H. M.; Cooper, B. T. “Liquid-liquid Partition Chromatography (LLPC) in an Open-tubular Format,” poster (HMS); ACS Meeting, San Diego, CA, March 2005.

Bullock, K. A.; Xu, Y.; Cooper, B. T. “Affinity Capillary Electrophoresis of Long-Chain Fatty Acid Binding to Serum Albumin,” poster (KAB) ; ACS Meeting, San Diego, CA, March 2005.

Bailey, S. E.; Sanzgiri, R. D.; Cooper, B. T. “Surfactant Affinity Capillary Electrophoresis of Monoclonal Antibodies: Parallel Versus Sequential Binding Mechanisms,” poster (SEB) ; ACS Meeting, San Diego, CA, March 2005.

Dixon, K. A.; Cooper, B. T. “Nanoflow Electrospray of Tryptic Digests from Gels Containing Ammonium versus Sodium Dodecyl Sulfate,” poster (KAD), ASMS Meeting, Montréal, QC, June 2003.

Cooper, B. T.; McKinnon, T. A.; Sanzgiri, R.; Hamper, A. M. “Probing Antibody Conformational Microheterogeneity by Surfactant Affinity Capillary Electrophoresis (SurfACE),” poster (BTC), HPCE Meeting, San Diego, CA, January 2003.

Emory, J. M.; Carlin, C. M.; Cooper, B. T. “Single-Molecule Electrophoresis in Microfabricated Glass Channels,” poster (JME), National ACS Meeting, New Orleans, LA; March 2003.

Cooper, B. T. *J. Am. Chem. Soc.* **2002,** *124,* 13638–13639. Book review of *Applied Electrospray Mass Spectrometry*, Pramanik, B. N.; Ganguly, A. K.; Gross, M. L., Eds., Marcel Dekker: New York, 2002.

Gunawardena, H. P.; Childs, A. J.; Ross, C. L.; Cooper, B. T. “Protein MEKC: Surfactant Binding and Monoclonal Antibody Analysis,” invited talk (BTC), EAS, Atlantic City, NJ, October 2001.

Gunawardena, H. P. *Electrophoretic and Mass Spectrometric Investigations of Protein-Dodecyl Sulfate Interactions,* M.S. Thesis, UNC Charlotte, 2001.

Shou, M. *Capillary Electrophoretic Characterization of Serum Albumin Heterogeneity and Fatty Acid Binding,* M.S. Thesis, UNC Charlotte, 2001.

Gunawardena, H. P; Shou, M. S.; Cooper, B. T. “Charge Ladder Calibration of Multiple Binding Equilibria in Affinity Capillary Electrophoresis,” poster (BTC), HPCE Meeting, Boston, MA, January 2001.

Cooper, B. T. *J. Am. Chem. Soc.* **2000,** *122*, 3981. Book review of: *Microcharacterization of Proteins,* 2nd Ed., Kellner, R.; Lottspeich, F.; Meyer, H. E., Eds., Wiley-VCH: Weinheim, 1999.

Cooper, B. T. “Engaging Undergraduates in Current Bioanalytical Research,” invited talk at Sigma Xi Monie A. Ferst Award Symposium in honor of Dale W. Margerum, October 2000.

Advisees (Career Total)

1 Ph.D. student (biology)
16 M.S. students (7 complete and 5 pending theses; 5 accepted to prestigious analytical Ph.D. programs)
28 undergraduate research students
3 high school students

Curriculum Development

“Modern Mass Spectrometry” (CHEM 6115: Advanced Analytical Chemistry), F99, S03, S05: http://www.chem.uncc.edu/faculty/cooper/6115/

“Bioanalytical Techniques Workshop: ‘Protein Analysis by MALDI-MS’” (CHEM 4090/5090: Special Topics in Chemistry), F00: http://www.chem.uncc.edu/faculty/cooper/workshop/

Novel laboratory experiments and materials for “Instrumental Analysis” (CHEM 4111), Spring semesters of 1998–2002; 2004: http://www.chem.uncc.edu/faculty/cooper/4111/

- “Analytical Figures of Merit,” (3-page handout that graphically illustrates key figures of merit)
- “An Exercise in Analytical Method Validation,” (group GC experiment designed to demonstrate analytical figures of merit in the laboratory)
- “UV-Vis Spectrophotometry and an Introduction to Electronic Measurements,” (introduces transducers and measurement aspects of spectrophotometry using a modified Spec-20)
- “Fourier Transform Infrared Spectroscopy and Quantitative Analysis of a Copolymer,” (goes beyond qualitative functional group analysis to introduce *quantitative* aspects of FTIR)
- “Gas Chromatography-Mass Spectrometry and the Analysis of Unleaded Gasoline,” (introduces *quantitative* GC-MS including dynamic range and the use of internal standards)
- “Molecular Fluorescence and Absorbance Measurements Using Microscale Methods,” (uses a microwell plate reader to detect NADH from an enzymatic lactate microassay)

Novel Materials for “Quantitative Analysis” (CHEM 3111): http://www.chem.uncc.edu/faculty/cooper/3111/

- “Introduction to Spreadsheets,” (4-page handout outlining scientific uses of spreadsheets and concisely explaining the use of absolute versus relative cell references in formulas).
- “Statistical Treatment of Data,” (7-page handout discussing statistical models from a physical sciences perspective and summarizing relevant equations).

JAMES F. CUTTINO

EDUCATION: Ph.D., Mechanical Engineering, The Precision Engineering Center, North Carolina State University, 1994.
M.S., Mechanical Engineering, Clemson University, 1987
B.S., Mechanical Engineering, Clemson University, 1985

PROFESSIONAL EXPERIENCE:

1999 - present	Associate Professor, **University of North Carolina at Charlotte** Director, NC Motorsports and Automotive Research Center (***NC***MARC) Member, Center for Precision Metrology Director, Precision Manufacturing Laboratory
1995 - 1999	Assistant Professor, **The University of Alabama**
Summer 1996	Visiting Researcher, **NASA Marshall Space Flight Center** - Huntsville, Alabama
1990 - 1994	Research Assistant, **North Carolina State University** - Precision Engineering Center
1987 – 1990	Research Engineer, **Michelin Americas Research and Development Corporation**

HONORS:

April 2005	Pi Kappa Alpha Teacher of the Month
May 1998	Tau Beta Pi Teacher of the Year Award for the UA College of Engineering
May 1998	Omicron Delta Kappa Leadership Honor Society, 1998

Selected Publications:

J.L. Overcash, J.F. Cuttino, "Tunable Ultrasonic Vibration-Assisted Diamond Turning of Steel," ***ASPE Proceedings 2004 Annual Meeting***, 2004, pp. 76-79.

Cuttino, J.F., A. Kachru, E. Morse, S. Patterson, T.S. Piwonka, "A Parametric Study of the Effects of Casting Parameters on Dimensional Variation in Thin Wall Iron Castings," ***Transactions of the American Foundry Society,*** Vol. 110, Paper No. 02-102, pp. 715 - 731, 2002.

Rakuff, S., J. Cuttino, and D. Schinstock, "Development of a High Bandwidth, High Power Linear Amplifier for a Precision Fast Tool Servo System," *Proceedings of The American Society for Precision Engineering Spring Topical Meeting*, Volume 23, April 2001, pp. 88-93.

Schinstock, D.E. and J.F. Cuttino, "Real Time Kinematic Solutions of a Non-contacting, Three Dimensional Metrology Frame," ***The Journal of the American Society for Precision Engineering***, Volume 24, No. 1, pp. 70-76, January 2000.

Cuttino, J.F., D.D. Newman, J.K. Gershenson, and D.E. Schinstock, "A Structured Method for the Classification and Selection of Actuators for Space Deployment Mechanisms," ***Journal of Engineering Design***, Volume 11, No. 1, March 2000.

Cuttino, J.F., A.C. Miller, Jr., and D.E. Schinstock, "Performance Optimization of a Fast Tool Servo for Single Point Diamond Turning Machines," ***IEEE/ASME Transactions on Mechatronics***, Volume 4, No. 2, pp. 169–179, June 1999.

Cuttino, J.F., D.E. Schinstock, and M.J. Prather, "Three-Dimensional Metrology Frame for Precision Applications," ***The Journal of the American Society for Precision Engineering***, Volume 23, No. 2, pp. 103-112, April 1999.

Cuttino, J.F., J. Andrews, and T. Piwonka, "Developments In Thin Wall Iron Casting Technology," ***Transactions of the American Foundrymen's Society***, Volume 107, Paper No. 99-189, 363-372, 1999.

Cuttino, J.F. and T.A. Dow, "Contact between Elastic Bodies with an Elliptic Contact Interface in Torsion," ***The ASME Journal of Applied Mechanics***, v 64, pp. 144 - 148, March 1997.

Cuttino, J.F., T.A. Dow, and B.F. Knight, "Analytical and Experimental Identification of Nonlinearities in a Single-Nut, Preloaded, Precision Ball Screw," ***ASME Journal of Mechanical Design***, Volume 119, pp. 15 - 19, March 1997.

Cuttino, J.F., D.E. Schinstock, and M.W. Todd, "A Flexible Alignment Fixture for the Fabrication of Replication Mandrels, *Proceedings of The American Society for Precision Engineering*, Volume 16, October 1997, pp. 390 - 393.

Schinstock, D.E. and J.F. Cuttino, "Forward and Inverse Kinematic Solutions of a New Three Dimensional Metrology Frame," *1997 ASME International Mechanical Engineering Congress and Exposition – Manufacturing Science and Engineering*, Volume 6-2, pp. 435-441.

Miller, A.C. and J.F. Cuttino, "Performance Evaluation and Optimization of a Fast Tool Servo for Single Point Diamond Turning Machines," *SPIE Optical Science, Engineering, and Instrumentation SD97 Symposium*, July 1996.

U. S. Patents:

"*A tunable cutting tool for vibration assisted diamond turning*," Patent applied for March 2002, J.F. Cuttino, Jerald Overcash, and J. van Assen.

"*Track dynamometer*," Disclosure filed April 27, 2004, J.F. Cuttino.

"*Shaft dynamometer system utilizing existing driveshaft*," Disclosure filed January 2003, J.F. Cuttino.

"*Variable Camber System*," Disclosure filed February 2003, J.F. Cuttino.

Research and Teaching Activities:

- Generated $1,870,000 in grants as PI, additional $2,180,000 as co-PI, total of $4,050,000. Also wrote a $4 million proposal to NC General Assembly to investigate the feasibility of a motorsports testing complex which was funded.
- Overhauled and developed undergraduate courses: *Measurement and Instrumentation* (and lab with manual), *Motorsports Instrumentation, Vehicle Dynamics*
- Director of the Precision Manufacturing Laboratory
- Director of the Motorsports and Automotive Research Center

External Service

- NC Governor's Motorsports Advisory Committee
- Cabarrus County Chamber of Commerce Motorsports Committee
- North Carolina Motorsports Association
- Presentations on NC Motorsports Industry and its impact on Economic Development to over 20 different Groups in University, State, and Local levels.

Professional and Honorary Societies:

American Society for Precision Engineering (ASPE)

- ASPE Nominating Committee (98, 99, 01-04, Chair 02)
- Session Chair for *Advances in Traditional Mfg* Session in upcoming 2002 Annual Conference
- Chair for 2001 Annual Conference in Crystal City, VA
- Annual Conference Exhibits Chairman (00)
- Conference Organizing Committee (96,97,98)
- Controls Session Chair, 1997 Annual Conference
- Reviewer for the Journal of the American Society for Precision Engineering

American Society of Mechanical Engineers (ASME)

- Reviewer for the ASME Journal of Dynamic Systems, Measurement and Control

Society of Automotive Engineers (SAE)

- 1999 and 2002 Southern Automotive Manufacturing Conference and Exposition Organizing Committees

- Southern Automotive Manufacturing Conference Track Leader (99), Session Chair (02)

American Council of Engineering Companies

- Continuing education seminar on Vehicle Dynamics, October 2004.

American Society for Professional Engineers (ASPE)

- Continuing education seminar on Technical Communication, February and March, 1997.

Graduate Students Advised:

John Shepherd – "Passive Suspension Design to Optimize Camber in a Passenger Vehicle," Master's Thesis, May 2006

Jerald Overcash – "Design And Development of a Tunable Cutting Tool for Vibration Assisted Diamond Turning," Ph.D. project, February 2006.

Stefan Rakuff – "Development and Control of a Long Range Fast Tool Servo," Ph.D. Thesis, December 2004.

Jonathon Beaman – "Empirical Optimization of Casting Parameters for Thin Wall Iron Castings," December 2004.

Jerald Overcash – "Fabrication of Non-axisymmetric Metrology Artifacts," Master's Thesis, projected graduation December 2002.

Ashish Kachru – "Analysis of Molding Parameters for Producing Thin Wall Iron Castings," Master's Thesis, January 2001.

Jeff Finlayson - "Design and Analysis of a Rolling Cup Flexure for Long Range Precision Motion," Master's Thesis, May 2000.

Stefan Rakuff – "Development of a Long Range Fast Tool Servo," Master's Thesis, projected graduation December 2000.

Michael Todd - "Long Range Fast Tool Servo for Diamond Turning," Master's Thesis, May 2000.

Guang Lu – "System Identification of a Precision, Fast Tool Servo System," Master's Thesis, August 1999.

Cheau Ng – "Attribute-Based Design Description System" Master's Thesis, projected graduation December 1998.

Dan Newman - "Design and Analysis Methodology for Space Joints," Master's Thesis, July 1998.

G. Jagannath Prasad – "Life-cycle Modularity in Product Design," Master's Thesis, June 1998.

Wu Yan - "Low-Cost Metrology of 6-Degree-of-Freedom, Millimeter-Range Stages," Master's Thesis, May 1998.

Kasra Daneshvar

Professor, Electrical and Computer Engineering Department
University of North Carolina, Charlotte, NC 28223
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FAX: 704-687-2352

Education

Louisiana State University	Electrical Engineering	BS	1970
University of Illinois	Electrical Engineering	MS	1972
University of Illinois	Physics	MS	1975
University of Illinois	Physics	Ph.D.	1979
University of Pennsylvania	Physics (Post-Doctoral Fellow)	1979-81	

Appointments

Professor: Electrical and Computer Engineering Department, University of North Carolina, Charlotte, NC, 1992-present
Associate Professor: Electrical Engineering Department, University of North Carolina, Charlotte, NC, 1987-91
Assistant Professor: Electrical Engineering Department, Auburn University, AL, 1984-87
Assistant Professor: Physics Department, Auburn University, AL, 1981-84
Senior Research Associate: Physics Division, Argonne National Lab. Argonne, IL, 1975-79

Recent Publications

1) R. Tsu* and K. Daneshvar, Optical Properties of Silicon – SiO_2 Superlattice, To be published in "Journal of the Electrochemical Society" 2006.
2) R. Tsu, D. Quinlan[+], and K. Daneshvar, Silicon – O-M-O – Silicon Superlattice, to be published in "Journal of Microelectronics" 2006.
3) K. S. Kang, H. L. Ju, K. Daneshvar, Origin of Blue Luminesecence from Hybrid Sol-gel After Thermal "Journal of Applied Physics Letter" April 2006.
4) E. Charles H. Sykes, Aja Andreu, Kasra Daneshvar, and Mahnaz El-Kouedi[*], Synthesis and Characterization of Nanowire based Anisotropic Conductors, submitted for publication in "Journal of Nanotechnology".
5) K. Daneshvar[+], K. Kang[++], and R. Tsu, Three Dimensional Quantum Dot Array, Microelectronics Journal, Vol 36/3-6, March-June 2005, pp. 250-252
6) K. Kang, K. Daneshvar, and R. Tsu, Size Dependence saturation and absorption of PbS Quantum Dots, Microelectronics Journal, Vol. 35/8, August 2004, pp629-633.
7) K. Kang and K. Daneshvar, Matrix and Thermal Effects of Photoluminescence from PbS Quantum Dots, Journal of Applied Physics, Vol. 95, No. 9, May 1 2004
8) K. Kang and K. Daneshvar, CdS Quantum Dots in Hybrid Sol Gel Matrix; Absorption and Room Temperature Photoluminescence, Journal of Applied Physics, Vol. 95, No. 2 15 January 2004, (646-648)

Patents

1) Electro-optical Method and Apparatus for Testing Integrated Circuits U.S. Patent No.: 5,216,359 Issue Date June 1, 1993.
2) Field Emitter Flat Panel Display Device and Method for Operating Same, U.S. Patent No.: 5,698,942, Issue Date Dec. 16, 1977.

Other

(ii) Graduate and Postdoctoral Advisors
D. Kovar, Argonne National Laboratory (Ph.D.) DOE, Div. Nuclear Physics/Director
D. Balamuth, University of Pennsylvania (Post Doctoral)
(iii) Thesis Advisor and Postgraduate-Scholars Sponsors (while at UNCC)
M. Raissi, General Electric, Greensboro, NC (Ph.D.),
D. Kang, Lucent, Research Triangle Park NC. (Ph.D.)
T. Dogaru, Has his own company
Total of 23 MS.and 12 Ph.D. students (including other universities)

Awards
Many educational and research awards.

Angela D. Davies

Home Address
2213 Kenmore Ave.
Charlotte, NC 28204
(704) 332-8714

Work Address
Department of Physics and Optical Science
University of North Carolina at Charlotte
9201 University City Blvd.
Charlotte, NC 28223-0001
(704) 687-2505, adavies@nist.gov

Education

Cornell University, College of Arts and Science, Ithaca, New York
Department of Physics
Doctor of Philosophy Degree, August 1994
Thesis Advisor: Professor Harold G. Craighead
Thesis Abstract: Ballistic-electron-emission microscopy (BEEM) was used to study the nanometer-scale properties of two types of metal/semiconductor contacts, laterally microfabricated interfaces and reverse-biased contacts. With the microfabricated interfaces, the microscopic variation of damage resulting from dry etching techniques was studied and the resolution capabilities of BEEM was explored. By reverse biasing the metal/semiconductor contact, depletion-layer transport was studied, indicating that the image potential, hot electron scattering and the details of quantum mechanical transmission significantly influence interface transport.

University of Oregon, College of Arts and Science, Eugene, Oregon
Department of Physics, Bachelor of Science Degree, May 1988

Relevant Experience

Physics Department, University of North Carolina at Charlotte, Charlotte, NC
Assistant Professor — July 2001 - Present

- Research and develop methods for characterizing precision optical systems
- Research and develop methods for evaluating performance of micro-optical systems

Advanced Optics Metrology Program, Manufacturing Engineering Laboratory, National Institute of Standards and Technology, Gaithersburg, MD
Physicist — June 1998 - Present

- Developed optics-oriented measurement methods and capabilities to support advanced optical and semiconductor system fabricators
- Developed measurement methods that allow traceable measurements without reference to external authorities or reference artifacts

Electron and Optical Physics Division, Physics Laboratory,
National Institute of Standards and Technology, Gaithersburg, MD
Physicist — September 1994 – June 1998

- Carried out scanning tunneling microscopy (STM) studies of growth processes on metal surfaces.
- Investigated STM light emission techniques that can be used to evaluate surface magnetization on the atomic scale.

Applied and Engineering Physics Department, Cornell University, Ithaca, NY
Graduate Research Assistant May 1989 – May 1994

- Set up a laboratory and extensively modified a commercial STM to enable the BEEM measurement. This involved design and construction of low-noise analog circuitry, electronic computer-to-experiment interfacing and machining.
- Fabricated Au/Si(SiGe) Schottky contacts using wet-etching and thin film deposition techniques.
- Assisted with the lithography of the microfabricated contacts involving plasma-enhanced chemical vapor deposition and electron-beam lithography.
- Developed software in C for data acquisition and analysis.

Physics Department, Cornell University, Ithaca, NY
Teaching Assistant May 1989 – May 1984
Courses : Mechanics and Heat (Phys 112)
Optics, Waves and Particles (Phys 214)

Teaching Experience
PHYS1101 Introductory Physics for Non-majors
PHYS2101 Introductory Physics for Engineering and Science Students
PHYS4271 Waves and Optics
OPTI6102/8102 Waves and Optics
OPTI6105/8105 Optical Property of Materials I

Directed Thesis/ Dissertation
Neil Gardner, M.S. Mechanical Engineering, Fall 2003
Brent Bergner, M.S. Optical Science and Engineering, Fall 2003
Daryl Purcell, M.S. Optical Science and Engineering, Fall 2005
Devendra Karodkar, MS Mechanical Engineering, Spring 2004
Ayman Samara, Ph.D. Optical Science and Engineering, Fall 2005
Katherine Medicus, Ph.D. Mechanical Engineering, Spring 2006

Refereed Publications
"Ballistic electron emission microscopy of laterally patterned microstructures." A. Davies, J. G. Couillard, and H. G. Craighead, Applied Physics Letters **61**, 1040-1042 (1992).

"Ballistic electron emission microscopy investigation of SiGe nanostructures fabricated using reactive ion etching." J. G. Couillard, A. Davies, and H. G. Craighead, Journal of Vacuum Science Technology B **10**, 3112-3115 (1992).

"Ballistic electron emission microscopy characteristics of reverse-biased Schottky diodes." A. Davies and H. G. Craighead, Applied Physics Letters, **64**, 2833-2835 (1994).

"Tunneling spectroscopy of bcc(001) surface-states." J. A. Stroscio, A. Davies, D. T. Pierce, R. J. Celotta, Physical Review Letters **75**, 2960-2963 (1995).

"Atomic-scale observations of alloying at the Cr-Fe(001) interface." A. Davies, J. A. Stroscio, D. T. Pierce, R. J. Celotta, Physical Review Letters **76**, 4175-4178 (1996).

Effect of interfacial roughness on exchange coupling." Unguris J, Celotta RJ, Davies A,

Pierce DT, Stroscio JA, Journal of Applied Physics **81**, 4342-4342 (1997).

"Observations of alloying in the growth of Cr on Fe(001)." Davies A, Stroscio JA, Pierce DT, Unguris J, Celotta RJ, Journal of Magnetism and Magnetic Materials **165**, 82-86 (1997).

"Polarized light emission from the metal-metal STM junction." D. T. Pierce, A. Davies, J. A. Stroscio, and R. J. Celotta, Applied Physics A 66, S403-S406 (1998).

"Non-collinear exchange coupling in Fe/Mn/Fe (001): Insight from scanning tunneling microscopy." D. T. Pierce, A. Davies, J. A. Stroscio, D. A. Tulchinsky, J. Unguris, and R. J. Celotta, Journal of Magnetism and Magnetic Materials, 222 (1-2) 13-27 (2000).

"Estimating the RMS of a Wavefront and Its Uncertainty." A. Davies and M. Levenson, Applied Optics, **40**, 6203-6209 (2001).

"Advanced Optics Characterization." A. Davies, C. Tarrio, and C. J. Evans, Optics & Photonics News, **12**, 34-38 (2001).

"Displacement Uncertainty in Interferometric Radius Measurements." T. L. Schmitz, C. J. Evans, A. Davies, and W. T. Tyler, Annals of the CIRP, 51/1: 451-454, 2002.

"Silicon Wafer Thickness Variation Measurements using the NIST Infrared Interferometer." T. Schmitz, A. Davies, C. J. Evans, and R. Parks, *Optical Engineering*, 42/8: 2281-2290, 2003.

"Correcting for Stage Error Motions in Radius Measurements." A. Davies and T. Schmitz, *Applied Optics*. 44 (28): 5884-5893 OCT 1 2005

"Self-calibration for Micro-refractive Lens Measurements." N. Gardner and A. Davies, *Optical Engineering*, 45 (3): ???, 2006.

Other Publications

"An investigation of uncertainties limiting radius measurement performance." T. Schmitz, C. J. Evans, and A. Davies, Extended Abstract, American Society for Precision Engineering Spring Topical Meeting on Precision Interferometric Metrology, May 2000.

"The NIST X-ray optics CALIBration InterefometeR (XCALIBIR)." A. Davies and C. J. Evans, Extended Abstract, American Society for Precision Engineering Spring Topical Meeting on Precision Interferometric Metrology, May 2000.

"Estimating the RMS Wavefront Error from a Data Set and the Associated Measurement Uncertainty." A. Davies and M. Levenson, Extended Abstract, American Society for Precision Engineering Spring Topical Meeting on Precision Interferometric Metrology, May 2000.

"Sensitivity of Homogeneity Measurements to Sample Position, Focus, and Beam Coherence." A. Davies and C. J. Evans, Extended Abstract, American Society for Precision Engineering Spring Topical Meeting on Precision Interferometric Metrology, May 2000.

"Interferometric Metrology of Photomask Blanks: Approaches Using 633 nm Wavelength." C. J. Evans, A. Davies, R. E. Parks, L. Shao, NISTIR 6701, December (2000).

"Haidinger interferometer for silicon wafer TTV measurement." R. E. Parks, L. Shao, A. Davies, and C. J. Evans, SPIE Conference Proceedings, SPIE's 26th Annual International Symposium Microlithography, February (2001).

"Interferometric Testing of Photomask Blank Flatness." C. J. Evans, R. E. Parks, L. Shao, T. Schmitz, and A. Davies, SPIE Conference Proceedings, SPIE's 26th Annual International Symposium Microlithography, February (2001).

"Uncertainties in interferometric measurements of radius of curvature." T. L. Schmitz,A. Davies, and C. J. Evans, SPIE Conference Proceedings, SPIE's 46th Annual International Symposium on Optical Science and Technology, July (2001).

"Interferometric figure metrology; enabling in-house traceability." C. J. Evans, A. Davies, T. Schmitz and R. E. Parks, SPIE Conference Proceedings, SPIE's 46th Annual International Symposium on Optical Science and Technology, July (2001).

"Improving Metrology for Micro-Optics Manufacturing." Invited Paper. A. Davies, SPIE Conference Proceedings, SPIE's 48th Annual International Symposium on Optical Science and Technology, Gradient Index, Miniature, and Diffractive Optical Systems III Conference, San Diego, August (2003).

"Defining the Measurand in Radius of Curvature Measurements." A. Davies and T. Schmitz, SPIE Conference Proceedings, SPIE's 48th Annual International Symposium on Optical Science and Technology, Recent Developments in Traceable Dimensional Measurements II Conference, San Diego, August (2003).

"Self-Calibration for Micro-Refractive Lens Measurements." Neil Gardner, Timothy Randolph, and Angela Davies, SPIE Conference Proceedings, SPIE's 48th Annual International Symposium on Optical Science and Technology, Optical Manufacturing and Testing V Conference, San Diego, August (2003).

"Self-calibration Technique for Transmitted Wavefront Measurements." Brent C. Bergner*, Angela Davies, SPIE Conference Proceedings, SPIE's 48th Annual International Symposium on Optical Science and Technology, Optical Manufacturing and Testing V Conference, San Diego, August (2003).

"Traceable Radius of Curvature Measurements on a Micro-Interferometer." Devendra

Karodkar, Neil Gardner, Brent C. Bergner, and Angela Davies, SPIE Conference Proceedings, SPIE's 48th Annual International Symposium on Optical Science and Technology, Optical Manufacturing and Testing V Conference, San Diego, August (2003).

"Compact Interferometer for Micro-Optic Performance and Shape Characterization." K. M. Medicus, D. Karodkar, B. Bergner, N. Gardner, A. Davies, SPIE Conference Proceedings, SPIE's 48th Annual International Symposium on Optical Science and Technology, Lithographic and Micromachining Techniques for Optical Component Fabrication II Conference, San Diego, August (2003).

"Radius of Curvature Uncertainty: Nonlinear Measurand and Treatment", T. Schmitz and A. Davies, Proceedings of Uncertainty Analysis in Measurement and Design, ASPE Summer Topical Meeting, State College, PA, pp. 78-82., June 30-July 1 (2004).

"Advances in micro-lens surface metrology: the role of retrace errors", Neil Gardner and Angela Davies, Proceedings of the Optical Fabrication and Testing Conference, Rochester, NY, October (2004).

"Traceable Radius Measurements of Micro-lenses", Ayman M. Samara, Brent C. Bergner, Angela Davies, Kate Medicus and Neil Gardner, Proceedings of the Optical Fabrication and Testing Conference, Rochester, NY, October (2004).

"The Effect of Phase Change on Reflection on Optical Measurements", Kate M. Medicus, Liesel R. Fricke, John E. Brodziak Jr., Sharon Carnevale, Marcus Chaney, Rachel Wolff, Angela D. Davies, Proceedings of the ASPE Annual Meeting, Orlando, FL, November (2004).

"Self-calibration for Micro-Refractive Lens Metrology", A. Davies and N. Gardner, Proceedings of the 2005 NSF DMII Grantees Conference, Scottsdale, Arizona, January (2005).

"A Simulation Package for Evaluating Interferometric Micro-Aspheric Lens Measurements", S. A. Gugsa and A. Davies, Proceedings of the 2005 NSF DMII Grantees Conference, Scottsdale, Arizona, January (2005).

"Measurement advances for micro-refractive fabrication", Neil Gardner, Angela Davies and Brent Bergner, Invited Paper, SPIE Conference Proceedings, SPIE International Symposium on Optical Metrology, Micro- and Nano-Metrology Conference, Munich, Germany, June (2005).

"Gaussian Beam Modeling of the Radius of Curvature", Kate M. Medicus, James Synder, Angela D. Davies, Proceedings of the ASPE 2005 Summer Topical Meeting, Precision Interferometric Metrology, Middletown, Connecticut, July (2005).

"Systematic Bias Compensation for a Moiré Fringe Projection System", D. Purcell, A.

Samara, A. Davies, and F. Farahi, SPIE Conference Proceedings, SPIE's 50th Annual International Symposium on Optics and Photonics, Recent Developments in Traceable Dimensional Measurements III Conference, San Diego, August (2005).

"Moiré and Fringe Projection Technique for the Measurement of Form, Waviness and Roughness", Ayman Samara, Angela Davies, and Faramarz Farahi, SPIE Conference Proceedings, SPIE's 50th Annual International Symposium on Optics and Photonics, Recent Developments in Traceable Dimensional Measurements III Conference, San Diego, August (2005).

"Monte Carlo analysis on determination of conic constant of an Aspheric Micro Lens based on SWLI Measurement", S. A. Gugsa and A. Davies, SPIE Conference Proceedings, SPIE's 50th Annual International Symposium on Optics and Photonics, Advanced Characterization Techniques for Optics, Semiconductors, and Nanotechnologies II Conference, San Diego, August (2005).

"Retrace error evaluation on a figure-measuring interferometer", Neil Gardner and Angela Davies, SPIE Conference Proceedings, SPIE's 50th Annual International Symposium on Optics and Photonics, Optical Manufacturing and Testing VI Conference, San Diego, August (2005).

"Radius case study: Optical bench measurement and uncertainty including stage error motions", Tony L. Schmitz, Neil Gardner, Matthew Vaughn, Angela Davies, SPIE Conference Proceedings, SPIE's 50th Annual International Symposium on Optics and Photonics, Recent Developments in Traceable Dimensional Measurements III Conference, San Diego, August (2005).

"The Effect of Phase Change on Reflection on Optical Measurements", Kate M. Medicus, Anneliese Fricke, John Edward Brodziak Jr, Angela Davies, SPIE Conference Proceedings, SPIE's 50th Annual International Symposium on Optics and Photonics, Recent Developments in Traceable Dimensional Measurements III Conference, San Diego, August (2005).

"Gaussian Beam Modeling of the Radius of Curvature Measurement", Kate Medicus, James J. Snyder, and Angela Davies, SPIE Conference Proceedings, SPIE's 50th Annual International Symposium on Optics and Photonics, Recent Developments in Traceable Dimensional Measurements III Conference, San Diego, August (2005).

MATTHEW A. DAVIES

Associate Professor, Department of Mechanical Engineering & Engineering Science
University of North Carolina at Charlotte, Charlotte NC
(704) 687-3285 (PH), (704) 687-3806 (FAX)
madavies@uncc.edu

PROFESSIONAL PREPARATION

B.S., Mechanical Engineering (Valedictorian), Carnegie Mellon University,1988.
Ph.D., Mechanical and Aerospace Engineering, Cornell University,1993.

APPOINTMENTS

Associate Professor, Department of Mechanical Engineering & Engineering Science, University of North Carolina at Charlotte (2002-present); Associate Research Professor (jointly with NIST position), Johns Hopkins University (2001-2002); Mechanical Engineer, National Institute of Standards and Technology (NIST) (1994-2002); Lecturer, Cornell University (1994); Postdoctoral Research Associate, Cornell University, (1994); Graduate Research Assistant, Cornell University (1998-1993), Co-op Student General Electric Aircraft Engines (1987, 1988).

PUBLICATIONS (10 Selected)

Journal & Conference Publications (5 Closely Related)

1. Davies, M. A., Evans, C. J., Patterson, S., Vohra, R., and Bergner, B., “Application of Precision Diamond Machining to the Production of Micro-photonic Devices”, *Proc. of the SPIE*, San Diego CA, August, 2003.
2. Davies, M. A., Yoon, H., Schmitz, T. L., and Kennedy, M. D., “Calibrated thermal microscopy of the tool chip interface in machining, *Machining Science and Technology*, **7**(2), 2003.
3. Yantek, D. S., Marsh, E. R. and Davies, M. A., “Simulation and measurement of chatter in diamond turning”, *Journal of Manufacturing Science and Engineering*, **120**(2):230-235, 1998.
4. Damazo, B. N, Davies M. A., Dutterer, B. Kennedy, M., Experiences in Micro-milling and Micro-drilling, *Proc. of the ASPE*, October, 1998.
5. Davies, M. A., Chou, K. and Evans, C. J., “On chip morphology, tool wear and cutting mechanics in precision hard turning”, *Ann. CIRP*, 1996, **45**(1):77-82.

Journal Publications (5 Other)

1. Davies, M. A., Cao, Q., Cooke, A. L., Ivester, R., “On the measurement and prediction of temperature fields in machining AISI 1045 steel”, Submitted to: *Annals of the CIRP*, **52**(1):71, 2003,.
2. Davies, M. A. and Burns, T. J., 2001, “Thermo-mechanical oscillations in material flow during high-speed machining”, *Proceedings of the Royal Society*, **359**:821-846, 2001.
3. Davies, M. A., Dutterer, B. and Pratt, J. R. and Burns, T. J., 2002, “Stability Prediction for Low Radial Immersion Milling”, *J. Man. Science Eng.*, **124**(2):217-225.
4. Burns, T. J. and Davies, M. A., “A nonlinear dynamics model for chip segmentation in machining”, *Phys Rev. Lett*., **79**(3): 447-450.
5. Davies, M. A., Dutterer, B., Pratt, J. R., and Schaut, A., submitted by Bryan, J., “On the dynamics high-speed milling with long slender endmills”, *Annals of the CIRP*, **47**(1), 1998.

SYNERGISTIC ACTIVITIES

1. **Member of the American Society for Precision Engineering** (ASPE) (1996-present); Member, Education Committee, ASPE (1998-present); Chair, Scholarship Committee, ASPE (1998-present).
2. **Co-Organizer**, *Manufacturing Three-Dimensional Components and Devices at the Meso- and Micro- Scales: A Workshop Cosponsored by the National Institute of Standards and Technology and The National Science Foundation* (NIST, May 18-19, 2001).
3. **Associate Editor**, *Journal of Manufacturing Science and Engineering* (2001-present)
4. **Corresponding Member**, International Congress of Production Engineering Research (CIRP) (1999-present);
5. **Member,** SPIE (2003-present).

COLLABORATORS AND OTHER AFFILIATIONS

Smith, K. S., Davies, A. D., Moyer, P. J., Hocken, R., Schmitz, T. L., Evans, C. J., Burns, T. J., Pratt, J. R., Dutterer, B. S., Moon, F. C., Schaut, A. J., Bayly, P., Feeny, B., Balachandran, B., Shefelbine, W., Damazo, B., Harper, K., Kennedy, M., Ivester, R., Athavale, S., Furness, R., Theile, J., Halley, J., Snyder J., Marsh, E., Dawson P., Chou, Y. K., Helvey, A., Medicus, K. M., Bergner, B., Muntean, G., Mann, B., Teague, E. C., Polvani, R., Farahi, F., S. Patterson, A. Davies, M. Fiddy, R. H. Hocken.

Thesis Advisor: F. C. Moon

Students: Halley, J., Larsen, E. R., Cao, Q., Cooke, A. L., Vohra, R., Starnes, W. C., Carter M. T., Larsen, S. P., Larsen, E. R., Nuttall, M., Ransom, K. L.

HONORS & AWARDS

John T. Parsons Outstanding Young Manufacturing Engineer (2000); Department of Commerce Bronze Medal (1997); Fannie and John Hertz Foundation Fellow (1988-1993); Valedictorian, Carnegie Mellon University (1988); Andrew Carnegie Society Scholar (1987).

Bernadette T. Donovan-Merkert
Professor and Chair
Department of Chemistry
University of North Carolina at Charlotte
9201 University City Blvd.
Charlotte, NC 28223-0001
(704) 687-4436; bdonovan@email.uncc.edu

Professional Preparation

Duke University	Chemistry	B.S. (1983)
University of Vermont	Analytical and Inorganic Chemistry	Ph.D. (1988)
Dartmouth College	Organometallic Chemistry	Postdoc (1988-90)
Univ. of Texas at Austin	Electroanalytical Chemistry	Postdoc (1990-92)

Appointments

2004	Professor and Chair, Department of Chemistry, UNC Charlotte
2003	Professor (Analytical Chemistry), UNC Charlotte
1998-2003	Associate Professor (Analytical Chemistry), Tenured, UNC Charlotte
1992-1998	Assistant Professor (Analytical Chemistry), UNC Charlotte

Awards and Honors (selected)

- Phi Kappa Phi (2006)
- Camille and Henry Dreyfus Scholar-Fellow Award (2003)
- Harshini V. de Silva Graduate Mentor Award, UNC Charlotte (2003)
- Discussion Leader, Gordon Research Conference on Organometallic Chemistry (2003)
- Finalist, Bank of America Award for Teaching Excellence, UNC Charlotte (2002)
- US Young Observer, IUPAC Meeting, Brisbane, Australia (2001)
- Invited Speaker, Organometallic Chemistry Gordon Research Conference (1999)
- Henry Dreyfus Teacher-Scholar Award (1998)
- Discussion Leader, Gordon Research Conference on Organometallic Chemistry (1997)

Recent Publications and Presentations (selected)

- Donovan-Merkert, B.T. "Electrochemically-promoted catalytic asymmetric hydrogenation reactions" *Abstracts of Papers*, 231st National Meeting of the American Chemical Society, Atlanta, GA, March 26-30, 2006; American Chemical Society, Washington, DC, 2006; ORGN 433.

- Donovan-Merkert, B.T.; Freeman, S.T.N. "Chiral modified electrodes for electrochemically-promoted hydrogenation reactions" *Abstracts of Papers*, 228th National Meeting of the American Chemical Society, Philadelphia, PA, August 22-26, 2004; American Chemical Society, Washington, DC, 2004; INOR 339.

- Hackney, S.H.; Donovan-Merkert, B.T. "The construction of a Rh(DIOP) modified electrode for electrochemically-promoted catalytic asymmetric synthesis" 229th National Meeting of the American Chemical Society, San Diego, CA, March 13-17, 2005; American Chemical Society, Washington, DC, 2005; INOR 215.

- Golden, M.L.; Donovan-Merkert, B.T. "Preparation of chiral ruthenium bis(oxazoline) complexes for electrochemically-promoted hydrogenation" 229th National Meeting of the American Chemical Society, San Diego, CA, March 13-17, 2005; American Chemical Society, Washington, DC, 2005; INOR 219.

- Baldridge, K.K.; Donovan-Merkert, B.T.; O'Connor, J.M.; Lee, L.I.; Closson, A.; Fandrick, D.; Tran, T.; Bunker, K.D.; Fouzi, M.; Gantzel, P. "Ring-strain effects on the oxidation potential of enediynes and enediyne complexes *Organic and Biomolecular Chemistry* **2003**, *1*, 763.

- Alvarez, H.M.; Krawiec, M.; Donovan-Merkert, B.T.; Fouzi, M.; Rabinovich, D. "Modeling Nickel Hydrogenases: Synthesis and Structure of a Distorted Octahedral Complex with an Unprecedented $[NiS_4H_2]$ Core" *Inorganic Chemistry* **2001**, *40*, 5736.

- B.T. Donovan-Merkert, J. Malik, L.V. Gray, J.M. O'Connor, B.S. Fong, M.-C. Chen, "Electrochemical Studies of a Metallacyclobutene Complex: Synthesis of a Furan by Oxidation of a Cobaltacyclobutene" *Organometallics* **1998**, *17*, 1007.

- B.T. Donovan-Merkert, C.R. Clontz; L.M. Rhinehart, H.I. Tjiong, C.M. Carlin, T.R. Cundari, A.L. Rheingold, I. Guzei, "Rhodocenium Complexes Bearing the 1,2,3-Tri-*tert*-butylcyclopentadienyl Ligand: Redox-Promoted Synthesis, Mechanistic, Structural and Computational Investigations", *Organometallics* **1998**, *17*, 1716.

Recent external funding

- Camille and Henry Dreyfus Scholar-Fellow Award**,** $105,000.00 (June 1, 2004 – June 30, 2006) "Electrochemically-promoted asymmetric synthesis (PI)

- National Science Foundation, $225,000.00 (August 15, 2001 – July 31, 2005) "Asymmetric Hydrogenation at Electrode Surfaces" (PI)

- National Science Foundation, RUI/MRI, $250,455.00 (UNC Charlotte match $115,384) (August 1, 2003-July 31, 2006) "Purchase of a 400 MHz NMR spectrometer" (Co-PI)

Thesis Advisor and Postgraduate-Scholar Sponsor

- Postdocs (total) = 4
- M.S. students advised (thesis director, total) = 9
- Undergraduate students advised in research (total) = 39
- High School students advised in research (ACS Project SEED) = 2

Graduate courses taught and developed

- Electroanalytical Chemistry (Chem 6115)
- Practical NMR Spectroscopy (Chem 6115)
- Organometallic Chemistry (Chem 6126)

Undergraduate courses taught and developed

- Quantitative Analysis lecture (CHEM 3111)
- Quantitative Analysis, lab (CHEM 3111)
- Survey of Instrumental Analysis, lecture (CHEM 3113)
- Instrumental Analysis, lecture (CHEM 4111)

- Instrumental Analysis, lab (CHEM 4111)
- Science, Technology and Society (LBST 2213)

Relevant Service Activities

- Co-program Chair, Division of Inorganic Chemistry, American Chemical Society (2003-present)
- Established the Student Travel Award Program for the Division of Inorganic Chemistry, American Chemical Society (2000)
- Chair of Student Travel Awards Committee, Division of Inorganic Chemistry, American Chemical Society (2000-2003)
- Member, Executive Committee, Division of Inorganic Chemistry, American Chemical Society (1999-present)
- Carolina-Piedmont Local Section of ACS (Chair, 1996; Chair-Elect, 1995)
- Faculty Advisor, Student Affiliates of the ACS (UNC Charlotte, 1999-2003)
- Chair, Steering Committee, UNC Charlotte Undergraduate Research Conference (since 2000)

Thomas D. DuBois

a. Professional Preparation

McMurry College Abilene, Texas	Chemistry	B.A., 1962
Ohio State University Columbus, Ohio	Inorganic Chemistry	M.S., 1965
Ohio State University Columbus, Ohio	Inorganic Chemistry	Ph.D., 1967

b. Appointments

Present-July 2004	Charles H. Stone Professor of Chemistry Director of Computational Chem. and Visualization Laboratory
June 2000-July 2004	Charles H. Stone Professor of Chemistry Chair, Department of Chemistry Director of the Computational Chemistry and Visualization Laboratory
Present - July 1997	Charles H. Stone Professor of Chemistry Director of the Computational Chemistry and Visualization Laboratory
Present - July 1996**	Charles H. Stone Professor of Chemistry
Present - July 1977	Professor, Department of Chemistry
July 1977 - June 1971	Associate Professor, Department of Chemistry
July 1971 - June 1967	Assistant Professor, Department of Chemistry University of North Carolina at Charlotte

*Member of Ph.D. faculty in Biology since 2000
**Member of Ph.D. Faculty in Electrical Engineering since 1996
Member of Ph.D. Faculty in Mechanical Engineering since 1996

c. Publications

Arthur Greenberg and Thomas D. DuBois, "Amid-N-Oxides: an Ab Initio Molecular Orbital Study" Journal of Molecular Structure, 567-568 (2001) 303-317.

Kim, Mahn-Jong, MacDonnell, Frederick M., Gimon-Kinsel, Mary E., DuBois, Thomas, Asgharain, Griener, James C., "Global Chirality in Rigid Decametallic Ruthenium Dendrimers," Angew. Chem. Int. Ed. 2000, 39, 615.

d. Synergistic Activities

Developed and taught the inorganic chemistry curriculum at UNC Charlotte (Intermediate Inorganic Chemistry (Chemistry 2125), Advanced Inorganic Chemistry with laboratory (Chemistry 4121/5121) and Theoretical Inorganic Chemistry (Chemistry 6125).

Played a leadership role in gaining ACS accreditation of the B.S. degree and in developing the chemistry honors program, the university-industry internship program and in developing and implementing the MS degree program at UNC Charlotte. Later developed the "Emphasis in Microelectronic" option for the M.S. Program

Developed and taught the microcomputer interfacing courses at UNC Charlotte (Modern Laboratory Methods (Chemistry 1106), Microcomputer Interfacing with laboratory (Chemistry 4112/5112).

Developed, with the aid of an NSF/ILI award, a computational chemistry and visualization laboratory based on eight SGI workstations. Developed and taught the Computational Chemistry course (Chemistry 4200/5200) and its laboratory (1996).

Developed materials and/or presented workshops and short courses in "Computer-Aided Experimentation," "Introduction to Computational/Visualization Methods in Chemistry," and "A Unified Approach to the Study of Chemical Reaction in Freshman Chemistry" for high school teachers and university faculty.

e. Graduate and Postdoctoral Advisors.

Dr. Devon W. Meek (Deceased)
Department of Chemistry
The Ohio State University
100 West 18th Avenue
Columbus, Ohio 43210-1185

Mahnaz El-Kouedi
Assistant Professor
Department of Chemistry, University of North Carolina, Charlotte
9201 University City Blvd.
Charlotte, NC 28223
Home (704) 548-1735, Work (704) 867-4440
melkoue@email.uncc.edu

EDUCATION

2001 Ph.D. in Chemistry, Georgetown University, Washington D.C.
Thesis Title: *The Optical Properties of Au/AgX Nanoparticle Composite.*
July 2001.

1995 B.Sc. in Chemistry (*cum laude*),
Minor in Physics,
American University in Cairo, Cairo, Egypt.

1991 International Baccalaureate
International School of the Sacred Heart, Tokyo, Japan.

POSITIONS HELD

2003-present Assistant Professor, Department of Chemistry, University of North Carolina, Charlotte

Research involves the fabrication of novel nano-materials for application to chemical and biological sensing.

2001-2003 Postdoctoral Fellow, The Pennsylvania State University
Advisor: Professor Christine D. Keating

- Developed techniques to self-assemble nanowires using DNA for molecular electronics applications.
- Studied nanowire aggregation phenomena at a two phase aqueous interface using reflectance optical microscopy.
- Trained graduates, undergraduate students and technical staff, including students from physics and engineering.
- Guest lectured undergraduate inorganic, honors chemistry, and introductory chemistry classes.

1996-2001 Graduate Assistant, Georgetown University
Advisor: Professor Colby A. Foss, Jr.

- Synthesized and characterized novel metal-semiconductor nanocomposite materials and colloids.

- Conducted experiments using various spectroscopic and electrochemical techniques.
- Gained experience in Transmission Electron Microscopy (TEM) and sample preparation procedures including sectioning.
- Performed computer simulations using single particle scattering and effective medium theories.
- Instructed general chemistry recitations as well as led advanced chemistry laboratories.

Fall 2000 Consultant, Surromed Inc. Palo Alto California
- Set-up anodic aluminum oxide anodization experiments, and trained technical staff in template synthesis technologies.

1995-1996 Teaching Assistant, American University in Cairo
- Supervised undergraduate labs including analytical, instrumental, organic and inorganic.

1995 Summer Trainee, National Institute of Chemistry, Prague
- Trained in Nuclear Magnetic Resonance (NMR).

1994 Summer Trainee, Naval American Medical Research Unit, Cairo.
- Experienced with serology, Elisa testing, preparation of growth media, and separation of blood.

AWARDS

1. Oak Ridge Associated Universities 2004 Ralph E. Powe Junior Faculty Enhancement Award.

CONFERENCE PRESENTATIONS

1. "An Investigation of the Influence of Striping Pattern on the Performance of Silver and Gold Striped Nano-Rod Arrays as SERS Substrates" Mahnaz El-Kouedi, and Brandy Broglin, ACS SERMACS meeting, Memphis November 2005.

2. "Enhanced Transmission of Light Through Chemically Grown Arrays of Sub-Wavelength Holes" Jerry Heath and Mahnaz El-Kouedi, ACS SERMACS meeting, Memphis November 2005.

3. "Novel Nanopatterned Surfaces to Investigate for Optimal SERS Enhancement" J. Tres Brazell, E. Charles Sykes and Mahnaz El-Kouedi, UNC-Charlotte Symposium on Nanoscale Science and Engineering, October 2005.

4. "Gold, Silver and Striped Nanorod Arrays Employed as Surface-Enhanced Raman Scattering Substrates" Broglin, B.; Andreu, A.; El-Kouedi, M. ACS National meeting, San Diego, March 2005.

5. "Novel Nano-materials for Chemical and Biological Sensing" Brazell, J.T.; El-Kouedi, M. North Carolina Symposium for Undergraduate Research, Raleigh, April 2005.

6. "Synthesis and Characterization of Nanoscale Electrochemical Sensors" Andreu, A.; El-Kouedi, M. ACS National meeting, Philadelphia, August 2004.

7. "Synthesis of Polymer Supported Metal Nanorod Arrays For Optical Biosensing" El-Kouedi, M. OSIE 2003, Orlando, November 2003.

8. "Nanoscale Design of Optical Materials" Schmedake, T.; El-Kouedi, M.; Stout, G.F.; Fiddy, M. Nanofair Conference, Dresden, December 2003.

9. "Combining Specific and Nonspecific Forces for Assembly of Metal Nanoparticles" El-Kouedi, M.; Goodrich, G.P.; Keating, C.D. FACSS 2002, Providence, October 2002.

10. "Aqueous Two Phase Systems as a Tool for Nanoassembly" El-Kouedi, M.; Goodrich, G.P.; Dillenback, L.M.; Etherton, M.R.; Reiss, B.D.; Keating, C.D. MRS 2002, Boston, December 2002.

11. "An Investigation of Mixing in Au/AgX Heterojunction Nanorods" El-Kouedi, M.; Foss, C.A. Jr. MRS 2000, Boston, November 2000.

12. "A Spectroscopic Investigation of Nanoparticle Silver Halides and the Effects of Adjacent Metal Particles on their Optical Properties" El-Kouedi, M.; Foss, C.A. Jr. CMACS 2000, Cincinnati, May 2000.

13. "Metal-Semiconductor Interactions in Gold-Silver Iodide Nanocomposite Systems"; El-Kouedi, M.; Foss, C.A. Jr. Manhattan Poster Project, National Institute of Standards and Technology, November 1998.

14. " The Effects of Electrochemical Synthesis Parameters on the Structure of Gold/Silver Iodide Nanoparticles"; El-Kouedi, M.; Foss, C.A. Jr. The 193rd Meeting of the Electrochemical Society, Abstract No. 9, San Diego, May 1998.

INVITED TALKS

1. "Novel Nanomaterials for Biological and Chemical Sensing" Chemistry Department, Simmons College, Boston, November 2005.
2. "Application of Nanostructured Materials to Biomolecule Detection" Chemistry Department, East Tennessee State University, February 2004.
3. "Application of Nanostructured Materials to Biomolecule Detection" Biology Department, UNC-Charlotte, November 2003.
4. "Optical Properties of Au/AgX Composite Materials" at the Materials Research Science and Engineering Center, Pennsylvania State University, October 2001.

PROPOSALS FUNDED

1. Junior Faculty Research Grant (UNC-Charlotte) " Electrochemical Detection of DNA using High Surface Area Nanorod Array Electrodes" (PI, $6,000)
2. Oak Ridge Associated Universities "Porous Aluminum Oxide-based Nanotechnology" (PI, $10,000)

STUDENTS DIRECTED IN UNDERGRADUATE RESEARCH

Fall 2003: Sarah Davidson, Fabrication of porous aluminum oxide
Fall 2003 and Spring 2004: Luis Lecaros, Metal nanoparticle synthesis
Fall 2003 and Spring 2004: Happy Wyche, DNA attachment to nanostructures
Spring and Summer 2004: Jonathon Brazell, Nanocomposites for SERS
Summer 2004: Dipika Patel, Electrochemical DNA sensors
Fall 2004 and Fall 2005: Jonathon Brazell, Surface patterned Al
Spring 2005: Mahbuba Begum, Chronocoulometry of Nanowires
Summer 2005: Neha Godiwala (UNC-Chapel Hill), Chronocoulometry of Nanowires

Summer 2005-Fall 2005: Sharonda Johnson, Reflectance Spectroscopy of Nanopatterned Surfaces

Fall 2005: W. Keith Burgess, Anisotropic Materials as Slow Light Substrates

Fall 2005-present: David Holland, Surface Area Analysis of Porous Silica Spheres

Fall 2005-present: Jeff Gerst, Striped Nanorod Arrays as SERS Substrates

Spring 2006: Sarah Subaran, Al nanopatterned surfaces

Spring 2006: Sonal Patel, Al SERS substrates

STUDENTS DIRECTED IN GRADUATE RESEARCH

Fall 2003-Fall 2004: Aja Andreu, Synthesis and Characterization of Nanoscale Electrochemical Sensors (Defended M.S. December 2004).

Fall 2003 – Summer 2005: Brandy Broglin, Striped Nanowire Arrays for Surface-Enhanced Raman Spectroscopy. (Defended M.S July 2005).

Spring/Summer 2005- Present: Jerry Heath, Plasmonic Nanolithography

COMMITTEES

Fall 2003-present	Chemistry Department Budget Committee
Summer 2004- present	Nanoscale Science Ph.D Planning Committee
Spring 2005-present	Nanotechnology Symposium Organization Committee
Summer 2005	Office Assistant Search Committee

TEACHING

Fall 2003	Chem. 1251 (General Chemistry)
Spring 2004	Chem. 1251 (General Chemistry)
Fall 2004	Chem. 3111 and 3111L (Quantitative Analysis)
Spring 2005	Chem. 1251 (General Chemistry)
Fall 2005	Chem. 3111 and 3111L (Quantitative Analysis)

Spring 2006 LBST 2213 (Science, Technology and Society)

PROFESSIONAL AFFILIATIONS

American Chemical Society

Materials Research Society

Electrochemical Society

American Physical Society

ACTIVITIES

1999-2000 Co-President of the Graduate Student Organization of Chemists.

- Acted as liaisons between faculty and students.
- Coordinated student run activities.

1999-2001 Student Representative of the Chemistry Department Safety Committee.

- Conducted departmental laboratory safety inspections.

1999 Georgetown University Writing Program Fellow.

2000 Volunteer for the Meridian International Center Cultural Ambassador Program.

2000-2001 Volunteer for "Kids for Chemistry" Program.

2001-present Member of the "Science Lions" outreach program at PSU

- Developed nanotechnology and colloidal chemistry demonstrations for school kids.

Summer 2002 Mentored high school student for the Women in Science and Engineering program, and trained high school teacher for the Materials Research Science and Engineering Center outreach program.

Spring 2003 Volunteer for the PSU Materials Research Science and Engineering Center (MRSEC) outreach program.

Spring 2003-Present Referee for *Langmuir*, and the *Journal of the American Chemical Society*.

Spring 2004 Judge for Graduate Research Fair

Spring 2004 Attended workshop entitled “Chemistry of Leadership: A Women's Leadership Development Program" sponsored by the Committee on the Advancement of Women Chemists (COACh) Anaheim, CA March 2003.

Fall 2004 Attended with UNCC delegation, the University of North Carolina Roundtable discussions with the Department of Defense, entitled “Biosupported Products and systems for National Defense”.

Fall 2004-Present Co-advisor of the Chemistry Club UNCC

Spring 2005-Present NSF proposal referee

Summer 2005 NSF panelist

Summer 2005 Participant in the UNC-Charlotte Summer Institute for Developing Multi-Cultural Curricular Modules.

Summer 2005 Guest speaker for the UNC-Charlotte UTOP program

Fall 2005-Present Organizer for the exhibit entitled “The Natural World as Art and Science”

Spring 2006-Present Journal referee for *Nanotechnology*

PUBLICATIONS

1. “Detection of DNA Oligonucleotides on Nanowire Arrays using Chronocoulometry” Andreu, A.; Merkert, J.W.; Lecaros, A.L.; Broglin, B.L.; Brazell, J.T.; El-Kouedi, M. *Sensors and Actuators B, Chemical,* In Press **2006**.

2. ““Synthesis and Characterization of Nanowire based Anisotropic Conductors” Sykes, E.C.H.; Andreu, A.; Deadwyler, D.A.; Daneshvar, K.; El-Kouedi, M. *Journal of Nanoscience and Nanotechnology (JNN),* Accepted **2006.**

3. “Biofunctionalized Nanoparticles for SERS and SPR” El-Kouedi, M.; Keating, C.D. In *NanoBiotechnology;* Mirkin, C.A.,: Niemeyer, C.M. Ed.; Wiley-VCH. **2004**.

4. “ Partitioning and Assembly of Metal Nanoparticles and their Bioconjugates in Aquesous Two-Phase Systems” Helfrich, M.R.; El-Kouedi, M.; Etherton, M.R.; Keating C.D. *Langmuir,* **2005**, 21, 8478.

5. “Nanowire based One Dimensional Conductive Films”. Sykes, E.C.H.; Andreu. A.; Deadwyler, D.A.: Daneshvar, K.; El-Kouedi, M. *Submitted to Advanced Functional Materials* **September 2005**.

6. “Pole Figure Analysis of Preferential Alignment of Au/AgI Composite Materials” El-Kouedi M.; Foss, C.A. Jr.; Bodolosky-Bettis, S.A.; Bachman, R.E. *J. Phys. Chem.* **2002,** 106, 7205.

7. “ Optical Properties of Gold-Silver Iodide Nanoparticle Pair Structures ”; El-Kouedi, M.; Foss, C.A. Jr. *J. Phys. Chem. B,* **2000**, 104, 4031.

8. “ Electrochemical Synthesis of Asymmetric Gold-Silver Iodide Nanoparticle Composite Films ”; El-Kouedi, M.; Sandrock, M.L.; Seugling, C.J.; Foss, C.A. Jr. *Chem. Mater.* **1998**, 10, 3287.

9. “Optical Properties of Nanoparticle Pair Structures”; Sandrock, M.L.; El-Kouedi, Gluodenis, M.; Foss, C.A. Jr. *MRS Symposium Proceedings*, **2000**, 635, C2.1.

10. “Toward Artificial Ion Channels: Self-Assembled Nanotubes from Calix[4]arene-Guanosine Conjugates”; Sidorov,V.; Kotch, F.; El-Kouedi, M.; Davis, J. *Chem. Comm.* **2000**, 23, 2369.

11. “An Investigation of the Influence of Striping Pattern on the Performance of Silver and Gold Striped Nano-Rod Arrays as SERS Substrates” Broglin, B.L.; Brazell, J.T.; Gerst, J.; El-Kouedi, M. *Manuscript in Preparation.*

Invention Disclosures Filed/Provisional Patents:

a) “Electrochemical detection of DNA using high surface area nanorod array electrodes” (#UNCC IR 2004-046)
b) “Fabrication of a Nanosensor DNA Microarray Chip” (#UNCC IR 2004-047)
c) “Synthesis and Characterization of Nanowire based Anisotropic Conductors” (#UNCC IR 2005-037)

REFERENCES

1. Professor Christine D. Keating- Department of Chemistry, Pennsylvania State University, University Park, State College PA, 16802, (814) 863-7832.
2. Professor Colby A. Foss, Jr.- Trex Enterprises Corporation Advanced Materials Group, 3038 Aukele Street, Lihue, HI, 96766, (808) 245-6465.
3. Professor Daniel Rabinovich-Department of Chemistry, UNC-Charlotte, Charlotte, NC, 28269.
4. Professor Robert E. Bachman- Department of Chemistry, University of the South, Sewanee, TN 37383, (931)598-1336.
5. Professor Paul S. Weiss-Department of Chemistry, Pennsylvania State University, University Park, PA 16802, (814)865-3693.

CURRICULUM VITAE
HORACIO V. ESTRADA

EDUCATION:

Ph. D.	Electrical Engineering, *Rensselaer Polytechnic Institute,* Troy, NY 12180	**1983**
M. Sc.	Electrical Engineering – *CIEA-National Polytechnic Institute,* México City, México	**1975**
B. Sc.	Control, Communications and Electronic Engineering, *University of Guadalajara* (México)	**1973**

PROFESSIONAL CAREER:

Associate Professor	Mechanical Engineering and Engineering Science Dept. *University of North Carolina-Charlotte,* Charlotte, NC 28223	**1983-Present**
Senior Design and Testing Engineer	*Goodrich Corp.* – Advanced Micromachines - Cleveland, OH Worked on the Design and Testing of MEMS-based Microsensors and Optical MEMS	**2001-2002**
Visiting Professor	Dept. of Electronics and Computing Engineering *University of Guadalajara* (México)	**Spring 1999**
Associate Researcher	Applied Physics Dept. *Research Center of Ensenada-CICESE,* Ensenada, BC (México) – Microwave Devices	**1980-1983**
Research Assistant	Electrical Engineering Dept. *Rensselaer Polytechnic Institute,* Troy, NY 12180	**1978-1980**
Instructor	Dept. of Electronics and Computing Engineering *University of Guadalajara* (México)	**1973-1976**

WORK AND RESEARCH INTERESTS:

- Design and Fabrication of MEMS and Microsensors
- Semiconductor Materials and Devices
- Ultrasound and Surface Acoustic Wave Devices
- Biosensors and Instrumentation
- Thin-Film Electronic Materials
- Semiconductor Processing & Microelectronics

PUBLICATIONS:

Over 30 scientific and technical papers in various journals and conference proceedings. Most recent:

- Syed Samsul Amin and Horacio V. Estrada, *Design of a Three Axes Accelerometer by Summit-V process,* Proceedings of the 2nd International Conference on Structure, Processing & Properties of Materials, SPPM, February **2004**, Dhaka, Bangladesh.
- L. Whitby, J. Weiss, J. Branonm, H. Estrada, et al. *A Guide for the Dynamic Calibration of Pressure Transducers*, **Calibration Standard**, Instruments Society of America, The Instrumentation Systems, and Automation Society, Nov. **2003.**
- C. Apanius, J. Siekkinen and H. V. Estrada, *Temperature Compensated User-Friendly Silicon Strain Gages*, Trans. Sensors Expo, Chicago, IL, Sept. **2001**.
- M. L. Nagy, C. Apanius, J. Siekkinen and H. V. Estrada, *A User-Friendly High Sensitivity Strain Gage*, Sensors Magazine, June **2001**.
- H. V. Estrada and J. F. Estrada-Vázquez, *A New Method for the Characterization of Longitudinal and Transverse Strain Sensitivities of Conductive Thin Films,* Proceedings of the 3rd. International Workshop on Mixed-Mode Integrated Circuits and Systems, IEEE-CONACYT, Puerto Vallarta, Mexico. Contributing paper #134, pp. 214-217, **1999.**

Manuscripts in preparation:

- N. Singh and H. V. Estrada, *A MEMS Polysilicon Linear Variable Differential Transformer (LVDT)*, submitted for presentation in the 3rd Annual Micro Nano Breakthrough Conference, to be held in Vancouver, WA, **July 2006**
- H. V. Estrada and P. H. DeHoff, A Simple and Accurate Method for the Characterization of Foil Metal Strain Gages' Transverse and Shear Sensitivity, to be submitted to the Journal of Experimental Mechanics, **May 2006**
- K. Lewis, J. McTighe and H. V. Estrada, *Health Monitoring of Carbon Fiber Reinforced Composites Using Silicon Strain Gages,* to be resubmitted.
- N. Singh and H. V. Estrada, *Design and Characterization of MEMS Surface Machined 3-D Silicon Coils*.

CONFERENCES PRESENTED:

Over 20 presentations in various national and international technical conferences, seminars and symposia. Most recent: A week-long "Workshop on MEMS-principles and MEMS-based Microsensors", as part of the BioMEMS Symposium at the Monterrey Institute of Technology, Monterrey, NL, Mexico, March **2004**, and "Microsensors for Automotive and Aerospace Applications" as part of the "2005 Mechatronics Symposium" at the Monterrey Institute of Technology,. Campus Guadalajara, Mex, **Oct. 2005,**

INVENTION DISCLOSURES – PATENTS:

- Patent **US#6,912,759 –** Coauthor – on Manufacturing of Thin Piezoresistive Pressure Sensors –**– July 2005**.
- Co-author of an invention on MEMS-based strain gages disclosed to Goodrich Corp. – **2001**
- 3 Patent Disclosures submitted to UNC-Charlotte, on temperature, strain and pressure sensors **–** 1996**-**99
- **In preparation –** invention disclosures to UNC-Charlotte:
  a) A Novel Structure/Principle for Humidity Sensing Application, **2006.**
  b) Thin Films Strain Gages and (Gage) Configuration/Geometry for the Full-Continuous Integration of Strains on Cylindrical Structural Elements and Optimization of Load Cells Based on Such - **2006**

RELEVANT TECHNICAL EXPERIENCE:

- Electronic device fabrication,
- Chemical microelectronics processing,
- Electrical characterization of electronic materials,
- Design and fabrication of SAW-devices, sensors and MEMS,
- Contactless measurement of critical-dimensions in MEMS and electronic devices,
- Computer data acquisition,
- Photolithography,
- Thin-film deposition techniques,
- Mechanical testing of materials,
- CAD-design
- Virtual Instrumentation

REVIEWER OF TECHNICAL AND SCIENTIFIC PAPERS, RESEARCH PROPOSALS AND TEXTBOOKS:

- Journal of Materials Research,
- American Physical Society,
- Journal of Dynamic Systems, Measurement and Control **(2004)**
- Prentice Hall **(2005)**
- The Electrochemical Society,
- North Carolina Chamber of Commerce
- Journal of Lightwave Technology **(2003)**

NATIONAL TECHNICAL COMMITTEES:

ISA - National Committee for Development of Standards for the Testing of Pressure Transducers, Member, 1997-**2002**

RESEARCH GRANTS AND CONTRACTS:

Principal Investigator or Co-Investigator of 20 Research and Development Grants from various institutions/companies, including the National Science Foundation, Department of Education, IBM, North Carolina Biotechnology, Tektronix, Microelectronics Center of North Carolina (MCNC) and UNC-Charlotte.

In preparation: Research proposal on "Thermal Optimization of MEMS-silicon Strain Gages and Hall-effect Devices", **2006**.

SCIENTIFIC AND PROFESSIONAL SOCIETIES:

IEEE, member

Instruments Society of America (ISA), member

COURSES, WORKSHOPS FOR PROFESSIONAL DEVELOPMENT:

Have attended several Short Courses and Workshops in the areas of MEMS, III-V compounds, semiconductor materials processing and characterization, instrumentation, and experimental stress analysis. Most recent: "Sandia Labs' SUMMIT-V MEMS Design", July **2003.**

TEACHING EXPERIENCE:

- *UNC-Charlotte. Mechanical Engineering and Engineering Science Dept.* Have taught on different subjects/topics at both, graduate and undergraduate levels, in the areas of MEMS, Microelectronics Processing, Electronic Materials, Semiconductor Devices, Engineering Materials, Circuits, Instrumentation, Laboratories, and Statics.
- *Research Center of Ensenada (México), Applied Physics Dept.,* Taught graduate-level courses in the areas of Linear Systems and Semiconductor Devices.
- *University of Guadalajara (México), College of Engineering and Graduate School,* Taught graduate and under-graduate courses in the areas of Instrumentation, Semiconductor Technology, Control Theory and Electronic Circuits

Advisor and/or Co-Advisor of Graduate Theses and Senior Projects:

- 11 Graduate Theses at the Master and Doctoral levels. Most recent Master - on the development of a new humidity principle/sensor **2005**. Work in progress - PhD student N. Singh – Development of a micro-LVDT and microcoils.
- 15 Senior Projects in Mechanical Engineering and Engineering Science
- 4 Design Projects in Electronics and Instrumentation

CONSULTING:

- *University of Florida*. Development of high-temperature strain gages, for the measurement of residual stresses in metal-ceramic structures. 1997.
- *Goodrich Corp.* Development of flexible silicon strain gages and their use on composite health monitoring. **1999-2004**

University of North Carolina at Charlotte, 9201 University City Boulevard, Charlotte, NC 28223
Phone: 704 687 4443; Fax: 704 687 3151; E-mail: metzkorn@email.uncc.edu

3040 Heathcroft Court, Charlotte, NC 28269
Phone: 704 549 4553

PERSONAL DATA

Date of Birth:	September 6th, 1970
Place of Birth:	Koblenz – Rhineland-Palatinate / Germany
Citizenship:	German
Employment status:	permanent US resident
Languages:	fluent in German and English, advanced in French
	basics in Spanish, Russian and Chinese

EDUCATION

12/98 **Dr. rer. nat. / Chemistry (Ph.D.)**
Albert-Ludwigs-Universität, Freiburg / Germany – Department of Chemistry
Dissertation: " Homologous (Iso)Pagodanes and (Iso)Pagodadienes: Syntheses, 4C/3e Radical Cations and 4C/2e Dications"
(Supervisor: Prof. Dr. Horst Prinzbach)

09/94 **Diplom-Chemiker (M.S.)**
Albert-Ludwigs-Universität, Freiburg / Germany – Department of Chemistry
Thesis: " Synthese von [2.2.1.1]Isopagodadiene: Oxidationspotential, Homo-konjugation"
(Supervisor: Prof. Dr. Horst Prinzbach)

10/91 **Vordiplom / Chemie (B.S.)**
Albert-Ludwigs-Universität, Freiburg / Germany – Department of Chemistry

PROFESSIONAL ORGANIZATIONS

Member of the German Chemical Society (GdCh)
the American Chemical Society (ACS)
and the Organic Division of the American Chemical Society
and the Fluorine Division of the American Chemical Society

PROFESSIONAL EXPERIENCE

Since 08/05 **Assistant Professor (Chemistry)**
UNC Charlotte

06/02-06/05 **Senior Research Associate**
University of Southern California / Loker Hydrocarbon Research Institute

06/99-05/02 **Postdoctoral Research Associate**

I) Research on synthetic hydrocarbons, related to alternate fuel sources: high pressure alkylation and acylation reactions in superacidic media, using homo- and heterogeneous systems

II) High Energy Density Materials (HEDM): development of a new and safe NF_2 transfer methodology, experimental experience with F_2, N_2F_4 and various aspects of fluorination chemistry, preparative targets included heterocyclic (e.g. diazocines) and polycyclic (e.g. natosanes) systems

III) Oxonium Ions and Polycations: multi-step syntheses of suitable precursors for the generation of mono-, di- and tricationic species (e.g. heteroadamantanes, asteranes, allenes)

IV) Syntheses of sterically crowded olefins and cyclopropane derived systems with the potential as a superior fuel in propellant formulations, work includes the revisiting of tetrakis-*tert.*-butylethylene

V) Further duties included supervising and teaching of undergraduate, graduate and summer students in the organic laboratory

(Mentors: Prof. Dr. George A. Olah, Katherine B. and Donald P. Loker Distinguished Professor and 1994 Nobel Laureate; Prof. Dr. G. K. Surya Prakash, George A. and Judith A. Olah Nobel Laureate Chair in Hydrocarbon Chemistry and 2004 ACS Fluorine Award winner)

10/94-05/99 **Graduate Research Associate**

I) Multi-step syntheses of complex cage hydrocarbons with defined structural modifications of the strategic cyclobutane core, involving a wide variety of organic reactions, particularly photochemical transformations; interpretation of ^{1}H-, ^{13}-C-NMR (including homo- and heteronuclear decoupling experiments), FT-IR, MS, elemental analysis and X-ray analysis

II) International co-operations to investigate the physicochemical properties of (iso)pagodanes by calculations, EPR, CV, FDMR and oxidation in magic acid

III) Supervisor for advanced undergraduate and graduate students in organic chemistry at the Institute of Organic Chemistry and Biochemistry

IV) Instructor of laboratory assistants and students (advanced organic chemistry)

Chemical Contractor

03/01-12/02 Literature evaluation for Metall-Chemie Goerrig GMbH &Co. KG, comparative literature and patent searches using SCIFinder and BeilsteinCrossfire

10/94-12/98 Concept development: “Recycling of laboratory waste”

01/96-07/96 Cooperation with BOEHRINGER INGELHEIM PHARMA KG: syntheses of heterocyclic drug candidates, aspects of SAR, combinatorial approach and pharmacological basics

05/96-12/97 Cooperation with the Institute of Biophysics and Radiation Biology at the University of Freiburg (Prof. Dr. Kreutz): syntheses of aromatic lead candidates

on a future diploma thesis. Supporting seminars were organized by supervisors and given by teachers and students weekly. Work included regular oral exams of the students and a final written test to be graded by the supervisors in co-operation with the responsible professor.

Further duties included maintaining a large laboratory in good working conditions (e.g. financial management, instrumental equipment, safety, waste management) and presenting our laborartoy to co-operating and sponsoring companies (e.g. KNF Neuberger) as well as to university and government safety agencies.

09/95 – 08/98 Instructor to Mrs. Christiane Schrempp during her apprenticeship to become a certified laboratory assistant. She was taught basic, advanced and highly specalized laboratory techniques, modern analytical methodology (sample preparation and interpretation of FT-IR, MS, one- and two dimensinal NMR, UV/VIS, EA) and theoretical aspects of organic chemistry.

06/99-06/05 Teaching special laboratory techniques (e.g. inert atmosphere chemistry, photochemistry) to graduate students.
Guiding summer and undergraduate students through small research projects and introducing them to modern preparative organic chemistry.

AWARDS AND SCHOLARSHIPS

06/99-05/04 President Sample Fellowship, University of Southern California

08/00 Honored as Junior Fellow of the Loker Hydrocarbon Research Institute

PUBLICATIONS

1. "Synthesis of new strained hydrocarbons derived from bis-(*exo*-methylene) bicyclo[2.2.1]norbornane – M. Etzkorn, G. K. S. Prakash, G. A. Olah, in preparation.
2. "1-Oxonia-adamantane" – M. Etzkorn, R. Aniszfeld, T. Li, H. Buchholz, G. Rasul, G. K. S. Prakash, G. A. Olah, in preparation.
3. "Direct oxidation of azides to nitro compounds" – G. K. S. Prakash, M. Etzkorn, *Angew. Chem.* **2004**, *116*, 26; *Angew. Chem. Int. Ed. Engl.*. **2004**, *43*, 26.
4. "Triphenylmethyldifluoramine: A stable reagent for the synthesis of *gem*-bis(difluoramines)" – G. K. S. Prakash, M. Etzkorn, G. A. Olah, K. O. Christe, S. Schneider, A. Vij, *Chem. Commun.* **2002**, 1712.
5. "Acid-Catalyzed Isomerization of Pivalaldehyde to Methyl Isopropyl Ketone via a Reactive Protosolvated Carboxonium Ion Intermediate" – G. A. Olah, T. Matthew, E. R. Marinez, P. M. Esteves, M. Etzkorn, G. Rasul, G. K. S. Prakash, *J. Am. Chem. Soc.* **2001**, *123*, 11556.

6. "Photochemical transformations, 85. [2.2.2.2]/[2.2.1.1]Pagodanes and [1.1.1.1]/[2.2.1.1]/[2.2.2.2] isopagodanes: syntheses, structures, reactivities – benzo/ene- and benzo/benzo-photo-cycloadditions" – M. Wollenweber, M. Etzkorn, J. Reinbold, F. Wahl, T. Voss, J.-P. Melder, C. Gruind, R. Pinkos, D. Hunkler, M. Keller, J. Worth, L. Knothe, H. Prinzbach, *Eur. J. Org. Chem.* **2000**, 3855.
7. "Long-lived [1.1.1.1] and [2.2.1.1]-'Isopagodane' dications: novel 4C/2e σ-bishomoaromatic dications" – G. K. S. Prakash, K. Weber, G. A. Olah, H. Prinzbach, M. Wollenweber, M. Etzkorn, T. Voss, R. Herges, *Chem. Commun.* **1999**, 1029.
8. "[2.2.2.2]Pagodane: Synthesis and Oxidation of Nonclassical Valence-Isomeric 4C/3e and σ-Bishomoaromatic 4C/2e Ions" – M. Etzkorn, F. Wahl, M. Keller, H. Prinzbach, F. Barbosa, V. Peron, G. Gescheidt, J. Heinze, R. Herges, *J. Org. Chem.* **1998**, *63*, 6080.
9. "(Iso)Pagodane Radical Cations in Liquid Hydrocarbons: 'Time-Resolved Fluorescence-Detected Magnetic Resonance' Study of Valence Isomeric Radical Cations" – A. D. Trifunac, D. Werst, R. Herges, H. Neumann, H. Prinzbach, M. Etzkorn, *J. Am. Chem. Soc.* **1996**, *118*, 9444.
10. "4C/3e-Radikalkationen mit Käfig-gesteuerten Konfigurationen" – G. Gescheidt, R. Herges, H. Neumann, J. Heinze, M. Wollenweber, M. Etzkorn, H. Prinzbach, *Angew. Chem.* **1995**, *107*, 1109; *Angew. Chem. Int. Ed. Engl.* **1995**, *34*, 1016.

CONFERENCES AND WORKSHOPS

1. "1-Oxonia adamantane: A novel cage oxonium ion", G. K. S. Prakash, M. Etzkorn, R. Aniszfeld, G. Rasul, H. A. Buchhloz, T. Li, G. A. Olah; oral presentation at Pacifichem 2005, Honolulu, HA, December 15-20, **2005**.
2. "1-Oxonia adamantane" – M. Etzkorn, G. K. S. Prakash, G. A. Olah, G. Rasul, R. Aniszfeld; poster and oral presentation at the 17th Winter Fluorine conference in St. Pete Beach, FL, January 9 – 14, **2005**.
3. "Synthesis of the parent 1-oxonia adamantane" – M. Etzkorn, G. K. S. Prakash, G. A. Olah, G. Rasul, R. Aniszfeld; oral presentation at the 227th National ACS Meeting in Anaheim, CA, March 28 – April 1, **2004**.

4. "1-Oxonia-trimethyladamantane" – M. Etzkorn, G. K. S. Prakash, G. A. Olah, H. A. Buchholz, R. Aniszfeld, T. Shamra; oral presentation at the 225th ACS National Meeting at New Orleans, LA, March 23-27, **2003**.
5. "Triphenylmethyldifluoramine: A stable reagent for the synthesis of *gem*-bis(difluoramines)" – M. Etzkorn, G. A. Olah, G. K. S. Prakash, K. O. Christe, A. Vij, S. Schneider; oral presentation at the 16th Winter Fluorine Conference in St. Pete Beach, FL, January 12-17, **2003**.
6. "Syntheses of (Iso)Pagodanes and Oxidation to Nonclassical Valence-Isomeric 4C/3e and σ-bishomoaromatic 4C/2e Ions" – M. Etzkorn, G. K. S. Prakash, G. A. Olah, H. Prinzbach; oral presentation at the 219th ACS National Meeting at San Francisco, CA, March 26-30, **2000**.
7. Participant at the Bayer Postdoc Workshop in West Haven, CT, **2000**.
8. Participant at the BASF Graduate Summer Course in Ludwigshafen, Germany, **1997**.

Michael A. Fiddy
University of North Carolina at Charlotte
Director, Center for Optoelectronics and Optical Communications
Professor of Physics and Optical Science and of Electrical Engineering

a. Professional Preparation:

B. Sc. Physics, First Class Honors, University of London, 1973
Ph. D. Physics University of London, January 1977

b. Appointments:

2002-	Director, Center for Optoelectronics and Optical Communications, UNC Charlotte Professor, Physics & Electrical Engineering Department, UNC Charlotte
1994-2001	Head of Department of Electrical & Computer Engineering, UML
1991-	Professor, Department of Electrical Engineering, UML
1987-1991	Associate Professor, Department of Electrical Engineering, UML
1985-86	Visiting Associate Professor in Mathematics Department, Catholic University of America, Washington, D. C.
1984-1987	Lecturer in Physics, Kings College, London University (tenured).
1982,1983	Visiting Associate Professor, Institute of Optics, U. of Rochester
1979-1984	Lecturer in Physics, Queen Elizabeth College, London University

Fellow of the Optical Society of America (member since 1979), the Institute of Physics (member since 1977), and the Society of Photo-Optical Engineers (member since 1988)
Senior Member IEEE Lasers and Electro-optics Society (since 1988)
Member of the Electromagnetics Academy since January 1990, the American Society for Engineering Education, ASEE, (since 1994), and Sigma Xi (since 1994)

c. Publications : (~120 refereed and 260 conference proceedings)

i. Selected Publications

H. M. Sheih, C. L. Byrne and M. A. Fiddy, "Image reconstruction: a unifying model for resolution enhancement and data extrapolation", J. opt. Soc. Amer. A 23, p258-266, (2006)
M. A. Fiddy, "The Center for Optoelectronics and Optical Communications at UNC Charlotte" (June issue OPN 2005)
U. Shahid, M. Testorf and M. A. Fiddy, "Minimum-phase based inverse scattering algorithm applied to Institut Fresnel data", Inverse Problems 21, S153-S164, (2005).
M. A. Fiddy and H. J. Caulfield, "The significance of phase and information", Ch 17 in "Tribute to Emil Wolf", T. P. Jannson Editor, SPIE Press, 2005, pp363-378.
H. J. Caulfield and M. A. Fiddy, "Backward thinking: holography and the inverse problem", Ch. 19, in Tribute to Emil Wolf", T. P. Jannson Editor, SPIE Press, 2005, pp401-420.
A. Kanaev, Y. Cao and M. A. Fiddy, "Axial frozen modes in finite anisotropic photonic crystals", Opt. Eng. 44, 095201, (2005).
A. Semichaevsky, M. E. Testorf, R.V. McGahan and M. A. Fiddy, "Unsupervised constrained radar imaging of low resolution targets", Waves in Random Media, 14, pp S415-S434, 2004.
M. A. Fiddy, "Inverse scattering and superresolved lithography", IEEE APS/URSI Conference, Session #56, Columbus, June 2003.

ii. Related Publications

W. Lazonick, M. A. Fiddy and S. Quimby, " 'Grow your own' in the new economy? Skill-formation challenges in the New England optical networking industry", Ch .12 in Globalization, Universities and Issues of Sustainable Human Development", Ed. J. L. Pyle and R. Forrant, Elgar Press, pp233-259, 2003
M. A. Fiddy and R. Hocken, " Photonics Manufacturing : Concurrent Engineering " *Proc. OIDA Photonics Manufacturing Conference*, Boston, June 2002, paper 3; (see "Cost – Reducing Technologies and Processes for Photonics Manufacturing, Ed. D. Krohn, OIDA Press, 2002).

Editor, Experimental and numerical methods for solving ill-posed problems: medical and nonmedical applications I and II, with Barbour, R.L. and M. J. Carvlin, vol 2570 (1995) and vol 3171, (1997)
Editor, Special Issue of *J.Opt. Soc. A*, on Signal Recovery and Synthesis Vol 16, July 1999
Editor, Image reconstruction from incomplete data I, II, III and IV, *SPIE* with R. Millane, vol 4123 (2000) and 4792 (2002); III in Denver, (2004), IV (2006)

d. Professional Activities:

1. **Editor**, *Waves in Random and Complex Media***,** since Jan 1996, Editorial board member since 1991;
   Topical Editor, *Signal and Image Processing*, Optical Society of America, 1994-2001;
   Area Editor, *Electro-optics and Lightwave Systems: CRC Press Dictionary of Electrical Engineering;*
   Associate Editor, *Multidimensional Systems and Signal Processing* (Kluwer).
   Member, SPIE Engineering, Science and Technology Policy Committee, 2005- .
2. UMass Lowell Outstanding Graduate Educator of the year, 1990/91.
3. **Courses taught during the last 5 years**

16.100/101 Introduction to Electrical Engineering	16.111Digital Information World
16.364 Engineering Mathematics	16.699 Res. methods in Elec/Comp Eng
16.511Digital image processing	16.568 Electro- and fiber optics
16.610 Optics for Information Processing	17.202 Introduction to Optical Systems
59.101 Values and creative thinking	OPTI 8621 Modern Coherence Theory
OPTI 8243 Opt. Propag. In Inhomog Media	OPTI 8221 Optical Communications

4. **Activities conducted in collaboration with K-12 schools or other educational organizations**
   Organized and taught (residential) High School Scholars Camp in E.E. 1998, 1999 and 2001

e. Collaborators

Dr. J. Ballato, Clemson: optical materials
Dr. D. Brady, Duke University: Coded aperture imaging
Dr. C.L. Byrne, Mathematics UML: Superresolution techniques
Dr. W. Cai, Mathematics UNC Charlotte: Photonic bandgap structures
Dr. J. Canning, Computer Science UML: Parallel Implementation of Algorithms
Dr. A. Figotin, Math, UC Irvine, Slow light structures
Dr. W. Goodhue, Physics, UML, MEMs based SLMs
Dr. M-A Hasan, ECE, UNC Charlotte: Photonic bandgap structures
Dr. W. Lazonick, Regional Economic & Social Development Dept, UML: Lucent Technologies
Dr. Carl Lawton, Chemical Engineering, UML: Quantum Dots
Dr. R. V. McGahan, AFRL, UML: Radar Foliage Penetration Studies
Dr. Babs Soller, UMass Medical Center: Retinal Spectroscopy
Dr. E. B. Stokes, UNC Charlotte: Sources and sensors
Dr. M. Testorf, Physics Department, Dartmouth College: Optical Processing and Imaging
Dr. R. Tsu, ECE, UNC Charlotte: Quantum confinement
Dr. S. Tsynkov, Math, NCSU, Nonlinear wave propagation
Dr. J. Waldman and Dr. R. Giles, Physics, UML: Radar Data Processing

f. Graduate students

Supervised and graduated 20 Ph.D. students and 51 MS students

Greg J. Gbur
Department of Physics and Optical Science
UNC Charlotte
Charlotte, NC

PROFESSIONAL PREPARATION

University of Chicago, Physics, B.A. (with honors), 1993
University of Rochester, Physics, M.A., 1996
University of Rochester, Physics, Ph.D., 2001

University of Rochester, postdoctoral, April 2001 – April 2002
Vrije Universiteit, Amsterdam, postdoctoral, April 2002 – August 2004

APPOINTMENTS

August 2001 – present, Assistant Professor, The University of North Carolina at Charlotte, Department of Physics and Optical Science, Charlotte, NC

PUBLICATIONS

Over 40 peer-reviewed publications, including:

1. H.F. Schouten, T.D. Visser, G. Gbur, D. Lenstra and H. Blok, "The diffraction of light by narrow slits in plates of different materials," J. Opt. A 6 (2004), S277.
2. H.F. Schouten, T.D. Visser, G.Gbur, D. Lenstra and H. Blok, "Connection between phase singularities and the radiation pattern of a slit in a metal plate," Phys. Rev. Lett. 93 (2004), 173901.
3. H.F. Schouten, N. Kuzmin, G. Dubois, T.D. Visser, G. Gbur, P.F.A. Alkemade, H. Blok, G.W. 't Hooft, D. Lenstra and E.R. Eliel, "Plasmon-assisted two-slit transmission: Young's experiment revisited," Phys. Rev. Lett. 94 (2005), 053901.
4. G. Gbur, H.F. Schouten and T.D. Visser, "Achieving superresolution in near-field optical data readout systems using surface plasmons," Appl. Phys. Lett. 87 (2005), 191109.
5. C.H. Gan and G. Gbur, "Strategies for employing surface plasmons in near-field optical readout systems," Opt. Exp. 14 (2006), 2385.

TEACHING EXPERIENCE

Courses taught at UNC Charlotte:

1. OPTI 6101/8101, Math Methods for Physics and Optical Science, Fall 2004, Fall 2005
2. OPTI 6271, Advanced Physical Optics, Spring 2005
3. PHYS 3141, Modern Physics, Fall 2005, Spring 2006
4. PHYS 3101, Math Methods for Physics, Spring 2006

Other experience with teaching and student supervision:

1. University of Rochester: Co-instructor with Professor Adrian Melissinos, *graduate mathematical methods for physicists 401- 403,* autumn 1999.

2. Currently supervising optics Ph.D student.
3. Supervising senior design project for two ECE students.
4. Informal independent study with optics Ph.D student on numerical methods.

SYNERGISTIC ACTIVITIES

Reviewer for numerous refereed scientific publications, including Optics Letters, Physical Review Letters, American Journal of Physics, Science Magazine and Waves in Random and Complex Media.

RECENT SEMINARS AND INVITED TALKS

1. G. Gbur, "*Surface plasmon effects in extraordinary optical transmission*," seminar at the University of Arizona, May, 2005.
2. G. Gbur, "*Nonradiating sources, nonscattering scatterers, and other 'invisible' objects*," 2005 Inverse Scattering Workshop, Charlotte.
3. G. Gbur, "*Developing 'Superbeams' for Improved Propagation Through Atmospheric Turbulence*," seminar at Michigan Technological University, March, 2006.
4. G. Gbur, "*Strategies for Employing Surface Plasmons in Near-Field Optical Readout Systems*," invited talk at Nanophotonics Topical Meeting (NANO), April, 2006.

Kenneth E. Gonsalves
Celanese Acetate Distinguished Professor of Polymer Chemistry
Department of Chemistry
Adjunct Professor of *Mechanical Engineering*
University of North Carolina
Charlotte, NC 28223

Academic:
PhD University of Massachusetts at Amherst 1980-84
Postdoctoral : MIT 1984-85
MS Boston College
BS (Honors) Delhi University
Research Assistant, Materials Res. Lab.
At the University of Massachusetts at Amherst 1981-84.

Experience:
Assistant Professor Stevens Inst. of Technology NJ, 1986-1990.
Assistant Professor University of Connecticut at Storrs, Sept. 1990 to May 1994.
Associate Professor University of Connecticut at Storrs, Sept. 1994
Professor, University of Connecticut at Storrs, Aug. 99-00
Visiting Professor Harvard University 1997
Visiting Scientist US Army Research Lab. Natick MA 1997-99
Scientific Advisor ININ Mexico1997-98
Associate Faculty member microelectronics, optoelectronics, Dept. of Electrical Engineering, UCONN 1998-00

Research Interests:
Materials Synthesis: Organic Polymer Chemistry, organometallic polymers, polymer and molecular precursors for ceramics and intermetallics; nanostructured materials/composites; biomaterials; novel resists for nanolithography; nanofabrication and nanopatterning of biomaterials.

Graduate Students:

UCONN(Fall 1990 to2000)

X. M. Chen	PhD 1993 President Quest Corp, DE
S. Venkataraman	MS 1993
P. Mungara	PhD 1995 faculty at U of Iowa
X. Chen	PhD 1996 at HP CA.
S. Zhang	PhD 1996 at Westvaco, SC
G. Carlson	PhD 1997 at Ciba Vision, IL
S. Jin	PhD 1998 at Dental Composites, CT
J. Wang	PhD 1999at Ciba , NY
H. Wu	PhD 2001at Clariant Corp., NJ
Wei He	PhD May 2003, now at GaTech
John Helwig	MS 2001, at Perkin Elmer Japan

UNCC(Spring 2001..)

Dalya Greenberg	MS May 2003 at St. Christopher's Medical College, London UK.
Yusif Umar	MS 2005
Nathan Jarnagin	MS expected 2006
Dania Alyounes	MS expected 2007

Undergraduates

A. Srinivasan : undergraduate visiting student from Mt Holyoke College Fall 1991.
P. Bouvet : visiting undergraduate student from Chemie de Rennes France summer 1993.
G. Tsubayama : junior high school student under NSF Young Scholars Program, summer 1994.
Dan Montville REU NSF Scholar summer 1998.
Jessica Semancin REU NSF Scholar summer 1999
Soha Sarfraz, REU-NSF Scholar summer 2002
Janet A. Cole UNCC 2001-2002 undergraduate research
An Nguyen UNCC Fall 2002 undergraduate research (now at GaTech in Chem. Engr.)
Kimberly Meade Jones Spring 2004; Postbach scholar UNCC

Stevens Institute of Technology(1986-1990):

Ron Holland	MS Materials Science 1990
John Oskam	MS Chemistry 1988
V. Shankar	MS Polymer Chemistry 1990
M. Trivedi	MS Chemical Engineering 1990.

Postdoctoral/ Research Associates:

Dr. Mingxing Wang (UNCC) 2005-
Dr. Jae H. Choi (UNCC) 2003-2004
Dr. M. Thiagarajan (UNCC) 2003-2005
Dr. Mohammed Azam Ali (UNCC) 2001-2003
Monica Rabinovich MS (Staff UNCC) 2001-
Dr. P. Bannerji (UNCC) 2001
Dr. Yongqui Hu (UCONN) 2000 now at Applied Materials CA
Dr. He Li (UCONN)1999-2000 now at ACS Abstracts OH
Dr. S. Jin (UCONN) 1998 now at Dental Composites, CT
Dr. S. P. Rangarajan (UCONN) 1995-97 now at Morton Thiokol, Boston, MA
Dr. Danny Xiao(UCONN) 1991-92 President of Nanocorp.
Dr. K. T. Kembaiyan (Stevens Inst.) 1987-88 now at Steel Corp, TX
Dr. S. S. Patel (Stevens Inst.) 1988-90
Dr. R. Agarwal (Stevens Inst.) 1986-87.

Visiting Scientists:

Prof. A. Garcia Ruiz UNAM Mexico 1995-1996
Dr. Z. Hou Academica Sinica, Shanghai PRC 1994-1995
Dr. G. C. Rojas ININ MX. 1998, 1999

COLLABORATIONS

US
Prof. J. Kumar UMass Lowell
Dr. C. C. Law Pratt & Whitney CT
Prof. J. I. Budnick UConn-Physics Dept.
Dr. G. Papaefthymiou, MIT National Magnet Lab. now at Villanova U., PA
Dr. J. Akkara US Army Lab., Natick, MA now at NSF
Prof. M. J. Yacaman, U of Texas Austin
Prof. J. Poler, UNCC
Prof. A. Chilkoti, Duke University
Dr. C. Halberstadt, Carolinas Medical Center at Charlotte
Prof. Cliff Henderson, Georgia Inst. of Technology
Dr. Dave Poker, ORNL, TN
Prof. M. Hudson, UNCC Dept. of Biology
Dr. Qi Lu, Carolinas Medical Center at Charlotte
Prof. Chris Yengo, UNCC Biology

International
Dr. R. Perez-Campos UNAM, Mexico
Dr. M. I. Baraton, LMCTS, Univ.de Limoges France
Prof. A. Ikai, Tokyo Inst. Technology Japan
Prof Y. Pomogailo, Russian Academy of Sciences, Moscow Region
Dr. L. Merhari, CERAMEC France
Dr. W. Bruegner, Fraunhofer Inst., Berlin, Germany
Dr. G. Cisniega ININ, MX
Dr. Nikola Battina, UAM, MX
Dr. H. Sumitami, Mitsubishi Electric, Tokyo, Japan
Dr. Hiroshi Watanabe, Mitsubishi Electric, Tokyo, Japan
Dr. Y. Wang INTEL Corp, OR
Dr. J. Roberts, INTEL, OR
Dr. K. Dean SEMATECH INT, TX

HONORS/AWARDS

International
Invited by the French Ministry of Foreign Affairs under the VIP Scientist Program to the University of Limoges FRANCE summer 1997.

TEACHING

Courses:

Stevens Institute of Technology(Jan. 1986 to August 1990)

Polymer Chemistry I: Synthesis & Mechanisms(grad)
Organometallic Chemistry(grad)
General Chemistry I & II(freshman)
Advanced Organic Chemistry(grad)
Organic Spectroscopy(undergrad)
Inorganic Polymers(grad)

University of Connecticut(Sept. 1990 to2000)

Polymer Chemistry I: Synthesis & Mechanism (grad)
Organic Chemistry (sophomore)
Determination of Organic Structure (grad)
Advanced Organic Reactions (grad)
Inorganic Polymers (grad: special topics)
Organic Chemistry: survey course for non majors
Polymer Characterization Lab. (grad)

Nanotechnology ESE 320/PMC 320: team taught with Electrical & Systems Engineering faculty.

Organizer of **Tutorial** on *"Surface Control of Nanoscale Materials Through Clean Syntheses, Functionalization and Characterization",* **Mater. Res. Soc.** Meeting Boston **Dec. 1997.**

"Advanced Resists for Micro- and Nanolithography" **Mater. Res. Soc. Meeting, Boston 1999. Tutorial**

UNCC (2001-

Polymer Synthesis: Spring 2001, Spring 2003
Hybrid Inorganic-Organic Polymers, Nanocomposites, Fall 2001
Organic Chemitsry I, Spring 2002/Fall 2002
Liberal Studies: Science Technology and Society Fall 2003

RESEARCH

My research focuses on the molecular design, synthesis, processing and characterization of novel materials. We draw on the fundamental knowledge of organic, inorganic/organometallic chemistry for the synthesis of polymers and precursors for various materials. Projects include the synthesis and processing of organometallic polymers as precursors for ceramics and intermetallics. In a related effort, reactive monomers and oligomers are being synthesized to produce high temperature coatings via thermal and/or laser techniques. Methods utilizing these chemical routes are also being developed to obtain ultrafine microstructures extending into the nanoscale regime. Polymer nanocomposites for photonic, electronic and magnetic applications are being synthesized and characterized. In another approach, biomimetic processing of novel ceramic/polymer composites is being pursued. Initial objectives include the adaptation of existing aqueous processing techniques for enabling the direct crystallization of inorganic phases on polymer matrices engineered as favorable substrates for heterogeneous nucleation and crystal growth. The direct synthesis of α–amino acids and oligomers is also being conducted via controlled peptide methods for drug delivery and targeting. Degradable polyamides and polyesteramides incorporating amino acids such as tyrosine-leucine and glycine have been successfully synthesized and their biodegradability examined with various enzymes and microrganisms. Self assembled nanostructures is a new focus of my group leading to novel sensors, structural including biomaterials as well as optical and magnetic materials. The latter are of special interest as scaffolds for tissue engineering applications.

New intiatives for developing novel resist materials for nanolithography (EUV, EB and X-ray) are underway. Concepts of nanostructured materials technology developed in my laboratory are now being applied to submicron and nano- (below 100 nm) structures for microelectronics. Details of our **nanotechnology** projects is as follows:

Nanolithography: Our research focuses on new high resolution resists applicable for next generation lithographies (NGL). Novel nanocomposite resists, new chemically amplified resists that incorporate inorganic moieties and photoacid generating groups, new non-chemically amplified yet photosensitive resists and hybrid organic-inorganic hybrid resists have been synthesized and tested. The latter follow the chain scission mechanism. Special emphasis is on ultrahigh sensitivity resists especially for low voltage e-beam resists.

Nanomanufacturing: The specific objective here is to design, fabricate and optimize an entirely new class of biomaterials and devices for tissue repair, e.g. ventral hernia, cardiovascular patches, etc. The specific objectives that are being pursued to develop an innovative 3-D scaffold that is both biochemical and mechanically functional involve a combination of polymer materials synthesis and processing strategies combined with

biochemical and tissue engineering as well as biomechanics. Both in vitro and in vivo studies are being carried out in conjunction with clinical groups at the Carolinas Medical Center.These micro/nanomechanical devices involve the coextrusion of polymer films with specific biochemical functionalities, microfabrication of alignment trenches and transport orifices for tissue engineering using patterned rollers; nanofabrication of channels within the alignment trenches for bionutrient and waste transport and finally lamination of the 3-D scaffolds with integrated mechanical functionality.

Polymer synthesis: Novel monomers and polymers are also being synthesized for specific applications- nanolithography, biomaterials and photonic-optoelectronics. The specific objective here is to design, fabricate and optimize an entirely new class of biomaterials and devices for tissue repair, e.g. ventral hernia, cardiovascular patches, etc. The specific objectives that are being pursued to develop an innovative 3-D scaffold that is both biochemical and mechanically functional involve a combination of polymer materials synthesis and processing strategies combined with biochemical and tissue engineering as well as biomechanics. Both in vitro and in vivo studies are being carried out in conjunction with clinical groups at the Carolinas Medical Center.These micro/nanomechanical devices involve the coextrusion of polymer films with specific biochemical functionalities, microfabrication of alignment trenches and transport orifices for tissue engineering using patterned rollers; nanofabrication of channels within the alignment trenches for bionutrient and waste transport and finally lamination of the 3-D scaffolds with integrated mechanical functionality.

PUBLICATIONS (selected)

"Improved Lithographic Performance for EUV Resists Based on Polymers having a Photoacid generator (PAG) in the Backbone", with K. Dean and M. Thiyagarajan; J. Photopolymer Sci. & Technol. **18(6),** 737 **(2005).**

"Design and Performance of EUV Resist Containing Photoacid Generator for Sub-100 nm Lithography", with M. Thiyagarajan, K. Dean and E. C. H. Sykes; **J. Nanoscience and Nanotechnology**1181-1183, **5(7)** (**2005**).

"Materials Design and Evaluation of Nanocomposite Resists for NGL" **Proc. SPIE 2005;** with M Thiyagarajan, P. Santiago, L. Rendon, A. Jeyakumar and C. Henderson.

"Newly Developed Polymer Bound PAG for Sub 100 nm Pattern by EUV Lithography"; **Proc. SPIE 2005**; with M. Thiyagarajan and K. Dean.

"New Resists for Nanometer Scale Patterning by Extreme UV Lithography" **Journal of Microlithography, Microfabrication, and Microsystems SPIE (JMM)**; **4(2),** 029701-1 – 029701-6**, April-June 2005** with M. Thiyagarajan and K. Dean.

"High Performance Resist for EUV Lithography", with M. Thiyagarajan, J. H. Choi, P. Zimmerman, F. Cerrina, P. Nealey, V. Golovkina, J. Wallace and N. Batina; **Microelectronic Engr. 2005** Vol 77/1 pp 27-35.

"BIORESIST: a lithographic approach for the patterning of cells in tissue engineering applications" **SPIE 2004, vol. 5376,** 502-507, with W. He, C. Halberstadt, Y. Umar and J. Choi.

"Lithography Application of a Novel Photoresist for Patterning of Cells" **Biomaterials** 25, 2055 (**2004)**; with W. He and C. Halberstadt.

"Non Cell Adhesive Photopolymerized Cross-linked Layers (**1**): Synthesis and Characterization", **J. Mater. Sci. : Mater. Med. : 14**(10), 833-841 **(2003);** with D. M Greenberg and M. A. Ali.

"High Sensitivity Nanocomposite Resist Materials for X-ray and EUV Lithography", **SPIE Proc.** *"Advances in Resist Technology and Processing XX"* **2003, 5039(**Part 2), 1173 ; with M. A. Ali, N. Batina, V. Golovkina and F. Cerrina.

Books/Proceedings

"Nanopatterning: From Ultralarge Scale Integration to Biotechnology" **Mater. Res. Soc**. **Proc. vol.** 705**,** L. Merhari, K. Gonsalves Eds. **(2002)**

"Materials Issues and Modeling for Device Nanofabrication", **Mater. Res. Soc**. vol. 584, **2000**; K. E. Gonsalves, L. Merhari et al Eds.

Patents

(1) "Synthesis of Iron- Cobalt Powders" *US patent No. 4,842,641* June 27, June **1989.** Assigned to GAF Chemicals Corp. New Jersey.

(2) "Synthesis of Nanostructured M50 Type Steel Powders' *US patent 5,589,011*, Dec. **1996.**

(3) "Nanostructured Metals, Metal Carbides and Metal Alloys" *US patent 5984996*, **Nov. 1999.**

(4) "Methods for the Manufacture of Nanostructured Metals, Metal Carbides and Metal Alloys" *US patent 6,033,624* , **March 2000.**

(5) "High Resolution Resists for Next Generation Lithographies"; US patent **09/992,560 2005. CIP filed Sept 2005**

(6) "Nanocomposite Negative Resists for NGL" **US patent filed Dec. 2002**; with M. A. Ali; (pending)

(7) "Microstamping Activated Polymer Surfaces", co-inventor with A. Chilkoti, J. Hyun and Z. Yang (Duke Univ.), **US patent filed Sept. 2002**; (pending).

PROFESSIONAL SERVICE

Guest **Editor** for a Special Issue of *Nanostructured Materials*, based on viewpoint set of selected papers from a special MRS Symposium on "Molecularly Designed Ultrafine/Nanostructured Materials" San Francisco, CA April 1994; **Vol. 5,** *No. 2*, **1995.**

Reviewed manuscripts for:
J. Biomaterials Science Polymer Ed.
Microelectronics Engineering
MACROMOLECULAR BIOSCIENCE MACROMOLECULAR BIOSCIENCE
Acta Biomaterialia
Encyclopedia of Biomedical Engineering, Wiley
Biomaterials
Langmuir
Makromolecular Chemie: Rapid Communications
Macromolecules published by the Amer. Chem. Soc.
Organometallics published by the Amer. Chem. Soc.
J. Adhesion Science & Technology
J. of Inorganic & Organometallic Polymers
Chem. of Mater. published by Amer. Chem. Soc.
Biomimetics
Advanced Functional Materials
Advances in Polymer Technology
J. of Aerosol Science
ACS Symp. Series(ad hoc)
Applied Organometallic Chem.
J. Polymer Science: Chem Ed.
J. Mater. Res.
J. Mater. Sci.
Adv. Mater.(Weinheim)
Nanostructr. Mater.
New Polymeric Materials
Mater. Sci. & Eng. C
Philosophical Tran. B
J. Physical Chem.
J. Amer. Ceram. Soc.
J. Nanoparticle Science & Technology
J. Appl. Polymer Sci.
J. Macromolecular Sci.-Pure and Appl. Chem.
J. Organometallic Chemistry
Colloids & Surfaces A: Physicochemical and Engineering Aspects
Chemistry of Materials (Am. Chem. Soc.)
Biomacromolecules
Surface & Coatings Technology
J. Electrochemical Soc.
Journal of Colloid and Interface Science.

GRANTS & CONTRACTS (selected)

1. K. Gonsalves Conference Chair and Main Organizer of " *Symposium on Nanoscale Science & Engineering: Convergence of the Top Down & Bottom Up Approaches";* UNC Charlotte **Oct 2005**- supported by Carolinas HealthCare System; South Carolina Research Authority; DOD/Army; CEM Corp., General Dynamics; Charlotte Research Institute; North Carolina Biotechnology Center- Total $31,000 raised by KEG for the Conference expenses.

2. 193 nm/EUV Lithography, INTEL Corp. $79,662; 8/17/04 to 6/30/06 + $30,000 Total $110,000. Renewal $110K for 2005-2006 approved. Third year $110,000. Total $330,000

3. K. Gonsalves Co-organizer-support for Symposium AA "Micron & Nanoscale Materials in Biology and Medicine" Materials Research Society, Boston MA Dec 2004: NIH-NIDCR $20,000, USAMRMC-TATRC Ft Dieterich MD $20,000, CRI $2,500, Whittaker Foundation $2,500

4. "Nanocomposite Resists for Next Generation Lithography: Development of EUVL Prototypes" **International SEMATECH**; May 1, 2003 to April 30, 2005; $302,00 for 2 years; $150K per year.

5. NSF DMII $5000, Whitaker Foundation $2500, Motorola France $1000, Nanoresist Tech. Inc. $500 and CERAMEC France $1000 for support on Symp on Nanotechnology at MRS Boston, Dec. 2001.

6. Faculty Recruitment grant NCBC $96,000 Aug. 2000-2002.

7. "New Resist Concepts for Electron Projection Lithography for Mass-production of Integrated Circuits with sub-100nm Critical Dimensions" SPAWAR/DARPA- $264K 99-01, K. Gonsalves PI.

8. Support for Symp. J: "Advanced Materials and Techniques for Nanolithography" MRS, Boston Dec. 99: ONR-$5000; NSF-$5000; ST Microelectronics France- $2000; ComSys GmbH-Germany-$2000; Ceramec France-$2000; Conexant Systems Inc.-$2000, MRS $1000.

M.-A. Hasan

Office Address:
Departmrent of Electrical Engineering,
University of North Carolina
9201 University City Blvd., Charlotte, NC 28223
Tel: (704) 687-6414, Fax: (704) 687-4762
E-mail: mhasan@uncc.edu

Home Address
5211 Basswood Dr.
Concord, NC 28025
Tel. (704)490-3919

Education:

- Licentiate of Engineering (2 to 3 years program after the Master degree), Department of Physics and Measurement Technology, Linköping Institute of Technology, Sweden, 1987.
- Ph.D. in Materials Physics , Department of Physics and Measurement Technology, Linköping Institute of Technology, Sweden, Sept. 1990.

Awards and Scholarships:

- Postdoctoral fellowship from the Swedish Natural Science Research Council (NFR: Naturvetenskapliga forskningsrådet), 1992-1993.
- Welch Scholarship Award from the International Union of Vacuum Science, Technique and Applications (IUVSTA), 1991 -1992
- Postdoctoral fellowship from the Swedish Natural Science Research Council (NFR: Naturvetenskapliga forskningsrådet) 1991-1992.
- Postdoctoral fellowship from the Sweden-America Foundation (Sverige-America Stiftelsen), 1991-1992
- Student Travel Award from the Electronic Materials and Processing Division of the American Vacuum Society, 1990. (Toronto Meeting)
- Student Travel Award from the Thin Film Division of the American Vacuum Society 1986. (Baltimore meeting)
- Postgraduate Scholarship Award from Sabah Al-Salem Al-Sabah foundation (Kuwait) for partly supporting my Ph.D. study in Sweden. 1985-1987
- Deutscher Akademisher Austanschdienst (DAAD) [German Academic Exchange Service] scholarship, KFA (Nuclear Research Center) Jülich GMBH, Germany, July-September 1977 (During the third year of my undergraduate study).
- Top-Ten Award: during all four years of undergraduate studies.

Publications: More than 34 refereed articles in scientific journals, 52 contributions to international and national conferences, one patent, one patent application, 8 patent disclosures.

Positions Held:

- Associate Professor, Department of Electrical Engineering, University of North Carolina, Charlotte, Spring 2000-present
- Assistant Professor, Department of Electrical Engineering, University of North Carolina, Charlotte, Fall 1995-Fall 99

- Research Assistant Professor, Electronic Materials Division, Coordinated Science Laboratory, Dept. of Materials Science and Engineering, University of Illinois at Urbana-Champaign (UIUC), USA, Sept. 1991- Aug. 1995

Review and Referee Duties

1. Since 1995, has reviewed proposals for:
1. DOE, 2. NIH, 3. Natural Science and Engineering Council of Canada, 4. The Southern Technology Council (STC), 5. NSF (review panel)

2. Has reviewed and currently review papers for the following journals:
1. Surface Science, 2. J. Materials Research, 3. Vacuum, 4.Thin Solid Films, 5. J. Vacuum Science and Technol, 6. Optical Engineering, 7. Journal of Applied Physics

3. Has been invited by the Strategic Innovations International to evaluate new technologies.

Research Experience:

**** Devices and optoelectronic characterizations***

- Growth of devices such as HBTs and FETs, delta-doped and quantum well based structures, Hall effect measurements and photoluminescence studies.

****Analyses:***

-*Post-deposition:*Electrical and optical characterizations, High-Resolution Triple-axis X-ray diffraction, Transmission Electron Microscopy (TEM), Scanning Electron Microscopy (SEM), Secondary Ion Mass Spectroscopy (SIMS).

-*In-situ:*Low-Energy Electron Diffraction (LEED), Reflection High-Energy Electron Diffraction (RHEED), X-ray Photoelectron Spectroscopy (XPS), Auger Electron Spectroscopy (AES), Mass-spectroscopy, Electron Energy Loss Spectroscopy (EELS), and recently Scanning Tunneling Microscopy (STM).

**** Design:*** *Low-Energy (50-1000 eV), UHV compatible, solid-metal and gas ion sources (Al, In, Sb, Ar, H_2, N_2). *Effusion cells (B, Al, In, Sb),*General UHV system components and gas handling systems for GS-MBE.

****Toxic-Gas Handling and safety:***

- Toxic-gas handling systems, laboratory layout and safety controls.

****Services and Management:***

- Established a new laboratory with multi million dollars worth of growth and characterization facilities that became a nucleus for wide range of activities and collaborations.

- Direct and co-supervision of at least 20 postgraduate students at the University of Illinois at Urbana-Champaign, Linköping University in Sweden and the University of North Carolina at Charlotte.

TSING-HUA HER

Assistant professor, Department of Physics and Optical Science
University of North Carolina at Charlotte
9201 University City Blvd, Charlotte, NC 28223
(704) 687-6126 ther@uncc.edu

Education

Ph.D. in Applied Physics, Harvard University, USA, 1998.

M.S. in Applied Physics, Harvard University, USA, 1996.

B.S. in Physics, *summa cum laude*, National Tsing-Hua University, Taiwan, 1990.

Appointment

University of North Carolina at Charlotte, Department of Physics and Optical Science
Assistant professor (Aug. 2003 – present)

Wellman Photomedicine Lab, Massachusetts General Hospital and Harvard Medical School
Visiting Research Scientist (Apr. 2003 – Aug. 2003)

OFS Laboratories, OFS Fitel LLC, Photonic Device Research Department
(former Fiber Research Department of Bell Labs)
Member of Technical Staff (Sep. 2001 –Feb.2003)
Bell Laboratories, Lucent Technologies, Optical Fiber Research Department
Member of Technical Staff (Dec. 2000 –Sep.2001)

University of California at Berkeley, Physics Department
Visiting postgraduate researcher (Nov. 1998 – Nov.2000)

Journal Publication (selected)

1 Min Hyung Cho, Wei Cai, and Tsing-Hua Her, "Boundary Integral Equation Method for Photonic Crystal Fibers," Journal of Scientific Computing, Apr 2006, Pages 1 - 16

2 T. Her, G. Raybon, C. Headley, "Optimization of Pulse Regeneration at 40-Gbit/s based on Spectral Filtering of Self-Phase Modulation in Fibers," Photonics Technology Letters 16(1), 200-2 (2004).

3 J. Jasapara, T. Her, R. Bise. R. Windeler, D. DiGiovanni, "Group velocity dispersion measurements in a photonic bandgap fiber," J. Opt. Soc. Am. B 20(8) 1611-5 (2003)

4 P. S. Westbrook, T. Her, B. J. Eggleton, S. Hunsche, G. Raybon, "Measurement of pulse degradation using all-optical 2R regenerator," Electronics Letters 38(20), 1193-4 (2002)

5 P. S. Westbrook, B. J. Eggleton, G. Raybon, S. Hunsche, T. Her, "Measurement of residual chromatic dispersion of a 40 Gbit/s RZ signal via spectral broadening," Photonics Technology Letters 14(3), 346-8 (2002)

6 S. Wielandy, M. Fishteyn, T. Her, D. Kudelko, and C. Zhang, "Real-Time Measurement of Accumulated Chromatic Dispersion for Automatic Dispersion Compensation," Electronics Letters 38(20), 1198-9 (2002).

7 T.-H. Her, R.J. Finlay, C. Wu and E. Mazur, "Ultrafast-laser-induced spike formation on silicon," Appl. Phys. A 70, 383-385 (2000)

Conference Proceeding (selected)

1 Haitao Zhang, Mingzhen Tang, Jerry McCoy, and Tsing-Hua Her, "Growth of Periodic Tungsten Nanoripples Induced by Linearly Polarized Femtosecond laser," CLEO 06

2 Mingzhen Tang, Haitao Zhang, Jerry McCoy, and Tsing-Hua Her, "Deposition of Tungsten Induced by Femtosecond Lasers," CLEO 06

3 Min Hyung Cho, Wei Cai, and Tsing-Hua Her, "Calculation of confinement loss for Photonic Crystal Fiber (PCF) using Boundary Integral Equation," SE 06-C6, *OISE* 2004.

4 Y. Cao, A. V. Kanaev, T. Her, A. S. Campell and M. A. Fiddy, "Two One-Dimensional Photonic Slow-light Structures and Their Performance Comparison" SE 06-C3, *OISE* 2004.

Patents

1 Invention Report on "Chemical Vapor Deposition of Periodic Sub-wavelength Nanostructures Induced by Single Femtosecond-pulsed Laser Beam," submitted to Tech Transfer Office, UNCC, April 2006

2 Provisional patent on "Nonlinear optical device comprising a spectrally broadening fiber"

3 Provisional patent on "Optical performance monitoring utilizing nonlinear detection"

Funding Awarded

1 (ACTIVE) Co-PI, UNC Charlotte Center for Precision Metrology, "THz Precision Metrology." Minor effort in grant writing but will have significant effort in execution. Requested and awarded $100k for 3 years.

2 (ACTIVE) PI, UNC Charlotte Junior Faculty Research Grant, "Mechanistic Study of Material Deposition by Femtosecond-laser-induced Chemical Vapor Deposition," Requested and awarded $6k. Award period January 2006 through May 2007.

3 (ACTIVE) PI, subcontract form Clemson University funded by Army Research Office / Joint Technology Office, "High Power Fiber Lasers." Requested $125k/yr for 5 years and awarded $75k/yr for 3 years. Award period Sep 2005 through Sep 2008.

4 PI, Wachovia Faculty Fellowship (Untenured Faculty) funded through Charlotte Research Institute, "Three-dimensional nanostructuring of polymers with ultrashort-pulsed laser," submit April 2004. Requested and awarded $4k. Granted award period summer 2004 through summer 2005

5 PI, UNC Charlotte Junior Faculty Research Grant, "Fabrication and Characterization of heterogeneously indexed Photonic Crystal fibers," Requested and awarded $6k. Award period January 2004 through May 2005.

Funding Not Awarded

1 Co-PI, NSF, "NIRT - Metallic Nano-Hole Arrays for Plasmonic Spectroscopic Substrates," submitted Nov. 2005 and requested $1.3M. Minor effort.

2 PI, NSF, "Fabrication of 3D Micro- and Sub-microstructures using Femtosecond-laser-induced Chemical Vapor Deposition at Room Temperature," submitted Oct. 2005 and requested $360k. Review rating: V\G\G\F.

3 PI, Physik Instrumente, "NanoInnovation Grant: Nano-positioning for precision fabrication of three-dimensional photonic crystals using two-photon-induced chemical vapor deposition," submitted March 2005 and requested $30k

4 Co-PI, NSF, "Multi-Tiered Long Range Surface Plasmon Polariton Waveguide Circuits," submitted Feb 2005 and requested $389k. Not recommended for funded.

5 PI, NSF, "GOALI - Microcoil fiber resonator," resubmitted Feb 2005 and requested $399k. Review rating: E\V\V\G. Recommended for funded.

6 Participant, NSF-MRSEC, minor effort, submitted Feb 2005.

7 Participant, NSF-IGRET, minor effort, submitted April 2004.

8 PI, NSF, "GOALI - Microcoil fiber resonator," submitted Oct 2004 and requested $350k. Review rating: V\V\G\G. Not recommended for funded. Reviewer's comments attached.

9 PI, Photonics Technology Access Program (PTAP), requested $30k for a nano-scanner from Insitu Tec, submit July 2004. Main reason to fail is the requested instrument is too close to commercialization which does not meet the goal of PTAP.

10 PI, NSF, "3D fabrication of scaffolds for neuron regeneration using two-photon-absorption lithography," proposed amount $430k. Submitted June 2004. Not recommended for funded.

11 PI, NSF ECS, "Tuning photonic crystal microcavity with microelectromechanical actuators," proposed amount $427k. Submitted February 2004. Not recommended for funded.

12 Participant, DARPA University OptoCenter, minor effort, "SLIM Slow Light Intelligent Microsystems," proposed amount $1.4M. Submitted October 2003.

Courses Taught

Opti6104/8104 "Electromagnetic Waves," Fall 2003-2004, Spring 2006

Phys4231/5231 "Electromagnetic Theory I," Spring 2005-6

Phys4232/5232 "Electromagnetic Theory II," Fall 2005

Phys 3101 "Topics and Methods of General Physics," Spring 2004-5

Service at UNCC

Member, chair advisory, 2005 – present

Member, undergraduate studies committee, 2004 – present.

Member, interdisciplinary optics program committee, 2003-present

Member, optics curriculum subcommittee, 2005

Subcommittee chair, optics core curriculum revision committee, 2003

Professional Service

Referee for Optics Letters, Photonics Technology Letters, Optics Express, Waves in Random

Program Committee, Micromachining Technology for Micro-Optics and Nano-Optics, Photonic West 2006-2007

Faculty Advisor, SPIE Charlotte Local Student Chapter, 2006-present

Co-chair, Program Committee on "Nonlinear Optics and Ultrafast Phenomena," Optics in Southeast, Nov 2004

Membership

Optical Society of America

Students Supervised

PhD students: Wesley Parker (2004-2005), MingZhen Tang (2004-current), Himansu Shekhar Pattanaik (2005-current), Rahul Sahariah (2006-current)

Master: Jerry McCoy (Current)

Undergraduate: Jerry McCoy (Spring 2005; undergraduate research award winner), Andre Van Rynbach (summer 2005), Andrew Winter (spring 2006; undergraduate research award winner)

ROBERT JOHN HOCKEN

Norvin Kennedy Dickerson, Jr., Distinguished Professor of Precision Engineering
And Director, Center for Precision Metrology
Department of Mechanical Engineering and Engineering Science
The University of North Carolina at Charlotte
Charlotte, North Carolina 28223

FORMAL EDUCATION

NBS-NRC Postdoctoral Fellow, 1974-75
State University of New York at Stony Brook, 1973, Ph.D. Physics
State University of New York at Stony Brook, 1969, M.A. Physics
Oregon State University, 1968, B.A. Physics
Oregon State University, 1968, B.A. Mathematics

PROFESSIONAL EXPERIENCE

National Institute of Standards and Technology (formerly National Bureau of Standards), Washington, DC, Sept. 1973 - Dec. 1988

- NBS-NRC Postdoctorate Fellow, Heat Division, September 1973 - March 1975
- Physicist, Dimensional Technology Section, March 1975 - August 1976
- Chief, Dimensional Technology Section, August 1976 - March 1979
- Group Leader, Dimensional Metrology, Mechanical Processes Division, Center for Mechanical Engineering & Process Technology, March 1979 – April 1980
- Chief, Automated Production Technology Division, Center for Manufacturing Engineering, April 1980 - 1985
- Chief, Precision Engineering Division, Center for Manufacturing Engineering, 1985 - December 1988

University of North Carolina at Charlotte, Charlotte, NC 28223, December 1988 - Present

- Norvin Kennedy Dickerson, Jr., Distinguished Professor of Precision Engineering
- Director, Center for Precision Metrology

TEACHING EXPERIENCE

State University of New York at Stony Brook, Teaching Assistant, 1968-1973
State University of New York at Farmingdale, Instructor, 1969
New York City Community College at Brooklyn, Instructor, 1971
New York Institute of Technology, Instructor, 1972-1973
University of Maryland, Visiting Professor, 1982
University of Tianjin, China, Invited Lecturer, 1983
Cranfield Institute of Technology, Bedford, England, Visiting Professor, 1985
University of North Carolina at Charlotte, Charlotte, NC, Distinguished Professor, 1988 - Present

UNIVERSITY AND COMMUNITY SERVICE

University Service:

Search Committee, Director Office of Research, 1997-98
Search Committee, Chair of Physics Department, 1997-98
Cameron Applied Research Center Committee, 1996-98
COE International Program Committee, 1995-97
ME & ES Faculty Search Committee, 1994-95; 1995-96
Undergraduate Curriculum Committee, 1994-95; 1995-96
College of Engineering Promotion and Tenure Committee, 1993-94, 1994-95

Chair, Search Committee, 1992-93, 1993-94
ME & ES Department Promotion and Tenure Committee, 1990

Standards Committees:

- ASME B89.4 Committee, Performance Measures for Coordinate Measuring Machines, 1996-98.
- ASME B5.52 Committee, Performance Measures for CNC Machining Centers and Lathes, 1996-98.
- ASME B89 Main Committee, Dimensional Metrology, 1996-98.
- ISO TC3 WG 10, Thermal Environment for Dimensional Measurement, 1995-98.
- ASME B89.4 Committee - Performance Measures for Coordinate Measuring Machines, 1995
- ASME B5.52 Committee - Performance Measures for CNC Machining Centers and Lathes, 1995
- ASME B89 Main Committee - Dimensional Metrology, 1995

International Committees:

- Chairman, American CIRP Delegation - 1994, 1995

Other Memberships:

- ASPE Scholarship Committee, 1996-98.
- ASPE Board of Directors, 1996-98.

SELECTED PUBLICATIONS

Authored over 80 publications including journal reports, featured articles, and proceedings, including invited lectures and presentations. A sample of recent publications:

REFEREED JOURNAL PUBLICATIONS

Wilhelm, Hocken, and Schwenke, "Task specific uncertainty in coordinate measurement", *CIRP Annals*, Vol 2, 2001
Hocken, Trumper and Wang, "Dynamics and Control of the UNCC Sub-Atomic Measuring Machine", *CIRP Annals*, Vol 1, 2001
Gao, Hocken, Patten and Lovingood, "Nano-machining instrument for nano-cutting of brittle materials", *CIRP Annals*, Vol 1, 2000.
Lucca, Chou, and Hocken, "Effect of tool edge geometry on the nanometric cutting of Ge", *CIRP Annals*, Vol 1, 1998.
Babu, U., Raja, J., Hocken, R., and Chen, K. "Sampling Methods and Substitute Geometry Algorithms for Measuring Cylinders in a Coordinate Measuring Machine," Transactions of NAMRI/SME, Volume XXV, pp. 353-358, 1997.
Boudreau, B.D., Raja, J., Hocken, R.J., Patterson, S.R., and Patten, J. "Thermal Imaging with Near-field Microscopy," *Rev. Sci. Instruments*, Vol. 68, pp. 3096-3098, 1997.
Hocken, R., and Wilhelm, R., "Frontiers in Precision Manufacturing – Metrology." *International Journal for Manufacturing Science and Production*, 1997.
Evans, C., Hocken, R., Estler, W., "Self-calibration: Reversal, Redunancy, Error Separation and Absolute Testing," *Annals of the CIRP*, 45, 3, 1996.
Badami, V., Smith, S., Raja, J., and Hocken, R., "A Portable Three-Dimensional Stylus Profile Measuring Instrument." *Precision Engineering*, 18, April/May, 1996.
Miller, J. Hocken, R., Smith, S., Harb, S., "X-Ray Calibrated Tunneling System Utilizing a Dimensionally Stable Nanometric Positioner." *Precision Engineering*, 18, April/May, 1996.
Hocken, R.J. *An American National Standard: Methods for Performance Evaluation of Coordinate Measuring Machines*, ANSI/ASME B89-4-1995, Standard for ASME, 1995.
Holmes, M., Trumper, D., Hocken, R., "Atomic-Scale Precision Motion Control Stage (The Angstrom Stage)." *CIRP Annals*, Vol. 44, January 1995.
Cloninger, T., Balasubramanian, S., Boudreau, B., Raja, J., and Hocken, R., "A Simple Technique for Screening Near-field Probes," *Ultramicroscopy*, 57 (1995).
Miller, J., Hocken, R.J., Smith, S.T., and Harb, H., "X-Ray Calibrated Tunneling System Utilizing a Dimensionally Stable Nanometer Positioner." *Elsevier Science, Inc.*
Hocken, R., "How to Cope with On-Machine Measurement", *Manufacturing Engineering*, Aug. 1993, pp 8-10.
Hocken, R., J. Raja, and U. Babu, "Sampling Issues In Coordinate Metrology", *Manufacturing Review*, Dec. 1993, pp. 282-294
Williams M.E., Trumper D.L., and Hocken R., "Magnetic Bearing Stage for photolithography", *CIRP Annals*, Vol 1, 1993
Hocken, R., et. al., *An American National Standard Methods for Performance Evaluation of Coordinate Measuring Machines ANSI/ASME B89.1.12M-1985*, March 1991.

CHAPTERS IN BOOKS

Cummings, A., Layer, H., and Hocken, R., "Lasers in Analytical Polarimetry", in *Lasers in Chemical Analysis*, Juman Press, NJ, 1980.

Hocken, R., "Measurement Integration," in *Coordinate Measuring Machines and Systems*, Marcel Dekker, NY, 1995.

RESEARCH INTEREST AND EXPERTISE

Present research efforts include the areas of engineering metrology, nanotechnology (concentrating on development of the methodology for microscopic machines, sensors, and actuators), electro-optical instrumentation (testing of a high-speed laser tracking system for manufacturing applications, and inspection systems for turbine blades and blisks), atomic force microscopy and optical stethoscopy, and dimensional metrology for Computer Aided Manufacturing (with efforts concentrating on advanced probes, controllers, surface measurement systems, including CMMs).

RECENT RESEARCH FUNDING

Principal Investigator

Automatic Inspection Systems, NCMS	63,373	
Coordinate Measuring Machine System, Brown & Sharpe	15,974	Equip. Donation
Laser Measurement System, Renishaw	58,154	Equip. Donation
Enhance the Development of Performance of CMMs, NSF	21,612	
Nanotechnology for Advanced Mass Storage, NSF	919,014	10/1/89 - 3/30/93
Sampling Techniques for Coordinate Measuring Machines, NSF	291,493	9/1/89 - 2/28/92
Laser Track Validation and Verification, NIST	70,442	11/7/89 - 4/1/90
Precision Engineering Guidelines, NCMS	28,621	
Dimensional Inspection Techniques, CAM-I	128,674	
Hewlett-Packard Laser Measurement System for Precision Engineering, HP	58,154	Equip. Donation
Star Linear Systems Metrology Equipment, SLS	5,750	Equip. Donation
Renishaw Inc. Machine Checking Gage, Renishaw	2,300	Equip. Donation
Crotts & Saunders Fosdick Jig Borer and Surface Plate, Crotts & Sanders	19,000	Equip. Donation
Research in Precision Engineering, NSF	950,234	10/1/91 - 9/30/97
Research in Precision Engineering - REU, NSF	40,000	10/1/91 - 9/30/97
Software Correction of Precision Machines, NIST	25,000	2/1/92 - 11/30/92
UNIDO, United Nations Industrial Development Organization, UNIDO	10,000	2/1/92 - 10/30/92
NSF 1993 Grantees Conference, NSF	97,532	6/1/92 - 5/30/93
Stratman: Engineering Metrology, NSF	600,000	3/1/93 - 8/31/97
Mechanics of Nanometric Cutting, NSF (through Oklahoma State University)	83,050	12/15/92 - 11/30/96
Automated Precision, Auto Precision	6,000	4/1/93 - 12/21/93
Measurement of Razor Blade Edge Profile, Gillette	12,075	8/27/93 - 8/26/96
Low Force Profiler, Tencor Instruments	59,750	6/1/93 - 10/15/93
Use of High Sensitivity Analog Photodetector Design, NSF	5,806	7/1/94 - 12/1/94
Academic Research Infrastructure, NSF	1,099,000	10/1/94 - 9/30/99
Analysis and Design of a Long-Range Scanning Stage, NSF (through MIT)	79,749	10/1/94 - 9/30/96
Finishing Performance and Wear of Ion Implanted CBN Tools, NIST	223,140	2/15/95 - 2/14/97
Correction Rotary, Cincinnati Milacron	25,000	1/1/96 - 12/31/96
Center for Precision Metrology, CPM Affiliates	3,000,000	12/1/95 - 6/30/2008
Magnetoresistive Displacement Sensor, Federal Products	72,691	5/5/96 - 4/30/97
Software Correction Training,	2,732	6/1/96 - 8/19/96
IUCRC Planning-Precision Metrology, NSF	25,000	3/1/97 - 2/28/98
Software Testing for CMMs	28,478	12/9/96 - 6/9/97
Direct Measurement of Fuel-Injection Holes, Caterpillar	61,770	3/15/97 -10/15/97
Coolit, Coolit	1,500	7/1/97 - 9/15/97
Machine Tool Research, NIST	86,058	1/29/98 - 1/28/99
Manufacturing 3D Components Workshop, NSF	28,436	6/1/99-5/31/2000
Sub-Atomic Measuring Machine, NSF	469,237	51/1/99-4/30/2002
Precision Metrology – I/UCRC, NSF	379,759	7/1/98-9/30/2003

Precision Metrology – I/UCRC, NSF	200,000	7/1/03-9/30/2008
Measurement of Dies and Test Parts	99,905	10/01/05-09/30/06
NIRT: Nanometrology for Naoscale Science and Engineering, NSF	1,500,000	07/01/05-06/30/09
Grazing Incidence Interferometry, NSF	224,993	10/01/03-9/30/07
U.S.-China Nanoforum, NSF	76,371	5/01/04-4/30-06
Laser Interferometry, Timken	30,000	Equip. Donation
Two Sphere Spindle Analyzer, Professional Instruments	5,000	Equip. Donation

Other

Near Field Scanning Infrared Microscope, NSF	309,573	2/15/91 - 1/31/95
Computer Numerically Controlled Milling Machine, SME	14,000	6/1/90 - 5/31/91
Economics of Temperature Control	109,751	5/15/94 - 2/28/96
SME Foundation Project, SME	10,000	5/1/96 - 5/1/97
SGER: Development of High Resolution Anemometer, NSF	50,000	8/1/97 - 7/31/98
NSEC:Center for Scalable and Integrated Nano Manufacturing, NSF	400,000	10/1/03-9/30/08

COURSES DEVELOPED

MEGR 5182	Machine Tool Metrology
MEGR 6181	Design of Precision Machines
MEGR 6182	Design of Precision Machines
MEGR 2180	Manufacturing Systems
MEGR 2156	Sophomore Design
MEGR 7283	Advanced Coordinate Metrology

THESES AND DISSERTATIONS

Served as advisor for nine (9) completed PhD dissertations (2 more in process):

C. Lavigne, from ISMCM Laboratoire de Mécatronique, France; *Comparative Study of S.T.M. & A.F.M. Microscopes*. (December 1993)

L. Howard, from the University of Warwick, England, *Constant Force Profiling for Engineering Surfaces*. (October 1993)

J. Miller, University of Warwick, England; *STM to Nanomemory: A Technology Transfer Feasibility Study*.

Z. Fang, from the National Institute of Metrology, Beijing, China; A *Precision Laser Polarimeter for Machine Tool Metrology*.

M. Holmes, UNC Charlotte, *Analysis and Design of a Long-range Scanning Stage*, December 1997.

J. Salsbury, UNC Charlotte, *Three-dimensional metrology of video coordinate measuring machines, May 2000*

P. Pereira, UNC Charlotte, *Characterization and Compensation of Dynamic Errors of a Scanning Coordinate Measuring Machine*, May 2001

J. Fu, UNC Charlotte, *Illumination Model and Plate Calibration Method for Vision-Based Coordinate Measuring Machines*, July 2000

M. Bauza, UNC Charlotte, *Development of Instrumentation for Macro- to Micro-scale Dimensional Metrology*, December 2005.

Served as advisor for 18 completed MS theses at UNC Charlotte (3 more in process):

S. Kumaran *Spindle Error Analyzer* (1992)

P. Tullar *Metrology Testing of a Single Beam Laser Tracking Interferometer* (1992)

K. Parmar	*Development and Use of a Telescoping Magnetic Ball Bar for Checking the Contouring Performance of Machine Tools* (1992)
G. Caskey	*A Streamlined Method for the Parametric Calibration and Compensation of a Coordinate Measuring Machine* (1992)
R. Wilson	*Form Errors of Cylindrical Features for Specific Manufacturing Processes* (1992)
C. Lalomia	*Systematic Effects of a Spherical Capacitance Probe While Probing Varied Curved Surfaces* (1995)
V. Badami	*Design of a Portable Three-Dimensional Surface Profiler* (1995)
S. Balasubramaniam	*Design of a Nanometric Cutting Instrument* (1995)
S. Suter	*Analysis of a Spindle's Error Motions with Different Driving Mechanisms* (1995)
P. Hurst	*X-Axis Stage for UNCC Diamond Turning Machine* (1996)
N. Joshi	*Machine Tool Metrology for Lathes*, May 1997.
R. Sourirajan	*Error Mapping of Rotary Axes*, December 1997.
A. Shah	*Design of a Tool for Vibration Assisted Diamond Turning* (1997)
A. Muralidhar	*Characterization of Scanning Probes CMMs* (1998)
H. Thakkar	*Characterization of Hybrid Coordinate Measuring Machines* (1998)
J. Lovingood	*Design, optimization and experiments with a second generation nanometric cutting instrument (1999)*
S. Eisenbies	*Error Budget by Constraints* (2001)
A. Sousa-Freire	*Dynamic Performance of a Coordinate Measuring Machine Measuring Small Radii, Corners and Edges* (May 2000)
G. Bushendorf	*Two Cylinder Stirling Engine* (2004)

U. S. PATENTS (submitted have been put into the University patent administration system)

No. 4,714,339, "Three and Five Axis Tracking Systems", Dec. 1987
"Laser Polarimetric Roll Detector", submitted, March, 1993
"Stabilized Diode Laser", submitted 1995
"Fiber Optic White Light Interferometer", submitted 1997
Dual-axis Static and Dynamic Force Characterization Device" (6,434,845)
Miniature CMM probes, submitted 2005
Laser system for large-scale metrology, submitted 2005

HONORS AND AWARDS

Summa Cum Laude, Oregon State University, 1968
NSF Fellow, 1971
Silver Medal, Department of Commerce, NBS, 1978
Outstanding Performance Award, 1979
F.W. Taylor Medal, International Institute for Production Engineering Research, Paris, France, 1979
IR 100 Award, Instrument for Large Scale Stereo Triangulation, 1980
Outstanding Performance Rating, NBS 1980

NBS Applied Science Award, Developments in 3-Dimensional Metrology, 1980
Outstanding Performance Award, 1982, 1983, 1984, 1985
IR 100 Award (Division), "Drill Up", 1983
Senior Executive Bonus, 1983, 1984, 1986
F.W Taylor International Research Award (Medal), Society for Manufacturing Engineers, 1985
IR 100 Award (Division), Software Correction of Machine Tools, 1985
Chairman, CIRP Scientific Technical Committee "Q", 1985
Charter Fellow, Society for Manufacturing Engineers, 1986
IR 100 Award (Division), "Space Beads" (first space manufacturing product), 1986
Gold Medal, Department of Commerce, 1986
Presidential Executive Award, 1987
Alcoa Award for Outstanding Faculty at the Graduate Level, 1992
First Citizens Scholars Medal, 2000
Lifetime Achievement Award, American Society for Precision Engineering, 2000
ASME Ennor medal for contributions to manufacturing, 2001
President, American Society for Precision Engineering, 2004
Certificate of Appreciation, ASPE, 2005
Harshini V. deSilva Graduate Mentor Award, 2006

PROFESSIONAL ASSOCIATIONS

American Physical Society
Society for Manufacturing Engineers (Senior Member, Fellow)
B89 Committee, American Society for Mechanical Engineers (ASME)
Full Member, International Institute for Production Engineering Research (CIRP)
American Society for Precision Engineering, member and Board of Directors
President, Scientific Technical Committee P, CIRP
B5 Committee, ASME, Machine Tool Performance Standards
American Society for Mechanical Engineers

INVITATIONAL ASSOCIATIONS

Editorial Board, Journal for Precision Engineering
Editorial Board, Journal for Manufacturing Systems
CIRP, 1993 US Statutory Chairman
CIDMAC Advisory Committee, Purdue University
Editorial Board, Manufacturing Review
Editorial Board, International Journal of Manufacturing Technology

CURRICULUM VITAE

NAME: Michael Carl Hudson

TITLE: Professor and Chair
University of North Carolina at Charlotte
Department of Biology
Charlotte, NC 28223
(704) 687-8694 (704) 687-3128 (fax)
e-mail:mchudson@uncc.edu
http://www.bioweb.uncc.edu/Faculty/Hudson/index.htm

EDUCATION:

Institution	Degree	Year Conferred
University of Kansas Microbiology	Ph.D.	1987
Boston University Biology	B.A.	1982

PROFESSIONAL EMPLOYMENT:

2005-	Chair, Department of Biology, The University of North Carolina at Charlotte, Charlotte, NC
2002-2005	Associate Chair, Department of Biology, The University of North Carolina at Charlotte, Charlotte, NC
2001-	Professor, Department of Biology, The University of North Carolina at Charlotte, Charlotte, NC
1996-2001	Associate Professor, Department of Biology, The University of North Carolina at Charlotte, Charlotte, NC
1990-1996	Assistant Professor, Department of Biology, The University of North Carolina at Charlotte, Charlotte, NC
1987-1990	N.I.H. Postdoctoral Fellow, Department of Biology, Washington University, St. Louis, MO
1982-1987	Research Assistant or Teaching Assistant, Department of Microbiology, The University of Kansas, Lawrence, KS

SOCIETY MEMBERSHIPS:

American Society for Microbiology

American Association for the Advancement of Science

Sigma Xi Scientific Research Society

HONORS:

Invited to the Microbiology Delegation to the former Soviet Union, Latvia, Estonia, and Helsinki (People to People Ambassador Program)

Invited to the Microbiology Delegation to the People's Republic of China and Mongolia (Citizen Ambassador Program)

William Arnold Graduate Fellows award, 1987

Dissertation Fellowship, University of Kansas, 1986-1987

Cora M. Downs award for excellence in research and teaching, 1986

Cora M. Downs award, 1985

TEACHING EXPERIENCE:

University of North Carolina at Charlotte
- Pathogenic Bacteriology
- Pathogenic Bacteriology Laboratory
- Mechanisms of Bacterial Pathogenesis
- Bacteriology
- Bacteriology Laboratory
- Microbiology
- Bacterial Genetics
- Senior Seminar
- Graduate Seminar
- Microbiology and Immunology
- Microbiology

Washington University in St. Louis
- Laboratory on DNA Manipulation

University of Kansas
- Introductory Microbiology Laboratory
- Microbial Genetics Laboratory
- Immunology Laboratory

FUNDED EDUCATION GRANTS:

North Carolina Biotechnology Center, Biotechnology Institute for High School Teachers, 1997 ($33,434) (CoPI)

North Carolina Biotechnology Center, Biotechnology Institute for High School Teachers, 1995 ($33,440) (CoPI)

North Carolina Biotechnology Center, Biotechnology Workshop for High School Teachers, 1993 ($22,529) (CoPI)

North Carolina Biotechnology Center, A Program in Biotechnology for Pre-Service Teachers, 1991 ($36,000) (CoPI)

FUNDED RESEARCH GRANTS (selected)**:**

National Institutes of Health, National Institute of Arthritis and Musculoskeletal and Skin Diseases, *S. aureus* Enhances Interaction with Biomaterials, 10-01-03 to 06-30-06 ($130,000) (PI)

Orthopaedic Trauma Association, Intracellular *Staphylococcus aureus*: a Mechanism for the Indolence of Osteomyelitis, 01-01-03 to 12-31-03 ($19,910) (CoI)

North Carolina Biotechnology Center, Science and Technology Development Program, DNA Microarray Facility- The Charlotte Genomics Consortium, 07-02-01 to 07-01-02 ($223,000) (CoI)

National Institutes of Health, National Institute of Allergy and Infectious Diseases, Limited IL-12B2 Receptor Expression during Salmonellosis, 07-01-01 to 06-30-04 ($487,500) (CoI)

Charlotte-Mecklenburg Health Services Foundation, Inc., Evaluation of Standard Surgical preparation performed on Desquamated Skin of a previously Cast-Immobilized Extremity, 07-01-01 to 06-30-02 ($35,780 Parent Project) ($3,536 Subproject) (CoI)

The Aircast Foundation, Inc., *S. aureus*-Infected Osteoblasts Initiate an Inflammatory Response, 12-15-00 to 12-14-02 ($ 99,772) (PI)

Foundation for the Carolinas, *Staphylococcus aureus* Gene Expression in Osteomyelitis, 10-01-99 to 09-30-00 ($5,000) (PI)

THESES DIRECTED:

Michael A. Reott Jr. (Master of Science), 2004. *Staphylococcus aureus* Induces TRAIL Expression in Both Osteoblasts Containing Intracellular *S. aureus* and Uninfected Osteoblasts

Samantha L. Ritchie (Honors), 2003. TRAIL Receptor Expression in *Staphylococcus aureus*-Infected Human Bone

Andy Phung (Honors), 2003. Cytokine Expression in *Staphylococcus aureus*-Infected Human Bone

Emily H. Alexander (Doctor of Philosophy), 2002. *Staphylococcus aureus* Induces Tumor Necrosis Factor-Related Apoptosis-Inducing Ligand Expression by Normal Mouse and Human Osteoblasts

Andrea Rivera (Honors), 2002. Activation of Caspase-8 by *Staphylococcus aureus*-Infected Osteoblasts

Sonia Vishin (Honors), 2001. Development of Antibiotic Resistance by Intracellular *Staphylococcus aureus*

J. Kent Ellington (Master of Science), 2000. Mechanisms of *Staphylococcus aureus* Invasion of Cultured Normal Mouse and Human Osteoblasts

Jennifer L. Bento (Master of Science), 1999. The Role of Fibronectin Binding by *Staphylococcus aureus* in Internalization by Osteoblasts

Christopher S. Leslie (Master of Science), 1999. *Staphylococcus aureus* Genes Induced During Osteoblast Invasion

Karen A. Tucker (Honors), 1999. Intracellular *Staphylococcus aureus* Induces Apoptosis in Osteoblasts

Kelly P. Frankenburg (Master of Science), 1998. Influence of Surface Structures and Exoproteins of *Staphylococcus aureus* on Association with Cultured Osteoblasts

J. Kent Ellington (Honors), 1998. Inhibition of *Staphylococcus aureus* Invasion of Cultured Osteoblasts

Eric E. Pullen (Honors), 1998. Glycocalyx Expression by Internalized *Staphylococcus aureus* Cells

Stephen B. King (Master of Science), 1997. Characterization of Two Plasmids from a *Staphylococcus aureus* Clinical Isolate Resistant to Multiple Antibiotics

Christopher S. Leslie (Honors), 1997. Stress Response and Cross Protection in *Staphylococcus aureus*

W. Todd Grey (Master of Science), 1996. Development of a Novel In Vivo System Measuring *Streptococcus mutans* Gene Expression within a Mammalian Host

Markku T. Nousiainen (Master of Science), 1995. Internalization of *Staphylococcus aureus* by Cultured Osteoblasts

Gretchen L. Clary (Master of Science), 1995. Characterization of an Unusual Fluoride-Resistant *Streptococcus mutans* Isolate

Christopher C. Boyles (Master of Science), 1994. Creation of a Tn*916* Mutagenesis System for *Clostridium perfringens*

Mariam El Janne (Master of Science), 1993. Construction and Utilization of an Integration Vector to Characterize Promoters from *Clostridium perfringens*

Robert W. Lanning (Master of Science), 1993. Construction of an Integration Vector for Studies of Regulation of Gene Expression in Gram-Positive Bacteria

Kathy M. Monroe (Master of Science), 1992. Regulation of Expression of the Fructosyltransferase Gene of *Streptococcus mutans*

Alejandro Abuin (Honors), 1992. Evidence for the Existence of a Restriction-Modification System in *Clostridium perfringens* 3624A

Janice M. High (Honors), 1991. The Isolation and Characterization of a Fluoride-Resistant Mutant of *Streptococcus mutans* UAB576 (A Clinical Isolate)

POSTDOCTORAL FELLOWS:

Sheila S. Reilly, 1996-1998

PUBLICATIONS (selected)**:**

Ellington, J. K., M. Harris, M. C. Hudson, S. Vishin, L. X. Webb, and R. Sherertz. 2006. Intracellular *Staphylococcus aureus* and Antibiotic Resistance: Implications for Treatment of Staphylococcal Osteomyelitis. J. Orthop. Res. 24: 87-93.

Stryjewski, M. E., M. C. Hudson, D. Yu, G. R. Corey, L. B. Reller, V. H. Chu, K. L. Bost, and V. G. Fowler, Jr. 2005. *Staphylococcus aureus* Bloodstream Isolates

Internalize Within and Stimulate IL-6 Secretion from Cultured Human Osteoblasts In Vitro. J. Clin. Microbiol. (submitted).

Marriott, I., D. L. Gray, D. M. Rati, V. G. Fowler, Jr., M. E. Stryjewski, L. S. Levin, M. C. Hudson, and K. L. Bost. 2005. Osteoblasts Produce Monocyte Chemoattractant Protein-1 in a Murine Model of *Staphylococcus aureus* Osteomyelitis and Infected Human Bone Tissue. Bone 37: 504-512.

Marriott, I., D. L. Gray, S. L. Tranguch, V. G. Fowler, Jr., M Stryjewski, L. S. Levin, M. C. Hudson, and K. L. Bost. 2004. Osteoblasts Express the Inflammatory Cytokine Interleukin-6 in a Murine Model of *Staphylococcus aureus* Osteomyelitis and Infected Human Bone Tissue. Amer. J. Pathol. 164: 1399-1406.

He, W., K. E. Gonsalves, N. Batina, D. B. Poker, E. Alexander, and M. Hudson. 2003. Micro/Nanomachining of Polymer Surface for Promoting Osteoblast Cell Adhesion. Biomed. Microdevices 5: 101-108.

Alexander, E. H., F. A. Rivera, I. Marriott, J. Anguita, K. L. Bost, and M. C. Hudson. 2003. *Staphylococcus aureus*-Induced Tumor Necrosis Factor-Related Apoptosis-Inducing Ligand Expression Mediates Apoptosis and Caspase-8 Activation in Infected Osteoblasts. BMC Microbiol. 3: 5-15.

Schrum, L. W., I. Marriott, B. R. Butler, E. K. Thomas, M. C. Hudson, and K. L. Bost. 2003. Functional CD40 Expression Induced Following Bacterial Infection of Mouse and Human Osteoblasts. Infect. Immun. 71: 1209-1216.

Ellington, J. K., M. Harris, L. Webb, B. Smith, T. Smith, K. Tan, and M. Hudson. 2003. Intracellular *Staphylococcus aureus*. A Mechanism for the Indolence of Osteomyelitis. J. Bone Joint Surg. Br. 85: 918-921.

Schrum, L. W., K. L. Bost, M. C. Hudson, and I. Marriott. 2003. Bacterial Infection Induces Expression of Functional MHC Class II Molecules in Murine and Human Osteoblasts. Bone 33: 812-821.

Alexander, E. H., and M. C. Hudson. 2001. Factors Influencing the Internalization of *Staphylococcus aureus* and Impacts on the Course of Infections in Humans. Appl. Microbiol. Biotechnol. 56: 361-366.

Bost, K. L., J. L. Bento, C. C. Petty, L. W. Schrum, M. C. Hudson, and I. Marriott. 2001. Monocyte Chemoattractant Protein-1 Expression by Osteoblasts following Infection with *Staphylococcus aureus* or *Salmonella*. J. Interferon Cytokine Res. 21: 297-304.

Alexander, E. H., J. L. Bento, F. M. Hughes, Jr., I. Marriott, M. C. Hudson, and K. L. Bost. 2001. *Staphylococcus aureus* and *Salmonella enterica* Serovar Dublin Induce Tumor Necrosis Factor-Related Apoptosis-Inducing Ligand Expression by Normal Mouse and Human Osteoblasts. Infect. Immun. 69: 1581-1586.

Ellington, J. K., A. Elhofy, K. L. Bost, and M. C. Hudson. 2001. Involvement of Mitogen-Activated Protein Kinase Pathways in *Staphylococcus aureus* Invasion of Normal Osteoblasts. Infect. Immun. 69: 5235-5242.

Bost, K. L., J. L. Bento, J. K. Ellington, I. Marriott, and M. C. Hudson. 2000. Induction of Colony-Stimulating Factor Expression following *Staphylococcus* or *Salmonella* Interaction with Mouse or Human Osteoblasts. Infect. Immun. 68: 5075-5083.

Tucker, K. A., S. S. Reilly, C. S. Leslie, and M. C. Hudson. 2000. Intracellular *Staphylococcus aureus* Induces Apoptosis in Mouse Osteoblasts. FEMS Microbiol. Lett. 186: 151-156.

RÉSUMÉ
Updated February, 2006

NAME Daniel Silas Jones, Jr.
RANK Associate Professor of Chemistry

EDUCATION
Ph.D., Harvard University, 1970
A.M., Harvard University, 1966
B.S., Wake Forest College, 1965

PROFESSIONAL EXPERIENCE
1973-Present University of N.C. at Charlotte
1978-present Associate Professor of Chemistry
1973-78 Assistant Professor of Chemistry
1971-73 National Academy of Sciences - National Research Council Resident Research Associate, Laboratory for the Structure of Matter, Naval Research Laboratory, Washington, D.C.
1970-71 Teaching-Research Associate, State University of New York at Buffalo.

MASTERS RESEARCH DIRECTED

1. Hsin-Hsi Lai, "Structure of Tris(2,2'-Biyrazine)Ruthenium(II) Hexafluorophosphate, $[Ru(BPYZ)_3(PF_6)_2]$; X-Ray Crystallographic Determination." Master's degree awarded 1988.

2. Qingyi Lu Horn, "Structure Determination of Chloro(1,5-cyclooctadiene) triphenylphosphiterhodium(I), $[RhCl(C_8H_{12})P(C_6H_5)_3]$ by X-Ray Crystallography. Master's degree awarded 1995.

3. B. Carlisle Crenshaw, III, "Structure Determination of 1,2,4,5-Benzenetetracarboxylic Anhydride by X-Ray Crystallographic Methods and Computational Studies of Related Structures." Master's degree awarded 1997.

4. Bruce H. Bailey, "Structural Analysis of 1-Diphenylamino-4-tricyanoethenylbenzene by X-ray Diffraction." Master's degree awarded May, 2003.

5. Daniel Nantz, "Structure Determination of (S)-(1-Benzyl-Pyrrolidin-2-yl)-di-naphthalen-1-yl-methanol and Redetermination of the Structure of Diiodotetrakis[(methylthio)methyl]silanecadmium(II) by X-ray Crystallographic Methods." Master's degree awarded August, 2005.

PUBLICATIONS IN REFEREED JOURNALS

1. "X-Ray Evidence for Bonding Electrons in Diborane," Daniel S. Jones and William N. Lipscomb, Journal of Chemical Physics, V. 51, pp. 3313-3314. (October 1, 1969).

2. "Analysis of Diborane X-Ray Diffraction Data Utilizing Structure Factors Calculated from Molecular Wave Functions," Daniel S. Jones and William N. Lipscomb, Acta Crystallographica, V. A26, pp. 196-207. (March 31, 1970).

3. "X-Ray Studies of Bonding Electrons. Corrections for Bonds to Hydrogen upon Extension of the Basis Sets," T. A. Halgren R. J. Anderson, D. S. Jones, and W. N. Lipscomb, Chemical Physics Letters, V. 8, pp. 547-549. (March 15, 1971).

4. "Photocyclizations of Pharmacodynamic Amines, VII. Photorearrangements and Roentgen-Ray analyses of Novel Tyramine Dimers," Takeo Iwakuma, Hideo Nakai, Osamu Yonemitsu, D. S. Jones, I. L. Karle, and Bernhard Witkop, Journal of the American Chemical Society, V. 94, pp. 5136-5139. (July 12, 1972).

5. "Electron Population analysis of Accurate Diffraction Data. IV. Evaluation of Two-Center Formalisms in Least-Squares Refinement," D. S. Jones, D. Pautler, and P. Coppens, Acta Crystallographica, V. A28, pp. 635-645. (November 1, 1972).

6. "The Crystal and Molecular Structures of Two Photodimers from N-chloro-acetyltyramine," Daniel S. Jones and Isabella L. Karle, Acta Crystallographica, V. B30, pp. 617-623. (March, 1974).

7. "Structure of 19R-Methoxy-5,19-methyleneoxido-17ß-acetoxy-5ß-androstan-3-one," Daniel S. Jones and Isabella L. Karle, Acta Crystallographica, V. B30, pp. 624-627. (March, 1974).

8. "The Structure of tris-(2,2'-Bipyridyl)ruthenium(II) Hexafluorophosphate, $Ru(bipy)_3(PF_6)_2$; an X-Ray Crystallographic Determination," D. Paul Rillema, Daniel S. Jones and Henri A. Levy, Chemical Communications, 1979, 849 (October, 1979).

9. Review of "Advances in X-Ray Analysis. Volume 24," Daniel S. Jones, Journal of the American Chemical Society, V. 105, p. 4119, (1983). (Invited Book Review).

10. Review of "X-Ray Diffraction by Disordered and Ordered Systems," Daniel S. Jones, Journal of the American Chemical Society, V. 105, p. 5521, (1983). (Invited Book Review).

11. "X-Ray Diffraction Data of a Distorted Brockite and its Solid-State Reactions with Na_2CO_3," M. Kizilyalli, D. S. Jones, N. Evin, and H. Gokturk, Journal of the Less-Common Metals, v. 93, pp.433-440. (September, 1983).

12. "Preparation of and X-Ray Diffraction Data for Gadolinium Ultraphosphate, GdP_5O_{14}," A. Sungur, M. Kizilyalli, and D. S. Jones, Journal of the Less-Common Metals, v. 93. pp. 441-446. (September, 1983).

13. "A New Method for the Preparation of $Na_3Gd(PO_4)_2$ and a Review of its Crystal Structure," M. Kizilyalli, A. Sungur, and D. S. Jones, Journal of the Less-Common Metals, v. 110, pp. 249-254. (August, 1985).

14. "Structure, Redox and Photophysical Properties of a Series of Ruthenium Heterocycles Based on the Ligand 2,3-Bis(2-pyridyl)-Quinoxaline," D. Paul Rillema, Donna G. Taghdiri, Daniel S. Jones, Charles, D. Keller, Laura A. Worl, Thomas J. Meyer, and Henri A. Levy, Inorganic Chemistry, v. 26, pp. 578-585. (1987).

15. "Crystal and Molecular Structure of the Photocatalyst Tris-(2,2'-bipyrazine)ruthenium(II) Hexafluorophosphate," Hsinhsi Lai, Daniel S. Jones, Donna C. Schwind, and D. Paul Rillema, Journal of Crystallographic and Spectroscopic Research, v. 20, pp. 321-325. (August, 1990).

16. "Comparison of the Crystal Structures of Tris Heterocyclic Ligand Complexes of Ruthenium(II)." D. Paul Rillema, Daniel S. Jones, Clifton Woods, and Henri A. Levy. Inorganic Chemistry, v. 31, pp. 2935-2938. (1992).

17. "Chloro(1,5-cyclooctadiene)(triphenylphosphine)rhodium(I)," Qingyi L. Horn, Daniel S. Jones, Robin N. Evans, Craig A. Ogle, and T. Craig Masterman, Acta Crystallographica, Volume E58, Part 2, pp. m51-m52. (January, 2002).

18. "*cis*-Dichlorotetrakis(2-mercapto-1-*tert*-butylimidazole)lead(II)," Robin N. Evans, David J. Mihalcik, Daniel S. Jones, and Daniel Rabinovich, Acta Crystallographica, Volume E59, pp. m370-m372. (May, 2003).

19. "(*S*)-2-(Methoxydiphenylmethyl)-1-(thiophen-3-ylmethyl)pyrrolidine," Erica Martin, A. Leigh Winfrey, Jason B. Human, C. Zachary Carlin, Daniel S. Jones and Craig A. Ogle, Acta Crystallographica, Volume E59, pp. o1970-o1971. (November, 2003).

20. "1-(3,4,5-Trimethoxyphenyl)naphthalene," Binita Suthar, Anthony Fowler, Daniel S. Jones and Craig A. Ogle, Acta Crystallographica, Volume E61, pp. o607-o608. (February, 2005).

PAPERS PRESENTED AT MEETINGS

l. "Experimental Determination of Molecular Charge Densities: A Test Case Utilizing Theoretical X-Ray Scattering Factors for Diborane," Daniel S. Jones and P. Coppens. Abstract B7, Abstracts of the Meeting of the American Crystallographic Association, Iowa State University; August, 1971.

2. "Crystal Structures of Two Photoproducts of N-chloroacetyltyramine," D. S. Jones and I. L. Karle. Abstract E7, Abstracts of the Meeting of the American Crystallographic Association, University of New Mexico; April, 1972.

3. "The Configuration of a Photoproduct of an Androstenone," D. S. Jones and I. L. Karle. Abstract A6, Abstracts of the Meeting of the American Crystallographic Association, University of Florida at Gainesville; January, 1973.

4. "The Molecular Configuration of Nortricyclene-4-carboxylic Acid," Daniel S. Jones, Abstract I8, Abstracts of the Meeting of the American Crystallographic Association, University of Connecticut; June, 1973.

5. "Differences Between the Solution and Solid State Structure of Iodo[2,3-butanedionebis(2-diphenylarsinoethylimine)]nickel(II) Perchlorate," D. S. Jones and H. A. Levy. Abstract H10, Abstracts of the Meeting of the American Crystallographic Association, Clemson University; January, 1976.

6. "The Structure of tris-(2,2'-Bipyridyl)ruthenium(II) Hexafluorophosphate, $Ru(bipy)_3(PF_6)_2$, a suggested Solar Energy Photochemical Catalyst," Daniel S. Jones, D. Paul Rillema, and Henri A. Levy. Abstract 113, Abstracts of the Southeastern Regional Meeting of the American Chemical Society, Roanoke, Virginia; October, 1979.

7. "Structure of $[Ru(C_{10}N_2H_8)_2(C_{18}N_4H_{12})][PF_6]_2$, A Derivative of the Photo-active Electron Transfer Agent $[Ru(bipy)_3][PF_6]_2$," Daniel S. Jones, D. Paul Rillema, Charles D. Keller, and Henri A. Levy. Abstract 04, Abstracts of the Meeting of the American Crystallographic Association, Eufaula, Alabama; March, 1980.

8. "Preparation of and X-Ray Diffraction Data for Gadolinium Ultraphosphate GdP_5O_{14}," M. Kizilyalli, D. S. Jones, and A. Sungur, 16th Rare Earth Research Conference, Florida State University; April, 1983. (Presented by M. Kizilyalli)

9. "The Crystal and Molecular Structure of (OC-6-22)-[[4,4'-(1,2-Ethanediyldinitrilo)bis[2-pentanonato]](2-)-N,N',O-O']bis(pyradine)cobalt(1+) Hexafluorophosphate, $Co(acacen)(py)_2(PF_6)$," Daniel S. Jones, D. Paul Rillema, and Neil R. Nance. Abstract 377, Abstracts of the Southeastern Regional Meeting of the American Chemical Society, Charlotte, N. C.; November, 1983.

10. "A New Method for the Preparation of $Na_3Gd(PO_4)_2$ and a Review of its Crystal Crystal Structure," M. Kizilyalli, A. Sungur, and D. S. Jones, Abstract DP7, International Rare Earth Conference, Zurich, Switzerland; March 4-8, 1985. (Presented by M. Kizilyalli)

11. "A Radiation Protection Device for the Picker Diffractometer Utilizing a Moving Beam Stop Design," Daniel S. Jones and Daniel A. Deadwyler, Abstract PI5, Abstracts of the Annual Meeting of the American Crystallographic Association, Philadelphia, Pa.; June, 1988.

12. "The Structure of the Photocatalyst Tris(2,2'-bipyrazine)ruthenium(II) Hexafluorophosphate, $[Ru(C_8N_4H_6)_3](PF_6)_2$." Daniel S. Jones, Hsinhsi Lai, Donna C. Schwind, and D. Paul Rillema, Abstract 285, Abstracts of the Southeastern Regional Meeting of the American Chemical Society, Winston-Salem, N. C.; October, 1989.

13. "Determination of the Crystal and Molecular Structure of 1,2,4,5-Benzenetetracarboxylic Anhydride and Related Computational Studies." Daniel S. Jones, B. Carlisle Crenshaw, III, Thomas D. DuBois, and Jerry J. Kaylor. Presentation 64, Physical Sciences Section, National Meeting of the American Association for the Advancement of Science, Anaheim, CA; January, 1999.

14. **"The Crystal and Molecular Structures of the Hydrogenation Catalyst Chloro(1,5-cyclooctadiene)triphenylphosphinerhodium(I), $RhCl(C_8H_{12})P(C_6H_5)_3$". Daniel S. Jones, Qingyi Lu Horn, and Craig A Ogle. Presentation 44, Physical Sciences Section, National Meeting of the American Association for the Advancement of Science, Washington, DC; February, 2000.**

15. **"Crystal Structure of a Cadmium Tetrathioether Complex." Daniel M. Nantz, Robin N. Evans, A. Brooke Smith, Daniel S. Jones, and Daniel Rabinovich. Paper number 462, National Meeting of the American Chemical Society, New York, NY; September, 2003. (Presented by Daniel Nantz)**

16. **"The Crystal and Molecular Structure of (*S*)-2-(Methoxy-Diphenyl-Methyl)-1-Thiophen-3-Ylmethyl-Pyrrolidine." A. Winfrey, Erica Martin, Jason Human, C. Carlin, Daniel Jones, Craig Ogle. Abstract 927, Abstracts of the Southeastern Regional Meeting of the American Chemical Society, Atlanta, Georgia; November, 2003. (Presented by A. Leigh Winfrey)**

17. **"Synthesis of Non Planar Chiral Compounds:1-(3,4,5-trimethoxyphenyl) naphthalene". Anthony J. Fowler, Binita M. Suthar, Daniel S. Jones, and Craig A. Ogle. Abstracts, 56th Southeast Regional Meeting of the American Chemical Society, Research Triangle Park, NC, November, 2004. (Presented by Anthony J. Fowler and Binita M. Suthar)**

18. **"Structure of a Precursor to a Novel Chiral Ligand: Structure of (S)-(1-Benzyl-Pyrrolidin-2-yl)-di-naphthalen-1-yl-methanol". Daniel S. Jones, Daniel M. Nantz, Erica D. Martin, Joel S. Marquess, and Craig A. Ogle. Abstract P144, Abstracts of the National Meeting of the American Crystallographic Association, Orlando, FL. May, 2005.**

GRANTS RECEIVED

UNC Charlotte Senior Faculty Research Grant
January, 2005 – June, 2006: $ 4500

CID Grant - Development of Curriculum Materials for CHEM 1204
Support for summer, 2000.

National Science Foundation, 1997-1999: $22,952. National Science Foundation ILI Grant.(Co-PI)

CID Grant - Development of Physical Chemistry Laboratory Curriculum; support for summer, 1995.

National Science Foundation, 1994. $38,592. Laboratory Instrumentation grant for a Laser Spectroscopy Laboratory (Co-PI).

The Foundation of the University of North Carolina at Charlotte. Research support for the summers of 1975-1980, 1982, 1985, 1987, 1988, 1990, 1991, 1993, 1994, 1996, 1997.

National Science Foundation, 1994: $82,000. ILI grant for the development of a laser spectroscopy laboratory course in physical chemistry. (Co-PI)

National Science Foundation, 1986: $31,850. Equipment grant for the acquisition of an automation package for a four-circle X-Ray diffractometer. (PI)

Novell, Inc., 1991: $4000. Software Grant

Participant Agreement #S-1765 with the Oak Ridge Associated Universities, 1974-1991.

NSF Institutional Grant for Science. Support for research during the summer of 1974.

PROFESSIONAL AFFILIATIONS

American Chemical Society
American Crystallographic Association

BIOGRAPHICAL SKETCH

Provide the following information for the key personnel and other significant contributors in the order listed on Form Page 2.
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NAME	POSITION TITLE
Joanna K. Krueger	Assistant Professor

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, and include postdoctoral training.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	YEAR(s)	FIELD OF STUDY
Kalamazoo College, Kalamazoo, MI	B.A.	1985	Chemistry
Princeton University	M.A.	1988	Chemistry
Princeton University	Ph.D.	1991	Chemistry

A. Positions and Honors

Experience

3/83-9/85 Research Assistant at KALSEC (Kalamazoo Spice Extraction Co.)
1/85-4/85 Senior Research Student at Texas A & M University
7/91-7/92 Research Assistant at U.T. Southwestern Medical Center, Dallas, Texas
7/92-8/95 Post-doctoral Associate (NIH fellow, 1993-95). University of Texas Southwestern Medical Center, Dallas. Texas
8/95-8/99 Post-doctoral Associate (NIH fellow, 1995-96). Los Alamos National Laboratory
8/99-present Assistant Professor. University of North Carolina at Charlotte. Chemistry Department

Honors & Awards

1982-85 F. W. and Elsie L. Heyl Scholarship- Full tuition paid undergraduate scholarship
1993-94 Cardiology Training Fellowship- National Institutes of Health
1994-96 National Research Service Award- A two-year post-doctoral fellowship awarded by the National Heart, Lung and Blood Institute
2001-02 Oak Ridge Associated Universities Ralph E. Powe Junior Faculty Enhancement Award
2003-05 Research Corporation Cottrell College Science Award

B. Selected peer-reviewed publications

1. Bassel-Duby, R., Hernandez, M. L., Gonzalez, M. A., Krueger, J. K., and Williams, R. S. (1993) "A 40-Kilodalton Protein Binds Specifically to an Upstream Sequence Element Essential for Muscle-Specific Transcription of the Human Myoglobin Promoter". *Mol. Cell. Biol.* 12 (11): 5024-5032.
2. Stull, J. T., Krueger, J. K., Zhi, G. and Gao, Z. -H. (1995) "Molecular Properties of Myosin Light Chain Kinases". In: *International Symposium on Regulation of the Contractile Cycle in Smooth Muscle.* April 26, 1995, MIE, Japan.
3. Krueger, J. K., Padre, R. C., and Stull, J. T. (1995) "Intrasteric Autoinhibition of Myosin Light Chain Kinase" *J. Biol. Chem.* 270(28): 16848-853.
4. Stull, J. T., Krueger, J. K., Kamm, K. E., Gao, Z.-H., Zhi, G. and Padre, R. C. (1996) "Myosin Light Chain Kinase". In: *Biochemistry of Smooth Muscle Contraction* (Barany, M., Ed.) pp. 119-128, Academic Press, Inc., San Diego.
5. Stull, J. T., Kamm, K. E., Krueger, J. K., Lin, P.-J., Luby-Phelps, K., and Zhi, G. (1997) "Ca^{2+}/Calmodulin-dependent Myosin Light Chain Kinase". Chapter for *Advances in Second Messengers and Phosphoproteins* (J. Corbin and S. Francis, Eds.) Vol. 31, pp. 141-149, *Raven* Press, New York.
6. Krueger, J.K., Olah, G. A., Rokop, S., Zhi, G., Stull, J. T. and Trewhella, J. (1997) "Structures of Calmodulin and a Functional Myosin Light Chain Kinase in the Activated Complex: A Neutron Scattering Study." *Biochemistry 36*: 6017-23.
7. Krueger, J. K., Bishop, N. A., Blumenthal, D. K., Zhi, G., Beckingham, K., Stull, J. and Trewhella, J. (1998) "Calmodulin Binding to Myosin Light Chain Kinase Begins at Substoichiometric Ca^{2+} Concentrations: A Small-Angle Scattering Study of Binding and Conformational Transitions" *Biochemistry 37(51)*: 17810-17.

8. Stull, J. T., Lin, P. J., Krueger, J. K., Trewhella, J., and Zhi, G. (1998) "Myosin Light Chain Kinase: Functional Domains and Structural Motifs". *Acta Physiol. Scand. 164:* 471-482.
9. Improta, S., Krueger, J. K., Gautel, M., Atkinson, R., Lefevre, J.-F., Moulton, S., Trewhella, J. and Pastore, A. (1998) "The Assembly of Immunoglobulin-like Modules in Titin: Implications For Muscle Elasticity". *J. Mol. Biol. 284(3)*: 761-777.
10. Krueger, J. K., Zhi, G., Stull, J.T., and Trewhella, J. (1998) "Neutron Scattering Studies Reveal Further Details of the Ca^{2+}/Calmodulin-Dependent Activation Mechanism of Myosin Light Chain Kinase". *Biochemistry 37(40)*: 13997-14004.
11. Trewhella, J., Gallagher, S. C., Krueger, J. K., and Zhao, J. (1998) "Neutron and X-ray Solution Scattering Provide Insights into Biomolecular Structure and Function". *Science Progress 81(2):* 101-122.
12. Krueger, J., McCrary, B., Wang, A. H.-J., Shriver, J. W., Trewhella, J., and Edmondson, S. P. (1999) "Solution Structure of Sac7d/DNA Complex Studied by Small-Angle X-ray Scattering". *Biochemistry 38(32):* 10247-10255.
13. Krueger, J. K., Gallagher, S. C., Wang, A., and Trewhella, J. (2000) "Calmodulin Remains Extended upon Binding to Smooth Muscle Caldesmon: A Combined Small-Angle Scattering and Fourier Transform Infrared Spectroscopy Study." *Biochemistry*, *39(14)*: 3979-3987.
14. Krueger, J. K., Gallagher, S. C., Zhi, G., Geguchadze, R., Persechini, A., Stull, J. and Trewhella, J. (2001, accelerated publication) "Activation of Myosin Light Chain Kinase Requires Translocation of Bound Calmodulin" *J. Biol. Chem. 276(7)*: 4535-4538.
15. Trewhella, J., and J. K. Krueger. (2001) "Small-angle Solution Scattering Reveals Information on Conformational Dynamics in Calcium Binding Proteins and in Their Interactions with Regulatory Targets". In *Methods of Molecular Biology*. (H.J. Vogel, Ed.) Vol 173, pp. 137 – 160. *Humana Press*.
16. Heller, W. T., Krueger, J. K., and Trewhella, J. (2003) "Further Insights into Calmodulin-Myosin Light Chain Kinase Interaction from Solution Scattering and Shape Restoration" *Biochemistry 42(36):* 10579-588.
17. Krueger J. K. and Wignall, G. D. (2004) "Small Angle Neutron Scattering from Biological Molecules". In Neutrons in Biology - Techniques and Applications (J. Fitter, T. Gutberlet, J. Katsaras, Eds.) *Springer Publications* Biophysical Studies Series

C. Research Support

ONGOING

Career Award (Krueger) 4/15/03-3/31/08
National Science Foundation
Integrated Structural Biology Approach to Building Atomic Models of Actin Complexes

The major goal of this project is to build an atomic-resolution model of actin:gelsolin complexes using interatomic distance contstraints provided by small-angle x-ray and neutron scattering data.

COMPLETED

Cottrell College Science Award (Krueger) 3/31/03-4/1/05
Research Corporation
Distance Constraints for Building an Atomic Model of Gelsolin:2Actin Complexes Determined by Chemical Cross-linking and Peptide Mapping

The major goal of this project is to provide lysine-lysine distance constraints within actin:gelsolin complexes using chemical cross-linking, and a peptide mapping technique, which involves protein digestion, µLC separation and MS detection.

Patrick J. Moyer
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EDUCATION

B.S. Physics, 1986, Moravian College, Bethlehem, PA

M.S. Physics, 1988, Saint Bonaventure University, Olean, NY
Thesis topic: "Squeezed Light from the One- and Two-Photon Jaynes-Cummings Model" (Computational Quantum Optics)
Thesis Advisor: Professor Christopher Gerry

Ph.D. Major: Physics, Minor: Electrical Engineering, March 1993, North Carolina State University, Raleigh, NC **(GPA 3.9/4.0)**
Thesis topic: "Development, Physics, and Applications of Near-field Scanning Optical Microscopy"
Thesis Advisor: Professor Michael A. Paesler

WORK EXPERIENCE

July, 2001 – present
Associate Professor (with tenure), **The University of North Carolina at Charlotte**, Department of Physics, Charlotte, NC

January 2001 – Dec 2002
Director, Photonic Development, **Waveguide Solutions, Inc.**, Charlotte, NC

August, 1996 – June, 2001
Assistant Professor (tenure track), **The University of North Carolina at Charlotte**, Department of Physics, Charlotte, NC

April, 1998 - August, 1998
Invited Guest Professor, **The Technical University of Dresden**, Institute for Applied Photophysics, Dresden, Germany

August, 1995 - August, 1996
Assistant Professor (tenure track), **Brooklyn College of the City University of New York** and **The Graduate Center of the City University of New York**, Department of Physics, Brooklyn, NY

March 1,1993 - August 1995:
Staff Scientist, **TopoMetrix Corporation**, Santa Clara, CA

REFEREED PUBLICATIONS

1. Jehong Kim and Patrick J. Moyer, "Experimental demonstration of replicated multimode interferometer power splitter in Zr-doped sol-gel", *J. Lightw. Technol.* **24**, 612 (2006).
2. Patrick J. Moyer, Andy Pridmore, and Faramarz Farahi, "Multimode Interference (MMI) switch design with low manufacturing tolerance", *Optical Engineering* **43**, 178 (2004).

3. Patrick J. Moyer, Timothy Martin, Andy Pridmore, Jan Schmidt, Thomas Hasche, and Lukas Eng, “Dependence of radiative lifetimes of porous silicon on excitation intensity and wavelength”, *Appl. Phys. Lett.* **76**, 2683 (2000).
4. Patrick J. Moyer, Jan Schmidt, Lukas Eng, Alfred J. Meixner, Gunther W. Sandmann, Hartmut Dietz, and Waldfried Plieth, “Surface enhanced Raman scattering spectroscopy of carbon domains on individual Ag nanoparticles on a 25 millisecond time scale”, *J. Am. Chem. Soc.* **122**, 5409 (2000).
5. Patrick J. Moyer, Todd L. Cloninger, James L. Gole, and Lawrence A. Bottomley, “Experimental evidence for molecule-like absorption and emission of porous silicon using near-field an far-field optical spectroscopy”, *Phys. Rev.* **B60**, 4889 (1999).
6. W. Plieth, H. Dietz, G. Sandmann, A. Meixner, M. Weber, P. Moyer, and J. Schmidt, “Nanocrystalline structures of metal deposits studied by locally resolved Raman microscopy”, *Elecctrochimica Acta* **44**, 3659 (1999).
7. Eric Ayars, David Aspnes, Patrick Moyer, and M.A. Paesler, “Proximal Electromagnetic Shear Forces”, *J. of Microscopy*, **196**, 59 (1999).
8. P.I. James, L.F. Garfias-Mesias, P.J. Moyer, and W.H. Smyrl, “Scanning Electrochemical Microscopy with Simultaneous Independent Topography”, *J. Electrochem. Soc.* **145**, L64-L66 (1998).
9. Michael A. Paesler and Patrick J. Moyer, *Near-field Optics: Theory, Instrumentation, and Applications*, Wiley-Interscience, 1996.
10. Patrick J. Moyer and Stefan Kammer, "High resolution imaging using near-field scanning optical microscopy and shear force feedback in water", *Appl. Phys. Lett* **68**, 3380-3382 (1996).
11. Patrick J. Moyer, Stefan Kämmer, Karsten Walzer, and Michael Hietschold, “Investigations of liquid crystals and liquid ambients using near-field scanning optical microscopy”, *Ultramicroscopy* (NFO3 Proceedings) **61**, 291 - 294 (1995).
12. Patrick J. Moyer, Karsten Walzer, and Michael Hietschold, "Modification of the optical properties of liquid crystals using near-field scanning optical microscopy", Appl. Phys. Lett. **67**, 2129-2131 (1995).
13. R.J. Pylkki, P.J. Moyer, and P.E. West, "Scanning Near-field Optical Microscopy and Scanning Thermal Microscopy", *Jap. J. Appl. Phys*. **33**, 332-340 (1994).
14. P.J. Moyer, S. P. Marchese-Ragona, and B. Christie, “Biological Applications of Near-field Scanning Optical Microscopy”, *American Laboratory* **26**, 30 (1994).
15. B.I. Yakobson, P.J. Moyer, and M.A. Paesler, "Kinetic limits for sensing tip morphology in near-field scanning optical microscopes", *J. Appl. Phys*. **73**, 7984-6 (1993).
16. Patrick J. Moyer and Michael A. Paesler, "Resolution and contrast enhancement in near-field scanning optical microscopy", *Proceedings SPIE*, Scanning Probe Microscopies, **1855**, 58 (1993).
17. E.L. Buckland, P.J. Moyer, and M.A. Paesler, "Resolution in collection-mode scanning optical microscopy", *J. Appl. Phys*. **73**, 1018-1028 (1993).
18. E.L. Buckland, P.J. Moyer, and M.A. Paesler, "Resolution issues in scanning optical microscopes", *Proceedings SPIE*, Scanning Probe Microscopies, **1639**, 24-30 (1992).

19. M.A. Paesler, P.J. Moyer, C.L. Jahncke, C.E. Johnson, R.C. Reddick, R.J. Warmack, and T.L. Ferrell, "Analytical Photon Scanning Tunneling Microscopy", *Phys. Rev.* ***B42***, 6750-3 (1990).
20. P.J. Moyer, C.L. Jahncke, M.A. Paesler, R.C. Reddick, and R.J. Warmack, "Spectroscopy in the evanescent field with an analytical photon scanning tunneling microscope", *Phys. Lett.* ***A145***, 343-7 (1990).
21. Rengan, N. Biunno, J. Narayan, and P. Moyer, "Laser assisted techniques for diamond and diamond-like thin films", Mat. Res. Soc. Symp. Proc., Boston, (1989).
22. Christopher C. Gerry and Patrick J. Moyer, "Squeezing and higher-order squeezing in one- and two-photon Jaynes-Cummings models", *Phys. Rev*. ***A38***, 5665 (1988).

OTHER RELEVANT ACTIVITIES

- Chaired 5 Conference Sessions
- 22 International Invited Talks
- 17 Contributed International Conference Talks
- 1 supervised M.S. thesis (Andy Pridmore, graduated 2000)
- Currently supervising 2 Ph.D. students
    a. Je Hong Kim, expected graduation August 2006
    b. Wes Parker, expected graduation December 2008
- More than $1M in external funding
- 1 U.S. patent granted
- 2 U.S. patents pending
- 5 student presentations at conferences

ARINDAM MUKHERJEE
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Assistant Professor, Department of Electrical and Computer Engineering
University of North Carolina at Charlotte, Charlotte, NC 28223
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A. PROFESSIONAL PREPARATION:
Jadavpur University, India, Electronics, B.Eng., 1996
The University of California, Santa Barbara, M.S., 1999
The University of California, Santa Barbara, Ph.D., 2002

B. APPOINTMENTS:
Assistant Professor, U. of N. Carolina at Charlotte, Dept. of Electrical and Comp. Eng., 2002
Research Assistant, The University of California at Santa Barbara, 1998-2002
Teaching Assistant, The University of California at Santa Barbara, 1997-1998
Software Engineer, Cadence Design Systems, Noida, India, 1996-1997.

C. PUBLICATIONS:
Most relevant publications:
1. A. Singh, L. Macchiarulo, A. Mukherjee and M. Marek-Sadowska, "A Novel High Throughput FPGA Architecture", Proceedings of ACM International Symposium on FPGAs, February 2000, pp.22-9.
2. A. Singh, A. Mukherjee and M. Marek-Sadowska, "Interconnect Pipelining in a Throughput Intensive FPGA Architecture", Proceedings of ACM International Symposium on FPGAs, February 2001, pp.153-60.
3. G. Parthasarathy, M. Marek-Sadowska, A. Mukherjee and A. Singh, "Interconnect Complexity-Aware FPGA Placement using Rent's rule", Proceedings of System Level Interconnect Prediction, March 2001.
4. A. Singh, A. Mukherjee, L. Macchiarulo and M. Marek-Sadowska, *"PITIA : An FPGA for Throughput-Intensive Applications"*, IEEE Transactions on Very Large Scale Integration (VLSI) Systems, Volume: 11 Issue: 3 , June 2003, pp. 354-363.
5. K. Regester, J. Byun, Arindam Mukherjee and Arun Ravindran, “Implementing bioinformatics algorithms on Nallatech-configurable multi-FPGA systems”, Xcell Journal., pp. 100-103 Second Quarter, 2005.

Other significant publications:
1. A. Singh, A. Mukherjee and M. Marek-Sadowska, *"Latency and Latch Count Minimization in Wave Steered Circuits"*, Proceedings of Design Automation Conference, June 2001, pp. 383-388.
2. A. Mukherjee, K. Wang, L. -H. Chen and M. Marek-Sadowska, *"Sizing Power/Ground Meshes for Clocking and Computing Circuit Components"*, Proceedings

of Design, Automation and Test in Europe Conference and Exhibition, March 2002, pp. 176-83.
3. A. Mukherjee and M. Marek-Sadowska, *"Wave Steering to Integrate Logic and Physical Syntheses"*, IEEE Transactions on Very Large Scale Integration (VLSI) Systems, Volume: 10 Issue: 4 , August 2002.
4. A. Mukherjee and M. Marek-Sadowska, *"Clock and Power Gating with Timing Closure"*, IEEE Design and Test - Special Issue on Power-Supply Design and Analysis for Integrated Circuits, May-June 2003, pp. 32-39.

D. SYNERGISTIC ACTIVITIES

1. Established the BioVLSI laboratory at UNC Charlotte for FPGA based High Performance Acceleration of Bioinformatics and Bioengineering applications.
2. Active research participant and Faculty Fellow of the Global Institute of Energy and Environmental Sciences (GIEES) – an internationally reputed center of research, based at UNC Charlotte.
3. Designed and automated the process of generating a very high performance, power efficient, finely pipelined circuit style called Wave Steering.
4. Developed and revised five courses, including those of Digital Logic design, Very Large Scale Integrated circuit design, VHDL circuit specification language, and Physical Design Automation.
5. Proposed a new course on the Verilog circuit design language to supplement the existing Computer Engineering program at UNC Charlotte.

E. COLLABORATORS AND OTHER AFFILIATIONS

(a) Collaborators and Co-Editors

Olaf Storaasli, ORNL
Bharat Joshi, UNC Charlotte
Malachy Devlin, Nallatech Inc.
Krishnenedu Chakravarty, Duke University
Helene Hilger, UNC Charlotte
Arun Ravindran, UNC Charlotte
Ivan Howitt, UNC Charlotte
Brian Larson, SGI

(b) Graduate Advisors

Malgorzata Marek-Sadowska, The University of California at Santa Barbara
Kwang-Ting Cheng, The University of California at Santa Barbara
Stephen I. Long, The University of California at Santa Barbara

(c) Thesis Advisor and Post-grad Sponsor

Chritopher Lankford	Jayant D'Souza
Rajsaktish Sankaranarayan	Paraag Vaishampayan
Joseph Johnson	Ankit Shah
Kushal Dutta	Ramya V. Vallabhaneni
Krishna Dusety	Jong-Ho Byun

Brigid Ann Mullany

Assistant Professor
Department of Mechanical Engineering and Engineering Science
The University of North Carolina at Charlotte
Telephone: 704-687-8343 Email: bamulla@uncc.edu

Education:

University College Dublin, Ireland	Mechanical Engineering	B.E. 1995
University College Dublin, Ireland	Mechanical Engineering	Ph.D. 2002
Carl Zeiss, Oberkocken, Germany	Marie-Curie Post Doc. Super-polishing and surface measurement techniques.	2002-2004

Appointments:

Aug. '04 – present	Assistant Professor, Department of Mechanical Engineering and Engineering Science, The University of North Carolina at Charlotte.
Aug. '95- Oct. '96	Industrial Engineer, Bose Ireland Limited, Carrickmacross, Co. Monaghan, Ireland.

Relevant Publications:

- A. Bielke, K. Beckstette, C. Kübler, B. Mullany, M. Pollmann, H. Wang, Fabrication of Aspheric Optics – Process Challenges arising from a wide range of Customer Demands and Diversity of Machine Technologies, SPIE proceedings, St Etiennes, France, Oct 2003.
- C. Evans, E. Paul, D. Dornfeld, D.A. Lucca, G. Byrne, M. Tricard, F. Klocke, O. Dambon and B.A. Mullany, Material Removal Mechanisms in Lapping and Polishing, CIRP Annals vol. 52/2/2003.
- B. Mullany, G. Byrne, The Effect of Slurry Viscosity on the Chemical Mechanical Polishing (CMP) of Silicon Wafers, Journal of Materials Processing Technology, 132, pp. 28-34, 2003.
- B. Mullany, G. Byrne, Pad-Wafer Interface Temperatures during Chemical Mechanical Polishing (CMP) of Oxide Coated Silicon Wafers, Proceedings of the 3rd International Conference and 4th General Meeting of the European Society for Precision Engineering and Nanotechnology, Vol. 1, pp. 261-264, 2002.
- B. Mullany, G. Byrne, M. Power, The Effect of Slurry Viscosity on CMP, 2000 Proceedings of the Seventeenth International VLSI Multi-level Interconnection Conference (VMIC), June 27-29, pp. 525-521, 2000 (invited paper).

Other Publications:

- B. Mullany, G. Byrne, M. Power, The Effect of Polishing Pad Geometry on CMP Planarisation Capabilities, Euspen Conference Proceedings vol 1, pp. 400-403, (ISBN 3-8265 6085-X), May 1999.
- B. Mullany, G. Byrne, P. Young, The Effect of Pad Wear on the Chemical Mechanical Polishing of Silicon Wafers, CIRP Annals, vol 48/1/1999, pp. 143-146, (ISBN 3-905 277-31-X), 1999.
- B. Mullany, G. Byrne, M. Power, The Effect of Polishing Pad Conditioning on the Planarisation Capability of the Chemical Mechanical Polishing Process, Proceedings of the Chemical Mechanical Polishing (CMP) for ULSI Multi-scale Interconnection Conference, pp. 147-150 (Library of Congress No. 89-644090), Feb. 1999.
- B. Mullany, P. Young, G. Byrne, FEM Analysis of Pad Conditions in the Chemical Mechanical Polishing of Silicon Wafers, Proceedings of the Fifteenth Conference of the Irish Manufacturing Committee, pp. 37-44, Sept 1998.
- B. Mullany, G. Byrne, P. Young, S. Galligan, Global Planarity of Silicon Wafers resulting from Chemical Mechanical Polishing, IMC-14 Proceedings of the Fourteenth Conference of the Irish Manufacturing Committee, pp. 451-459, Sept. 1997.

Synergistic Activities:

- *Graduate Curriculum Development:* Teaches a graduate level class in the area of Advanced Surfaces and Polishing. This class encompasses both manufacturing and measurement aspects of precision surfaces. The PI is also the faculty advisor for the graduate student chapter of the American Society for Precision Engineers.
- *Undergraduate involvement in research:* The PI is a member of a committee responsible to increasing the involvement of undergraduates in research within the department. A scheme to hire and employ students for the summer months will be fully operational for 2005/2006.
- *Industrial collaborations:* In addition to collaborating with Nanophase Technologies, the PI is establishing links with locally based related industries such as Northrop Grumman Synoptics (Manufacture finished Laser optics) and Sutton Scientifics (produce synthetic polishing pitches). Northrop Grumman has already donated equipment (a polisher and a wire saw) to the Department through the PI.
- *International:* The PI is a member of CIRP and actively participates in workshops on surface finishing and thermal measurements in manufacturing environments.

Collaborators and other Affiliations:

Research Collaborators:	Ed Paul (Stockton College), P. Murray (NanoPhase).
Ph.D. Advisor:	Prof. G. Byrne, University College Dublin, Ireland.
Postdoctoral Advisor:	Dr. H. Wang, Carl Zeiss, Oberkochen, Germany.
Thesis Advisee:	V. Puri, W. Willams and A. Landis (University of North Carolina at Charlotte).

CRAIG ALAN OGLE
Professor of Chemistry
The University of North Carolina Charlotte

Education:

1973 to 1976,	Otterbein College, Westerville, Ohio. B.A. in math and chemistry.
1977 to 1980,	The University of Arizona, Tucson, Arizona. M.S. in organic chemistry.
1980 to 1982,	The University of Arizona, Tucson, Arizona. Ph.D. in organic chemistry.

Professional Experience:

1976 - 1977,	Battelle Memorial Institute, Columbus, Ohio. Research associate.
1982 - 1984,	The University of Lausanne, Lausanne, Switzerland. Postdoctoral fellow.
1984 - 1985,	The University of North Carolina, Charlotte. Lecturer.
1985 - 1991,	The University of North Carolina, Charlotte. Assistant professor.
1991 - 1996,	The University of North Carolina, Charlotte. Associate professor.
1996 - present	The University of North Carolina, Charlotte. Professor.

Papers at Meetings (selected)**:**

1. F. Lin and C. Ogle "Preparation of chiral C2 symmetric phenols for asymmetric synthesis." The 221st National Meeting of the American Chemical Society, San Diego, April 1-5, 2001.
2. J. B. Human and C. A. Ogle "Carbon bound chiral heterocuprates" The 221st National Meeting of the American Chemical Society, San Diego, April 1-5, 2001.
3. J. S. Marquess and C. A. Ogle "Preparation of nontransferable proline based chiral ligands for use in organocuprate conjugate addition reactions." The 223rd National Meeting of the American Chemical Society, Orlando, April 7-11, 2002.
4. M. L. Williams and C. A. Ogle "Synthesis and characterization of two new chiral non-transferable ligands for organocuprate reactions." The 223rd National Meeting of the American Chemical Society, Orlando, April 7-11, 2002.
5. A. W. Trammell, F. F. Navarro and C. A. Ogle "Synthesis and reactions of functional monomers for anionic polymerizations." The 223rd National Meeting of the American Chemical Society, Orlando, April 7-11, 2002.
6. J. Human, F. Lin and C. A. Ogle "Chiral non-transferable ligands for use in organocuprate reactions." The 223rd National Meeting of the American Chemical Society, Orlando, April 7-11, 2002.
7. "Enantioselective copper catalyazed conjugate addition to α,β-unsaturated enones using chiral β-silyl amido cuprates" Abhinav Rastogi, Steven Bertz and Craig Ogle 227th ACS National Meeting, Anaheim, CA, March 28-April 1, 2004
8. "Rapid injection NMR investigation of the early stages of the butyllithium initiated polymerization of isoprene in benzene." Taylor, Brad J.; Eudy, Paul M.; Murphy, Mike; Ogle, Craig A. 230th ACS National Meeting, Washington, DC Aug. 28-Sept. 1, (2005).
9. "Synthesis and reactions of atropisomeric compounds." Fowler, Anthony J.; Ogle, Craig A. 230th ACS National Meeting, Washington, DC Aug. 28-Sept. 1, (2005).
10. "An investigation of silyl groups on asymmetric induction in a conjugate addition reactions with chiral n-silylamidocuprates." Cope, Stephen K.; Bertz, Steven H.; Ogle, Craig A. 230th ACS National Meeting, Washington, DC Aug. 28-Sept. 1, (2005).
11. "Structure of a Precursor to a Novel Chiral Ligand: Structure of (*S*) – (1-Benzyl-Pyrrolidin-2-yl_-di-naphthalen-1-yl-methanol". Jones, Daniel S.; Nantz, Daniel M.; Martin, Erica D.; Marquess, Joel S.; Ogle, Craig A. Abstract P144, Abstracts of the National Meeting of the American Crystallographic Association, Orlando, FL. May, 2005.

Books:

"Carbanion Chemistry," R. B. Bates and C. A. Ogle, Springer Verlag, 1983.
"Exercises in Organic Structure Determination" developed for Chemistry 4133.

Publications (selected)**:**

1. "Re-evaluation of Organocuprate Reactivity. Logarithmic Reactivity Profiles for Iodo- vs. Cyano-Gilman Reagents in the Reactions of Organocuprates with 2-Cyclohexenone and Iodocyclohexane." S. H. Bertz, A. Chopra, M. Eriksson, C. A. Ogle, Chemistry, A European Journal. **1999**, 2680-92 (1999).
2. "Preparation of the Tomato Pinworm Pheromone, (E)-4-Tridecenyl Acetate, from Dihydropyran and *n*-Octyllithium." J. P. Mitchener Jr., *J. C. Thomas* and C. A. Ogle, Main Group Metal Chemistry, 22, 435 (1999).
3. "Rapid-Injection NMR Study of Iodo- and Cyano-Gilman Reagents with Cyclo-hexenone: Observation of π-Complexes and their rate of formation." S. H. Bertz, C. M. Carlin, D. A. Deadwyler, M. D. Murphy, C. A. Ogle, and P. H. Seagle, J. Am. Chem. Soc., 124, 13650-13651(2002).
4. "Chiral lithiothiophenes as non-transferable ligands in organocuprate conjugate addition reactions." Ogle, Craig A.; Human, Jason B. Tetrahedron: Asymmetry (2003), 14(21), 3281-3283.
5. "(S)-2-(Methoxydiphenylmethyl)-1-(thiophen-3-ylmethyl)pyrrolidine" Erica Martin, A. Leigh Winfrey, Jason B. Human, C. Zachary Carlin, Daniel S. Jones and Craig A. Ogle Acta Cryst. 2003, E59, 1970-1.
6. "Opening the black box': oscillations in organocuprate conjugate addition reactions.**"** Murphy, Michael D.; Ogle, Craig A.; Bertz, Steven H. Chem. Comm. (2005), (7), 854-856.
7. "Remarkable Effect of Silyl Groups on Asymmetric Induction in a Conjugate Addition Reaction with O-Methylnorephedrine-Based N-Silylamidocuprates." Bertz, Steven H.; Ogle, Craig A.; Rastogi, Abhinav. J. Am .Chem. Soc. (2005), 127(5), 1372-1373.
8. "Subtle factors are important: radical formation and transmetallation in reactions of butyl cuprates with cyclohexyl iodide." Bertz, Steven H.; Human, Jason; Ogle, Craig A.; Seagle, Paul. Organic & Biomolecular Chemistry (2005), 3(3), 392-394.
9. **"**1-(3,4,5-trimethoxyphenyl)naphthalene**"** Binita Suthar, Anthony Fowler, Daniel S. Jones, Craig A. Ogle. Acta. Cryst. (2005). E61, o607-o608.

Patents:

"Process to selectively place functional groups within polymer chain," United States Patent No. 6,225,415 issued May 1, 2001 to Craig Ogle, assigned to the University of North Carolina at Charlotte.

Grants (selected)**:**

- "Organic Intermediates via Lithium Chemistry." Lithium Division of FMC, 1995-1997, $270,000.
- "Analysis of Complex Mixtures in Complex Media." NSF-ILI, Co-principle investigator, 1996-98, $34,813.
- "Novel Syntheses of Important Tricyclic Pharmaceuticals." UNCC Foundation, 1998, $4000.
- "Enantioselective conjugate additions with chiral heterocuprates" Research Corporation, 2001-02, $42,030.
- "Development of a new process for the synthesis of n-butyl lithium" Postin Products, 2001-2 $43,680.
- "Support of Polymer Research" Kraton Polymers LLC, $52,000, 2001-05.
- "RUI/MRI-Purchase of a 400 MHz NMR Spectrometer" NSF $250,445

- RUI: Rapid Injection NMR Studies of Conjugate Addition Reactions of Carbanionic Species NSF $194,000

Professional Activities:

- Treasurer Carolina-Piedmont Section of the American Chemical Society, 1987.
- Secretary Carolina-Piedmont section of the American Chemical Society, 1988.
- Chairman-elect Carolina-Piedmont Section of the American Chemical Society, 1989.
- Chairman, Carolina-Piedmont Section of the American Chemical Society, 1990 and 1995.
- Director, **R**egional **A**nalytical **Che**mistry **L**aboratory, UNC Charlotte.
- Consultant for CEKAL Specialities.
- Editorial Board, Main Group Metal Chemistry.

1/2006

CURRICULUM VITAE

James D. Oliver
Professor of Biology
Cone Distinguished Professor of Teaching

EDUCATION:

University of Arizona (Dept. Microbiology)	1964-68	B.S.
Georgetown University (Dept. Biology)	1969-73	Ph.D.

PROFESSIONAL EXPERIENCE:

Central Soya Co., Inc., Chicago, IL	
(Assistant Research Microbiologist)	1968-69
University Ottawa, Canada	
(Post-Doctoral Fellow, Dept. Biochemistry)	1973-74
University of North Carolina at Charlotte	
Assistant Professor	1974-80
Associate Professor	1980-84
Professor	1984-
Coordinator, Interdisciplinary Biotechnology Program	1986-1994
Director	1994-2003
Member, Ph.D. Faculty, Dept. Electrical Engineering	1995-
Member, Program Faculty, Interdisciplinary Ph.D. Program in Biology	1998-
Senior Faculty Fellow, Global Institute for Energy and Environmental Systems (GIEES)	2001-
University of Göteborg, Sweden	
Visiting Professor	1990
North Carolina State University	
Visiting Professor	1994, 1995, 1996
Royal Veterinary and Agricultural University, Copenhagen, Denmark	
Visiting Professor	1998

NATIONAL SERVICE:

Member, Editorial Board, Applied and Environmental Microbiology, 1988-91, 1991-93.
Elections Committee, American Academy for Microbiology, 1992-1996
Special Advisor to the Chairman, *Vibrio vulnificus* Committee,
Interstate Shellfish Sanitation Commission, 1995

Committee on Certification, American Academy of Microbiology, 1999
National Science Foundation Policy Working Group on Microbial Genomics, 2000
National Marine Pathogen Plan Workshop, 2000
External Review Committee, Department of Microbiology, Miami University Ohio, 2000
Standard Methods Committee, American Water Works Association, 2000-
Joint Task Group for Section 9213 Recreational Waters for Standard Methods for the Examination of Water and Wastewater. American Water Works Association. 2004-

INTERNATIONAL SERVICE:

Working Party on Culture Media, International Committee on Food Microbiology and Hygiene, International Union of Microbiological Sciences, 2000-
Consultant, Food and Agriculture Organization of the United Nations World Health Organization; Risk Assessment of *Vibrio vulnificus* in Raw Oysters. 2004.
Member, Editorial Board, FEMS Microbiology Ecology, 2005-

PUBLICATIONS (selected):

Essential role for estrogen in protection against *Vibrio vulnificus* induced endotoxic shock. 2001. Merkel, S.M., S. Alexander, J.D. Oliver, and Y.M. Huet-Hudson. Infect. Immun. 69:6119-6122.

Effects of refrigeration and alcohol on the load of *Aeromonas hydrophila* in oysters. 2002. Birkenhauer, J.B. and J.D. Oliver. J. Food Protect. 65:560–562.

Use of diacetyl to reduce the load of *Vibrio vulnificus* in the Eastern oyster, *Crassostrea virginica*. 2003. Birkenhauer, J.B. and J.D. Oliver. J. Food Protect. 66:38-43.

A comparison of thiosulphate-citrate-bile salts-sucrose (TCBS) agar and thiosulphate-chloride-iodide (TCI) agar for the isolation of *Vibrio* species from estuarine environments. 2003. Pfeffer, C. and J.D. Oliver. Lett. Appl. Microbiol. 36:150-151.

Analysis of *Vibrio vulnificus* from market oysters and septicemia cases for virulence markers. 2003. DePaola, A., J.L. Nordstrom, A. Dalsgaard, A. Forslund, J. Oliver, T. Bates, K.L. Bordage, and P.A. Gulig. Appl. Environ. Microbiol. 69: 4006-4011.

The ecology of *Vibrio vulnificus* in estuarine waters of eastern North Carolina. 2003. Pfeffer, C.S., M.F. Hite and J.D. Oliver. Appl. Environ. Microbiol. 69:3526-3531.

RpoS-dependent stress response and exoenzyme production in *Vibrio vulnificus*. Hülsmann, A., T.M. Rosche, I.-S. Kong, H.M. Hassan, D.M Beam, and J.D. Oliver. 2003. Appl. Environ. Microbiol. 69:6114-6120.

Survival of *Helicobacter pylori* in a natural freshwater environment. 2003. Adams, B.L., T.C. Bates, and J.D. Oliver. Appl. Environ. Microbiol. 69:7462-7466.

Effects of temperature on detection of plasmid or chromosomally encoded *gfp*- and *lux*-labeled *Pseudomonas fluorescens* in soil. 2004. Bunker, S.T., T.C. Bates, and J.D. Oliver. Environ. Biosaf. Res. 3:83-90.

Biochemical and virulence characterization of viable but nonculturable cells of *Vibrio parahaemolyticus*. 2004. Wong, H.-C. and J.D. Oliver. J. Food Prot. 67:2430-2435.

The viable but nonculturable state of *Vibrio parahaemolyticus*. 2004. Bates, T.C. and J.D. Oliver. J. Microbiol. 42:74-79.

Role of catalase and *oxyR* in the viable but nonculturable state of *Vibrio vulnificus*. 2004. Kong, I.-S., T.C. Bates, A. Hülsmann, H. Hassan, and J.D. Oliver. FEMS Microbiol. Ecol. 50:133-142.

Pulsed-field electrophoresis analysis of *Vibrio vulnificus* strains isolated from Taiwan and United States. 2004. Wong, H.-c., S.Y. Chen, M.-Y. Chen, J.D. Oliver, L.-I. Hor, and W.-Ch. Tsai. Appl. Environ. Microbiol. 70:5153-5158.

Changes in membrane fatty acid composition during entry of *Vibrio vulnificus* in the viable but nonculturable state. 2004. Day, A.P. and J.D. Oliver. J. Microbiol. 42:69-73.

Induction of *Escherichia coli* and *Salmonella typhimurium* into the viable but nonculturable state following chlorination of wastewater. 2005. Oliver, J.D., M. Dagher, and K. Linden. J. Water and Health 3.3:249-257.

Wound infections caused by *Vibrio vulnificus* and other marine bacteria. "Special Article". Oliver, J.D. 2005. Epidemiol. Infect. 133:383-391.

A rapid and simple PCR analysis indicates there are two subgroups of *Vibrio vulnificus* which correlate with clinical or environmental isolation. 2005. Rosche, T.M., Y. Yano, and J.D. Oliver. Microbiol. Immunol. 49:381-389.

The viable but nonculturable state in bacteria. 2005. Oliver, J.D. J. Microbiol. 43:93-100.

Cloning, sequencing and expression of a GroEL-like protein gene of *Vibrio vulnificus*. 2005. Wong, H.-c., K.H. Lu, and J.D. Oliver. Taiw. J. Agric. Chem. Food Sci. 43:1-7.

RpoS involvement in osmotically-induced cross protection in *Vibrio vulnificus*. 2005. Rosche, T.M., T.C. Bates, D.J. Smith, E.E. Parker, and J.D. Oliver. FEMS. Microbiol. Ecol. 53:455-462.

115. Intrapopulational variation in *Vibrio vulnificus* levels in *Crassostrea virginica* is associated with the host size but not with disease status or developmental stability. 2005. Sokolova, I.M., L. Leamy, M. Harrison, and J.D. Oliver. J. Shellfish Res. 24:503-508.

Engineering behavior of biofilm amended earthen barriers used in waste containment. 2005. Daniels, J.L., R. Cherukuri, H.A. Hilger, J.D. Oliver, and S. Bin. Int. J. Manage. Environ. Qual. 16: 691 – 704.

FUNDED RESEARCH (selected)

EPA. 2001-2003. "Development of a method for resuscitation of *Helicobacter pylori* coccoid cells in environmental waters". $316,000.

National Marine Fisheries (SK Program). 2002-2004. "The Role of the *rpoS* Gene in Virulence of *Vibrio vulnificus*". $101,990.

NC Sea Grant Program. 2002-2004. "The Viable but Nonculturable State in Human Bacterial Pathogens in Eastern North Carolina Waters". $60,500.

Gulf Oyster Industry Program. 2004-2006. "Research to Induce Loss of Virulence in Cells of *Vibrio vulnificus* in Oysters". $216,624.

NC Sea Grant Program. 2004. "Identification of Genetic Markers of High Resistance to *Vibrio vulnificus* and *Perkinsus marinus* in Eastern Oysters". $5000 (with Drs. Inna Sokolova and Larry Leamy).

Dept. Energy. 2005. "Bio-Tarp: Reducing landfill methane emissions with bioactive alternate daily cover". $404,047 (with Helene Hilger, Dept. Civil Engineering).

NOAA. 2005. "Ecology and Significance of Two *Vibrio vulnificus* Genotypes. $259,671.

Society for General Microbiology (UK). "Entry of the food-borne pathogen, *Listeria monocytogenes*, into the viable but nonculturable state"; Funding is for a summer "mini-sabbatical at the National University of Ireland, Galway. £5000 (~$8950)

HONORS AND AWARDS (selected)

National Research Council (U.S.A.) Resident Research Associateship,1974 (declined).
National Academy of Sciences Exchange Scientist (Romania), 1982.
Received First Citizens Bank Scholar Award for Excellence in Research. 1988.
(The highest award given for research accomplishment at this University)
Elected to Fellowship, American Academy of Microbiology, 1990-
Elected to Phi Kappa Phi. 1991.
Finalist, NationsBank award for "Excellence in Teaching", 1994.
Recipient, Cone Distinguished Professorship for Teaching, 1998
(The highest teaching award given by this University)
Selected as a Burrows Wellcome Fund Visiting Professor in the Microbiological Sciences, 1999
Elected a fellow, Phi Beta Delta, Honorary Society for International Scholars, 1999
Harshini V. de Silva Graduate Student Mentoring Award, 2002

COURSES TAUGHT AT UNCC

Undergraduate (Service):	Bacteriology (Service course for College of Nursing)
Undergraduate/Graduate:	Microbiology*
	Marine Microbiology
	Virology

Recombinant DNA Techniques
Lipidology
Microbial Physiology and Metabolism*
Topics in Marine Biology (Marine Microbiology Section)
Undergraduate Seminar (various topics)

Graduate (M.S.): Gram-negative Bacterial Cell Envelopes
Microbial Toxins
Microbiology Seminar
Bacterial Stress Proteins

Graduate (Ph.D.): Microbiology and Immunology* (UNCC; team taught)
Strategies and Methods for the Determination of Bacteria and Activity in Environmental Samples. Department of Ecology and Biology, The Royal Veterinary and Agricultural University, Copenhagen, Denmark. August, 1998.

*courses currently taught on a regular basis

Other Courses: Advanced Research Training in Marine Molecular Biology and Biotechnology. Duke University Marine Laboratory. 1991, 1992.
General Microbiology. North Carolina State University, 1994, 1995, 1996

Special Workshops: Summer Workshop in Biotechnology (High School Biology teachers). 1988, 1989
"Encountering Vibrios", Memorial Medical Center. Sponsored by Southeastern Assoc. for Clinical Microbiology, 1989.

Postdoctoral Fellows

Victoria McGovern	1993-1996
Anja Hüelsmann	2000-2002
Thomas Roche	2003-

Ph.D. Students

Ms. Bryn Adams, (Major advisor). 2002-2005 Survival of *Helicobacter pylori* in natural environments

Ph.D. Committees

Mr. William Langley, North Carolina State University, 1989-1992

Ms. Deborah Sharer, UNC Charlotte (Dept. Electrical Engineering), 1995
Mr. Suwanchai Nitisoravut, North Carolina State University, 1993-1995
Ms. Tanya Barrett, University of Aberdeen, Scotland, 1995-1998

M.S. THESES DIRECTED (completed)

1. Fehon, William. 1977. The taxonomy and crude oil degradation by bacteria from the surface microlayer of two estuarine systems.

2. Basinger, William. 1977. The action of bacitracin on *Halobacterium cutirubrum*.

3. Elium, Pam, 1978. The effect of a *Listeria monocytogenes* challenge on the development of a murine lymphoma.

4. Poole, Michael. 1979. Experimental pathogenicity of the halophilic lactose-positive *Vibrio* species.

5. Dellinger, Judith. 1980. Histological examination of the ligated ileal loop in the rabbit: lactose-positive *Vibrio* studies.

6. Smith, J. Edward, 1982. The effect of hydrostatic pressure on the phenomenon of microbial primary film formation.

7. Simpson, Linda. 1982. Siderophore production by *Vibrio vulnificus*.

8. Wright, Anita. 1982. The role of iron in the pathogenesis of *Vibrio vulnificus*.

9. Stringer, William. 1983. Starvation-induced changes in viability and membrane lipid composition in a psychrophilic marine bacterium.

10. Cleland, David. 1984. Adaptation of a spectrophotometric assay for use in measuring microbial degradation of particulate organic carbon in aquatic environments.

11. Davidson, Larry. 1984. Incidence of plasmid DNA among clinical and environmental isolates of lactose-fermenting vibrios.

12. Thomas, Brad. 1984. An investigation of the hemolysin(s) produced by *Vibrio vulnificus*.

13. Wear, John. 1985. Cytotoxicity of lactose-fermenting marine vibrios.

14. Zakaria, Zairani. 1987. Ability of haptoglobin and its phenotypes to withhold iron from *Vibrio vulnificus* and other bacteria.

15. Massad, George. 1987. Production and characterization of hemolysin mutants of *Vibrio vulnificus*.

16. Linder, Katherine. 1988. Studies on the non-recoverable phase of *Vibrio vulnificus*.

17. East, Sonya. 1988. Role of iron in the pathogenesis of non-01 *Vibrio cholerae* wound infections.

18. Bahrani, Farah. 1989. Studies on the lipopolysaccharide of *Vibrio vulnificus*.

19. Wolf, Paula. 1990. Role of temperature in the nonculturable state of *Vibrio vulnificus*.

20. Preyer, Janet. 1990. Starvation-induced thermotolerance in a marine psychrophilic bacterium.

21. Brauns, Laura. 1991. Use of the polymerase chain reaction in the detection of culturable and nonculturable cells of *Vibrio vulnificus*.

22. Rice, Scott. 1991. The starvation-survival response of a deep-sea bacterium.

23. McLaughlin, Brian. 1991. (M.A.). The viable but nonculturable state in marine bacteria and its relationship to the starvation state.

24. Groubert, Trudi. 1992. Uptake and depuration of the opaque and translucent biotypes of *Vibrio vulnificus*, and the effects of oyster passage on virulence.

25. McDougald, Diane. 1993. Transformation of *Vibrio vulnificus* by electroporation and conjugation.

26. Morton, Darla. 1994. Induction of carbon-starvation proteins in *Vibrio vulnificus*.

27. Sun, Yi. 1994. Effects of GRAS compounds on *Vibrio vulnificus* in oysters.

28. Jarecki, Alicja. 1995. Role of carbon starvation in the serum resistance of *Vibrio vulnificus*.

29. Marlowe-Duda, Caroline. 1995. The role of iron availability in the phagocytosis of *Vibrio vulnificus* by murine macrophages.

30. Whiteside, Mark. 1996. Studies on resuscitation of *Vibrio vulnificus* from the viable but nonculturable state.

31. Warner, Jennifer. 1997. The use of RAPD-PCR in the molecular epidemiology of *Vibrio vulnificus*, and as affected by starvation and entry into the viable but nonculturable state.

32. Hite, Frances. 1998. Resuscitation of viable but nonculturable cells of *Vibrio vulnificus* in the estuarine environment.

33. Linkous, Debi. 1998. Effects of LPS and capsular serotypes on virulence of *Vibrio vulnificus.*

34. Lowder, Melanie. 1999. The effect of starvation and the VBNC state on GFP fluorescence in two *Pseudomonas* species.

35. Smith, David. 1999. Effects of osmotic shock on cross-protection in *Vibrio vulnificus*.

36. Bunker, Stephen. 2000. Effects of environmental stresses on culturability of genetically modified *Pseudomonas fluorescens* in soil.

37. Bates, Tonya. 2001. The VBNC state in *Vibrio parahaemolyticus*.

38. Birkenhauer, Jennifer. 2001. Use of GRAS compounds to reduce loads of *Vibrio vulnificus* in oysters.

39. Day, Ashley. 2002. Membrane fatty acid changes in *Vibrio vulnificus* induced by low temperature and osmotic shock.

40. Courtney Pfeffer. 2002. Involvement of *Vibrio vulnificus* in wound infections in the Neuse River area of North Carolina.

41. Daren Beam. 2004. Quorum sensing and pathogenesis in *Vibrio vulnificus*.

42. Ben Smith. 2005. *In situ* and *in vitro* gene expression by *Vibrio vulnificus* during the VBNC and starvation-survival states.

43. Karen Dyer Blackwell. 2005. The viable but nonculturable states of *Vibrio vulnificus*, *Vibrio cholerae*, and *Vibrio parahaemolyticus* in the natural environment.

44. Tamara Hilton. 2006. Capsular switching among the clinical- and environmental-genotypes of *Vibrio vulnificus*.

Current M.S. students:

Alan Buck. The role of the VBNC state in the epidemiology of *Helicobacter pylori.*

Liza Warner. Physiological differences between clinical- and environmental-genotypes of *Vibrio vulnificus*.

Ryan Bogard. Serum sensitivity of two genotypes of *Vibrio vulnificus*.

Brett Froelich. Capsular polysaccharide phase variation among the two genotypes of *Vibrio vulnificus*.

Jordan C. Poler, Ph.D.
Associate Professor
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University of North Carolina at Charlotte
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Research Interests:

Most of my research interests are toward the fundamental studies of complex systems at the nanoscale with regard to applications of materials at the macroscale. Complex systems exist at surfaces, interfaces and thin films. The experimental techniques that I use to study these systems are both optically and electronically based. Scanning probe microscopes are the work-horses of my research. In particular, the scanning electron microscope (SEM), the scanning tunneling microscope (STM) and the newly developed scanning thermopower microscopes (STPM) are central in my studies of surfaces, interfaces and nanoparticles. The complex systems that are of most interest to me are in the areas of both; "soft" materials (e.g., self assembled monolayers, biological molecules and Langmuir films) and "hard" materials (e.g., semiconductors, metals and nanoparticles). We are particularly intereseted in how large supramolecular systems interact with nanoparticles like carbon nanotubes and quantum dots. Specifically, we are trying to elucidate energy and charge transfer mechanism between these systems while we work toward efficient manufacturing methods of nanomachines, nanosensors, nanotransducers and nanoparticle based composites.

Education:

State University of New York, Brockport	B.S.	1987	Chem. & Physics
University of North Carolina, Chapel Hill	Ph.D.	1992	Physical Chemistry/Materials Science
Princeton University	Postdoc.	'93-'95	Materials Science /Molecular Biology

Research Appointments:

5/85 - 9/85; 5/86 - 9/86; 12/86 - 1/97; 5/87 - 8/87: Student Internships at the T. J. Watson Research Center, IBM, Yorktown NY

5/90 - 9/90:	Student Intern at the T. J. Watson Research Center, IBM, Yorktown NY
8/87 - 2/93:	Research Assistant, University of North Carolina at Chapel Hill, Chapel Hill NC
2/93 - 8/95	Research Associate, NIH Fellow, Princeton University, Princeton NJ
8/95 – 7/01	Assistant Professor, University of North Carolina at Charlotte, Charlotte NC
7/01 -	Associate Professor, University of North Carolina at Charlotte, Charlotte NC

Fellowships:

Fall '87	C. N. Reilley Fellowship (UNC-CH)
Spring '88	Microelectronics Center of North Carolina (MCNC) Fellowship
Fall '88	Dobbins Fellowship (UNC-CH)
Spring '89	Department of Education (DoE) Fellowship
9/89 - 2/93	Semiconductor Research Corporation (SRC) Fellowship
9/93 - 8/95	National Institute of Health (NIH) Postdoctoral Fellowship

Honors and Awards:

SUNY at Brockport: *Summa Cum Laude*
- President's Citation (Highest Academic award at SUNY, Brockport)
- Sigma Chi Award for Research in Chemistry
- Departmental Scholar in Physics
- American Institute of Chemists Award
- Academic Dean's List (every semester while attending SUNY)

Society of Plastics Engineering, Certificate of Merit Annual Best Paper, 1986

Affiliations:
ACS, MRS, AAAS, AVS and *ALPHA CHI* National Honors Scholarship Society

Publications:
Nguyen, L.T., J.C. Poler, S.L. Buchwalter, C.A. Kovac. **Physical properties of cycloaliphatic epoxide formulation**s. IBM Technical Report RC 12320 (1986).

Ameen, J.G., G.O. Dearing, S.Buchwalter, C. Kovac, J. Poler and P.A. Poore. **Encapsulating C-4 joints on metallized ceramics**. IBM Technical Report TR 01.A230 (1987).

Bixler, J.W., M. Fifield, J.C. Poler, A.M. Bond and W. Thormann. **An evaluation of ultrathin ring and band microelectrodes as amperometric sensors in electrochemical flow cells**. Electroanalysis **1**, 23-33, (1988).

Thomas, O., I. Stolt, P. Buaud, J.C. Poler and F.M. d'Heurle. **Oxidation and formation mechanisms in disilicides: VSi_2 and $CrSi_2$, inert marker experiments and interpretation**. J. Appl. Phys. **68**, 6213-6223, (1990).

Poler, J.C. and E.A. Irene. **Pre-oxidation anneal kinetics: Interface degradation of thin SiO_2 films on silicon**. Chemical Surface Preparation, Passivation and Cleaning for Semiconductor Growth and Processing, Mater. Res. Soc. Proc.) (Spring 1992).

Poler, J.C. and E.A. Irene. **Pump-probe charge integrating investigation of trap emission kinetics in ultrathin MOS capacitors**. (Mater. Res. Soc. Proc., **Symposium G**, Fall 1992.).

Poler, J.C., K.K. McKay and E.A. Irene. **Microroughness at the Si/SiO_2 interface from pre-oxidation annealing, measured using quantum oscillations in Fowler-Nordheim tunneling currents**. (Mater. Res. Soc. Proc., **Symposium B**, Fall 1992.).

Poler, J.C., W.S. Woodward and E.A. Irene. **Novel charge integrating pulsed I(V) technique: A measurement of Fowler-Nordheim currents through thin SiO_2 films**. Rev. Sci. Instrum. **64**, 781-787, (1993).

Poler, J.C. and E.A. Irene, **Pump-probe charge integrating technique: A study of trap emission kinetics**, Appl. Phys. Lett. **62**(24), 3123-3125, (1993).

Martin, Y., J.C. Poler and H.K. Wickramasinghe. **Sidewall profiling using scanning force microscopy**. U.S. Patent, IBM No. Y09,91,162 (Feb. 1, 1994).

Poler, J.C., K.K. McKay and E.A. Irene, **Characterization of the Si/SiO_2 interface morphology from quantum oscillations in Fowler Nordheim tunneling currents**, J. Vac. Sci. Technol. B **12**(1), 88-95, (1994).

Poler, J.C., and E.A. Irene, **Investigation of trap emission kinetics in MOS capacitors using a pump-probe charge integrating technique**, J. Appl. Phys. **75**(5), 2555-63, (1994).

Zafar, S., J.C. Poler, E.A. Irene, X. Xu, G. Hames, R. Kuehn and J.J. Wortman, **Tunneling current in thin SiO_2 films**, Rapid Thermal and Integrated Processing III, Mater. Res. Soc. Proc. **342**, (Spring 1994)

Poler, J.C., R.M. Zimmermann and E.C. Cox, **Scanning Photon Emission DNA Mapping**, Patent Disclosure, Princeton University, (Aug. 29, 1994).

Poler, J.C., R.M. Zimmermann and E.C. Cox, **Scanning Thermopower Microscopy of Guanine Monolayers**, Langmuir **11**, 2689-2695, (1995).

Ye, W., B. Drozd, M.A. Hasan and J. C. Poler, **Cross Sectional AFM of Oxidized Porous Silicon**, Atomic Resolution Microscopy of Surfaces and Interfaces, Mater. Res. Soc. Proc., **466**, pp 63-66 (1997)

Poler, J.C., R.M. Zimmermann and E.C. Cox., **Scanning Thermopower Microscopy: a technique for organic and biological molecules complementary to STM** in Procedures in Scanning Probe Microscopies edited by Richard Colton, Andreas Engle, Jane Frommer, Hermann Gaub, Andrew Gewirth, Reinhard Guckenberger, Wolfgang Heckl, Bruce Parkinson and Jürgen Rabe., John Wiley and Sons: New York, , pp 55-60 (1998).

Poler, J.C., **Surface Oxidation Kinetics: A Scanning Tunneling Microscopy Experiment,** J. Chem. Educ. **77**, 1198-1200, (2000)

J. C. Poler and David Schiraldi, **Atomic Force Microscopy of Polymers**, Invited Review for Encyclopedia of Polymer Science and Technology, 3rd Ed., Wiley Interscience, Jacqueline I. Kroschwitz (Editor-in-Chief) (2002)

Poler J.C., Thomas A. Schmedake, and Weijun Ye, **Cross-sectional AFM study of etching kinetics of oxidized porous silicon**, Phys. Stat. Sol. (a) **201**, No. 4, 756–761 (2004) / **DOI** 10.1002/pssa.200306767

J.W. Hovick and J.C. Poler‡ "Misconceptions in sign conventions: flipping the electric dipole moment", J. Chem. Ed. Vol. 86 No.6 June 2005 p 889

Internet Publications

Zschocher, Robert; Bush, Fowler S.; Poler, Jordan C., **Plots of the amplitude of the bonding and antibonding orbitals formed by the overlap of two H1s orbitals**, Mathcad Documents for Physical Chemistry, http://www.niagra.edu/~tjz/mathcad/mathindx.htm , (1998)

Presentations

Ellisent Austin and Jordan Poler, "Design and Photolithographic Construction of a flow cell to enable high resolution DNA Mapping" Project Promise 2nd Annual Symposium, August 9, 1996 UNC Charlotte

J.C. Poler, "STM Study of Adenine-Thymine Co-monolayers on HOPG" Southeast Regional Meeting of the American Chemical Society, November 11, 1996

Weijun Ye and J.C. Poler Dept. of Chemistry, B. Drozd, A. Filos and M.A. Hasan Dept. of EE, "Cross-sectional AFM of Oxidized Porous Silicon", Materials Research Society, December 4, 1996 Boston, MA

Devashish R. Desai and Jordan Poler, "Studies of the affect of molecular strain on biological process activity" Tri-λ undergraduate research symposium, UNC Charlotte April 1998.

Daniel L. Felton, Timothy D. Champion and Jordan C. Poler, "Studies of Biological Activity in Response to Substrate Mechanical Strain", 6th Annual Undergraduate Research Conference, UNC Charlotte, April 1999.

Timothy D. Champion Daniel L. Felton, Pamela Hedrick, Steve McCartney and Jordan C. Poler, "Studies of Biological Activity in Response to Substrate Mechanical Strain: a Preliminary Study", 51st Southeastern Regional Meeting of the American Chemical Society October 18, 1999.

Timothy D. Champion, Bryce N. Chaney, Pamela Hedrick, Steve McCarthy, and Jordan C. Poler, "Studies of Biological Activity in Response to Substrate Mechanical Strain: A Research Project at the Interface of Materials Science and Molecular Biology", ACS Division of Chemical Education's Committee on Computers in Chemical Education CONFCHEM '00, An on-line conference April 3 - May 5, 2000.

Chirag Faldu and J. C. Poler, "New technology for real-time assessment of student's comprehension". Undergraduate Research Conference UNC Charlotte, April 14, 2000.

Teresa Brown, Nichole Palmer and J. C. Poler, "AFM studies of Metalodrimers". Undergraduate Research Conference UNC Charlotte, April 14, 2000.

Jeremy Granger, David Nicewicz, Nicole Palmer and J.C. Poler, "Substrate-Directed Self-Assembly of Rigid Metallodendrimers" Eighth Foresight Conference on Molecular Nanotechnology, November 3, 2000.

Nicole Palmer and J.C. Poler, "Computational Studies of Metallodendrimers at functionalized Gold Surfaces" 8th Annual Undergraduate Research Conference March 30, 2001 UNC Charlotte

Yi-Ching J. Hsu and J.C. Poler, "Preparation and isolation of DNA constructs for mechanical analysis" 8th Annual Undergraduate Research Conference March 30, 2001 UNC Charlotte

Jeremy Granger and J.C. Poler, "Construction and Calibration of a Variable Angle Spectroscopic Ellipsometer" 8th Annual Undergraduate Research Conference March 30, 2001 UNC Charlotte

James Luther and J.C. Poler, "Substrate Directed Self-Assembly" 8th Annual Undergraduate Research Conference March 30, 2001 UNC Charlotte

James Luther and J.C. Poler, "Substrate Directed Self-Assembly of Ru^{2+} Metallodendrimers" 1st Annual GPSG Graduate Research Fair April 14, 2001 UNC Charlotte

Amanda Hammond and J.C. Poler, "Variable Angle Spectroscopic Ellipsometry for studies of polymer surfaces: 9th Annual Undergraduate Research Conference April 19, 2002 UNC Charlotte

Amanda Hammond and J.C. Poler, "Preliminary Studies of How Polymer Surface Patterning Changes Surface Energy" 8th Annual SAEOPP/UTK McNair National Scholars Research Conference, July 11-14, 2002, Knoxville, TN)

Amanda Hammond and J.C. Poler, "Preliminary Studies of How Polymer Surface Patterning Changes Surface Energy" Ronald E. McNair Scholars Forum, July 19, 2002 UNC-Charlotte

Amanda Hammond and J.C. Poler, "PRELIMINARY STUDIES OF SURFACE ENERGY MODIFICATIONS BY NANOSTRUCTURING POLYMER SURFACES", Southeast Regional Meeting of the American Chemical Society, November 13-16, 2002, Charlston, SC

Jordan C. Poler and T.D. DuBois "Modeling of carbon nanotube and rigid dendrimers to form 3D-assemblies" Eleventh Foresight Conference on Molecular Nanotechnology, October 9-12 2003.

Jordan C. Poler , T.D. DuBois and T.A. Schmedake "Functionalized Carbon Nanotubes through mechanically bound and rigid organometalic complexes" Materials Research Society Symposium HH Boston, MA November 29th 2004.

Jordan C. Poler, T.D. DuBois and T.A. Schmedake "Computational studies of Si and Ru complexes bound to Carbon Nanotubes" Materials Research Society Symposium II Boston, MA November 29th 2004.

Chris M. Roberts and J.C. Poler, "Quantum Mechanical and Molecular Mechanical Modeling of Supramolecular Systems on Carbon Nanotubes" Research in the Capital, Raleigh, NC April 12th 2005

Chris M. Roberts and J.C. Poler "Computational Analysis of Mechanically docked Nanoparticles", 12th Annual Undergraduate Research Conference, UNC Charlotte, April 22nd 2005

Harsh Chaturvedi and J.C. Poler "Imaging and Manipulation of Pristine Isolated Single Walled Nanotubes" 5th Annual GPSG Graduate Research Fair UNC Charlotte April 9th , 2005

Harsh Chaturvedi and J.C. Poler "Molecular Combing and Aligning of Carbon Nanotubes" 12th Annual Undergraduate Research Conference, UNC Charlotte, April 22nd 2005

Harsh Chaturvedi and J.C. Poler "Imaging and manipulation of pristine isolated Single walled carbon Nanotubes" 5th Annual Fitzpatrick Symposium,Duke University.(May 18-20,2005)

H.Chaturvedi, J.C.Poler "Nanolithography and Probing of Electronic Properties of Single Walled Carbon Nanotubes as Field Effect Transistor" **Symposium on Nanoscale Science & Engineering***: Convergence of the Top Down and Bottom Up Approaches* Student Activity Center (SAC) – Salons University of North Carolina - Charlotte, Charlotte, NC Oct 24-25, 2005

Jordan Poler, Tom DuBois and Thomas A. Schmedake "Functionalized Carbon Nanotubes through Mechanically Bound and Rigid Organometalic Complexes" **Symposium on Nanoscale Science & Engineering***: Convergence of the Top Down and Bottom Up Approaches* Student Activity Center (SAC) – Salons University of North Carolina - Charlotte, Charlotte, NC Oct 24-25, 2005

External Grants or Contracts

- ACS-PRF GB grant, **PI**,
  "Scanning Thermopower Micrsocopy of hydrated Monolayer Crystals" **$20,000** 9/96 - 8/98
- NCBC-ARIG grant, **PI**,
  "High Resolution Physical Mapping of Chromosomal DNA" **$40,000** 7/96 - 6/98
- NSF ILI-IP grant, **PI**,
  "Introduction of Surface Science/Quantum Mechanical Tunneling Ecperiments to the Physical Chemistry Laboratory" **$45,903** 6/97 - 8/99
- Research Corporation Grant, **PI**,
  "Substrate-Directed Self-Assembly of Rigid Metallodendrimers" **$38,617** 5/99-5/01
- NSF NER 0404193, **PI**
  "NER: Diameter Specific Separations of Carbon Nanotubes for 3D Nanoassembling"
  $99,933 7/1/04 – 6/30/06

DANIEL RABINOVICH

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EDUCATION

1994	Ph.D. (Inorganic Chemistry), Columbia University, New York, NY.
1993	M.Phil. (Chemistry), Columbia University, New York, NY.
1990	M.A. (Chemistry), Columbia University, New York, NY.
1990	B.S. (Chemistry), Catholic University, Lima, Peru.

EXPERIENCE

2002-present Associate Professor, Department of Chemistry, The University of North Carolina at Charlotte, Charlotte, NC.
Research interests in synthetic, structural, and mechanistic inorganic and organometallic chemistry, including:

- poly(pyrazolyl)silane chemistry.
- coordination chemistry with multidentate sulfur-donor ligands, including polythioethers and poly(mercaptoimidazolyl)borates.
- bioinorganic chemistry: synthesis of model compounds for the active sites in nickel hydrogenases and other sulfur-rich enzymes.

2003 (July) Visiting Professor, Dept. of Chemistry, Catholic University, Lima, Peru.

1996-2002 Assistant Professor, Department of Chemistry, The University of North Carolina at Charlotte, Charlotte, NC.
Research interests in synthetic, structural, and mechanistic inorganic and organometallic chemistry.

1994-1996 Postdoctoral Research Associate, Los Alamos National Laboratory, Los Alamos, NM.
Syntheses, structures, and reactivity of dicarbollide complexes of uranium and thorium. Advisor: Dr. Kent D. Abney.

1990-1994 Research Assistant, Dept. of Chemistry, Columbia University, NY.
Synthetic, reactivity, and mechanistic studies of tungsten trimethylphosphine complexes, including (i) C-H bond activation chemistry of phenols, (ii) an investigation of inverse equilibrium isotope effects in the oxidative addition of dihydrogen, and (iii) the preparation of terminal sulfido, selenido, and tellurido derivatives (Ph. D. Thesis). Advisor: Professor Gerard Parkin.

HONORS

2005 Indiana University Excellence in Undergraduate Chemical Research Award
2005 IUPAC Young Observer Award
2004 Phi Beta Delta (The Honor Society for International Scholars, Inc.)
2002 Henry Dreyfus Teacher-Scholar Award
1996 Camille and Henry Dreyfus Faculty Start-up Award
1993 Pegram Award, Department of Chemistry, Columbia University, New York, NY

TEACHING

A. UNDERGRADUATE

(1) Principles of Chemistry, CHEM 1251
(2) Inorganic Chemistry, CHEM 2125
(3) Advanced Inorganic Chemistry, CHEM 4121
(4) Advanced Inorganic Chemistry Laboratory, CHEM 4121L

B. GRADUATE

(1) Organometallic Chemistry, CHEM 6126

Research Experience

Advisor to a total of fourteen M.S. students.
Advisor to a total of undergraduate students.

Academic & Professional Service

- Carolina-Piedmont local ACS section, executive committee member at large, 1999-00.
- ACS National Committee on Minority Affairs, associate member, 2002; member, 2003-present.
- ACS National Committee on Project SEED: associate member, 2004-05.
- F. Albert Cotton Award in Synthetic Inorganic Chemistry Selection Committee member, 2005.
- NSF/UNC Charlotte Pre-college Research Experience Program (PREP) summer research mentor for one middle school teacher and five high school students.
- American Chemical Society's Project SEED program coordinator at UNC Charlotte (1999-present) and research mentor for three high school students.
- Laboratory tour guide and poster presentation judge for the 2000 NC Junior Science and Humanities Symposium (Charlotte, NC).
- Villa Heights Elementary School (Charlotte, NC) science club mentor, 2002-present.
- U.S. Department of Energy's Ronald E. McNair Post-Baccalaureate Achievement Program at UNC Charlotte research mentor for three undergraduate students.
- Research advisor for six undergraduate students from Johnson C. Smith University (Charlotte, NC).
- Research advisor for two high school students from the North Carolina School of Science and Mathematics (Durham, NC): Bhaskar (Buro) Mookerji (summer 2004) & Suman Medda (summer 2005).

RESEARCH FUNDING (CURRENT) *[D. Rabinovich, PI, unless otherwise noted]*

(1) 2005-08 **ACS Petroleum Research Fund**, type B grant (**$50,000**): "Boranes as Lewis Bases and the Synthesis of Metallaboratranes".

(2) 2003-06 **National Science Foundation** grant (**$195,000**): "RUI: Synthesis and Reactivity of Tetrahedral Nickel Thiolate Complexes".

(3) 2003-06 **National Science Foundation** MRI grant (**$250,445 + $115,384** in matching funds from UNC Charlotte): "RUI/MRI-Purchase of a 400 MHz NMR Spectrometer" *[Co-PI with T.D. DuBois, B.T. Donovan-Merkert, C.A. Ogle, and K.E. Gonsalves]*

(4) 2002-07 **The Camille and Henry Dreyfus Foundation, Inc.** Henry Dreyfus Teacher-Scholar award (**$60,000**): "An Investigation of the Syntheses and Structures of Nickel Compounds in a Sulfur-Rich Environment that Mimics Hydrogenase Enzymes"

RESEARCH COLLABORATORS

1. X-RAY CRYSTALLOGRAPHY
Prof. Arnold L. Rheingold (University of California - San Diego)
Dr. Glenn P. A. Yap (University of Delaware)
Prof. William T. Pennington (Clemson University)
Prof. Barry L. Westcott (Central Connecticut State University)
Prof. Robert D. Pike (College of William and Mary)
Prof. Joseph M. Tanski (Vassar College)
Prof. Daniel S. Jones (UNC Charlotte)
Dr. Don VanDerveeer (Clemson University)

2. NANOMATERIALS SYNTHESIS AND CHARACTERIZATION
Prof. Chuan-Jian Zhong (SUNY-Binghamton)
Prof. Huaqiang Cao (Tsinghua University, China)
Prof. Thomas A. Schmedake (UNC Charlotte)

3. COMPUTATIONAL CHEMISTRY
Prof. Leonardo D. Slep (University of Buenos Aires, Argentina)
Prof. Thomas R. Cundari (University of North Texas)
Prof. Thomas D. DuBois (UNC Charlotte)

4. COORDINATION AND BIOINORGANIC CHEMISTRY
Prof. Michael Knorr (Université de Franche-Comté, France)
Prof. Carsten Strohmann (Universität Würzburg, Germany)
Dr. Maribel C. Navarro (Venezuela Institute of Scientific Investigations, Venezuela)

5. ANALYTICAL TECHNIQUES
Prof. Dennis L. Lichtenberger (University of Arizona) – Photoelectron Spectroscopy
Dr. Nadine E. Gruhn (University of Arizona) – Photoelectron Spectroscopy

Prof. Gordon T. Yee (Virignia Tech) – Magnetochemistry
Prof. Bernadette T. Donovan-Merkert (UNC Charlotte) – Electrochemistry
Prof. Alice Haddy (UNC Greensboro) – Electron Paramagnetic Resonance (EPR) Spectroscopy

PUBLICATIONS (SELECTED)

(25) "Syntheses and Structures of Methyltris(pyrazolyl)silane Complexes of the Group 6 Metals" Pullen, E. E.; Rabinovich, D.; Incarvito, C. D.; Concolino, T. E.; Rheingold, A. L. *Inorg. Chem.* **2000**, *39*, 1561-1567.

(26) "Bismuth(III) Thioether Chemistry: Synthesis and Structure of a Coordination Polymer Derived from $BiCl_3$ and $MeSi(CH_2SMe)_3$" Yim, H. W.; Lam. K.-C.; Rheingold, A. L.; Rabinovich, D. *Polyhedron* **2000**, *19*, 849-853.

(27) "Synthesis and Structure of $\{\eta^3\text{-}MeSi(CH_2SPh)_3\}Cr(CO)_3$: How Long Can a Cr(0)—S(thioether) Bond Length Be?" Blackwell III, W. C.; Bunich, D.; Concolino, T. E.; Rheingold, A. L.; Rabinovich, D. *Inorg. Chem. Commun.* **2000**, *3*, 325-327.

(28) "Zinc Bis(pyrazolyl)silane Complexes" Richburg, L. M.; Farouq, J. A.; Incarvito, C. D.; Rheingold, A. L.; Rabinovich, D. *Polyhedron* **2000**, *19*, 1815-1820.

(29) "Synthesis and Characterization of Two New Bulky Tris(mercaptoimidazolyl)borate Ligands and their Zinc and Cadmium Complexes" Bakbak, S.; Bhatia, V. K.; Incarvito, C. D.; Rheingold, A. L.; Rabinovich, D. *Polyhedron* **2001**, *20*, 3343-3348.

(30) "Modeling Nickel Hydrogenases: Synthesis and Structure of a Distorted Octahedral Complex with an Unprecedented $[NiS_4H_2]$ Core" Alvarez, H. M.; Krawiec, M.; Donovan-Merkert, B. T.; Fouzi, M.; Rabinovich, D. *Inorg. Chem.* **2001**, *40*, 5736-5737.

(31) "Synthesis and Characterization of Novel Mononuclear Cadmium Thiolate Complexes in a Sulfur-Rich Environment" Bakbak, S.; Incarvito, C. D.; Rheingold, A. L.; Rabinovich, D. *Inorg. Chem.* **2002**, *41*, 998-1001.

(32) "Novel Spherical Assembly of Gold Nanoparticles Mediated by a Tetradentate Thioether" Maye, M. M.; Chun, S. C.; Rabinovich, D.; Zhong, C.-J. *J. Am. Chem. Soc.* **2002**, *124*, 4958-4959.

(33) "Bulky Tris(mercaptoimidazolyl)borates: Synthesis and Molecular Structures of the Group 12 Metal Complexes $(Tm^{tBu})MBr$ (M = Zn, Cd, Hg)" White, J. L.; Tanski, J. M.; Rabinovich, D. *J. Chem. Soc., Dalton Trans.* **2002**, 2987-2991.

(35) "Construction of Spherical Assembly of Gold Nanoparticles Using Tetra[(methylthio)methyl]silane as Ligand" Maye, M. M.; Lim, I.-I. S.; Luo, J.; Han, L.; Rabinovich, D.; Chen, S.; Maye, M. P.; Zhong, C.-J. *Mat. Res. Soc. Symp. Proc.* **2003**, *739*, H2.6.1-H2.6.6.

(36) "Homoleptic Group 12 Metal Bis(mercaptoimidazolyl)borate Complexes $M[Bm^R]_2$ (M = Zn, Cd, Hg)" Alvarez, H. M.; Tran, T. B.; Richter, M. A.; Alyounes, D. M.; Rabinovich, D.; Tanski, J. M.; Krawiec, M. *Inorg. Chem.* **2003**, *42*, 2149-2156.

(39) "Size-Controlled Assembly of Gold Nanoparticles Induced by a Tridentate Thioether Ligand" Maye, M. M.; Luo, J.; Lim, I.-I. S.; Han, L.; Kariuki, N. N.; Rabinovich, D.; Liu, T.; Zhong, C.-J. *J. Am. Chem. Soc.* **2003**, *125*, 9906-9907.

(41) "Bis(mercaptoimidazolyl)borates and the Control of Nuclearity in Cadmium Thiolate Complexes" Philson, L. A.; Alyounes, D. M.; Zakharov, L. N.; Rheingold, A. L.; Rabinovich, D. *Polyhedron* **2003**, *22*, 3461-3466.

(42) "Poly(mercaptoimidazolyl)borate chemistry and the predominance of κ^3-*S,S,H* over κ^2-*S,S* or κ^3-*S,S,S* coordination modes: unexpected formation of square pyramidal Ni(II) complexes" Alvarez, H. M.; Tanski, J. M.; Rabinovich, D. *Polyhedron* **2004**, *23*, 395-403.

(43) "Thallium Bis(mercaptoimidazolyl)borates" Alvarez, H. M.; Gillespie, P. A.; Gause, C. D.; Rheingold, A. L.; Golen, J. A.; Rabinovich, D. *Polyhedron* **2004**, *23*, 617-622.

(44) "Cobalt Tris(mercaptoimidazolyl)borate Complexes: Synthetic Studies and the Structure of the First Cobaltaboratrane" Mihalcik, D. J.; White, J. L.; Tanski, J. M.; Zakharov, L. N.; Yap, G. P. A.; Incarvito, C. D.; Rheingold, A. L.; Rabinovich, D. *Dalton Trans.* **2004**, 1626-1634.

(45) "Manganese(I) Poly(mercaptoimidazolyl)borate Complexes: Spectroscopic and Structural Characterization of Mn···H—B Interactions in Solution and in the Solid State" Graham, L. A.; Fout, A. R.; Kuehne, K. R.; White, J. L.; Marks, F. M.; Yap, G. P. A.; Zakharov, L. N.; Rheingold, A. L.; Rabinovich, D. *Dalton Trans.* **2005**, 171-180.

(46) "Mediator–Template Assembly of Nanoparticles" Maye, M. M.; Lim, I.-I. S.; Luo, J.; Rab, Z.; Rabinovich, D.; Liu, T.; Zhong, C.-J. *J. Am. Chem. Soc.* **2005**, *127*, 1519-1529.

(47) "Formation of Extended 1D Coordination Polymers in Tetrathioether Complexes of Mercury(II): Effect of the Organic Substituents on the Crystal Structures of $\{Si(CH_2SR)_4\}HgBr_2$ (R = Me, Ph)" Peindy, H. N.; Guyon, F.; Knorr, M.; Smith, A. B.; Farouq, J. A.; Islas, S. A.; Rabinovich, D.; Golen, J. A.; Strohmann, C. *Inorg. Chem. Commun.* **2005**, *8*, 479-482.

(48) "Tris(mercaptoimidazolyl)borate complexes of the coinage metals: syntheses and molecular structures of the first gold compounds and related copper and silver derivatives" Patel, D. V.; Mihalcik, D. J.; Kreisel, K. A.; Yap, Glenn P. A.; Zakharov, L. N.; Rabinovich, D.; Kassel, W. S.; Rheingold, A. L.; Rabinovich, D. *Dalton Trans.* **2005**, 2410-2416.

(49) "Poly(mercaptoimidazolyl)borate Complexes of Cadmium and Mercury" Rabinovich, D *Struc. Bonding* **2006**, accepted for publication.

(50) "General Classification of Organometallic Reactions" Rabinovich, D. In *Comprehensive Organometallic Chemistry III*; Crabtree, R. H., Mingos, D. M. P., Eds.; Elsevier: New York, accepted for publication.

JAYARAMAN RAJA

EDUCATION:

B.E, Mechanical Engineering, 1974; Madras University, Madras, India
M.Sc (Eng.), Production Eng., 1978; Madras University, Madras, India
Ph.D., Mechanical Engineering, 1980; Indian Institute of Technology, Madras, India

PROFESSIONAL EXPERIENCE:

1996- Present	Professor & Chairman (2000 - present)
1989-1996	Associate Professor, Mechanical Engineering and Engineering Science Department at the University of NC at Charlotte
1985-1989	Assistant Professor, M.E. and E.S Department, Michigan Technological University.
1984-1985	Research Associate, Manufacturing Systems Engineering Program, University of Wisconsin, Madison
1980-1983	Postdoctoral Fellow, Department of Engineering Science, University of Warwick, Coventry, U.K.
1987,1988,1989,1998	Summer Faculty Fellow, Precision Engineering Division, NIST

AREAS OF SPECIALIZATION:

Surface metrology, Form metrology and Precision Engineering

COMPANIES AND ORGANIZATIONS THAT FUNDED RESEARCH PROJECTS:

Cummins Engine Co., Caterpillar, Ford, Kodak, Norton, Brown & Sharpe, Mahr-Federal, WYKO Corp., NIST, CAMI-1, NSF, Westinghouse, Bosch Breaking System

PROFESSIONAL SOCIETIES AND STANDARDS COMMITTEES INVOLVEMENT:

Member of the Editorial Board of "Precision Engineering" Journal
Member of the Editorial Board of "Measurement" Journal
Member of the ASME Board on Standardization
Member and past Chair of the ASME standards committee on "Surface Texture"
Member of the US Expert group to ISO TC 213 working groups (1996 – present)
(Geometrical Product Specification, 3D characterization of Surfaces)

PUBLICATIONS CLOSELY RELATED TO THE PROPOSED PROJECT:

Orji NG, Sanchez MI, Raja J and Vorburger TV, "AFM characterization of semiconductor line edge roughness" In: Applied Scanning Probe Methods (Bhushan, Fuchs, Hosaka. eds), Springer-Verlag Berlin, (2004) chpt. 9.

Orji NG, Vorburger TV, Fu J, Dixson RG, Nguyen CV and Raja J (2004), "Line Edge Roughness Metrology using Atomic force Microscopes." Measurement Science and Technology 16 2147-2154

Orji NG, Vorburger TV, Gu X, J. Raja, "Scale-space analysis of line edge roughness on 193 nm lithography test structures". Proc. of ASPE 18th Annual Meeting, p419 (2003)

Orji NG, Vorburger, TV and Raja J, "Atomic force microscopy of semiconductor line edge roughness", Proc. of ASPE 17th Annual Meeting pp 63-66. (2002)

OTHER PUBLICATIONS:

B. Muralikrishnan & J. Raja, "Functional filtering and performance correlation of plateau honed surface profiles", *ASME Journal of Manufacturing Science and Engineering*, 127(1), 193-197, 2005

B. Muralikrishnan, S. Venkatachalam, J. Raja and M. Douglass, "Process mapping and functional correlation in surface metrology: a sheet metal case study", *International Journal of Advanced Manufacturing Technology*, in press 03/2004

S.Fu, B.Muralikrishnan and J.Raja, "Engineering surface analysis with different wavelet bases", *ASME Journal of Manufacturing Science and Engineering*, 125(4), 2003, 844-852

Raja, J., Muralikrishnan, B., Fu, S., "Recent advances in separation of roughness, waviness and form", Precision Engineering: Journal of the International Societies for Precision Engineering and Nanotechnology, 26 (2002) 222-235

SYNERGISTIC ACTIVITIES:

- Participated in the International Semiconductor Manufacturing Initiative in Metrology
- Teaching graduate level courses in the area of metrology (Engineering Metrology, Advanced Surface Metrology) at the University of North Carolina at Charlotte.
- Research in the areas of surface and form metrology with applications to manufacturing process control and functional performance evaluation of engineering components.
- Played a significant role in the development of the metrology laboratory and research programs in metrology at UNC Charlotte. Has authored or co-authored over 75 papers. and directed the work of 20 masters students and 8 Ph.D students in the areas of surface and form metrology.
- Have extensive experience in surface and form metrology standards development for industry. I am currently the chair of the ASME committee on roundness and a member of the ASME Board on Standardization. Have served as the chair of the ASME standards committee on Roughness. Also, a subject matter expert for the USA in the ISO standards committees dealing with surface and form metrology. I am currently an Associate Editor for "Precision Engineering – Journal of the International Societies for Precision Engineering and Nano technology".

ARUN A. RAVINDRAN
Co-Principal Investigator
Assistant Professor, Department of Electrical and Computer Engineering
University of North Carolina at Charlotte, Charlotte, NC 28223
Phone (704) 687-4389, FAX (704) 687-2352, e-mail aravindr@uncc.edu

A. PROFESSIONAL PREPARATION:

Birla Institute of Technology and Science, Pilani, India, Instrumentation, B.Eng., 1996
Birla Institute of Technology and Science, Pilani, India, Microelectronics, M.Eng., 1997
The Ohio State University, Columbus, M.S., 2000
The Ohio State University, Columbus, Ph.D., 2003

B. APPOINTMENTS:

- Assistant Professor, U. of N. Carolina at Charlotte, Dept. of Electrical and Comp. Eng., 2003-Present
- Research Assistant, The Ohio State University, 2002-2003
- Teaching Assistant, The Ohio State University, 1998-2002
- Design Engineer, IBM, Bangalore, India, 1998.

C. PUBLICATIONS:

Most relevant publications:

1. A. Ravindran, K. Ramarao, E. Vidal and M. Ismail, "Compact Low-voltage four quadrant CMOS current multiplier", Electronic Letters, Volume: 37 Issue: 24, 22 Nov. 2001, pp. 1427-1428.
2. H. Elwan, A. Ravindran and M. Ismail, "A CMOS low power baseband chain for a GSM/DECT multi-standard receiver", IEE Proceedings: Circuits, Devices, and Systems, Vol. 149, Issue 5, pp. 337-347, Oct. 2002
3. A. Ravindran, E. Vidal, S. Yoo, K. Ramarao and M. Ismail, "A differential current mode variable gain amplifier with a digital dB-linear gain control", Journal of Analog Integrated Circuits and Signal Processing, Vol. 38, Issue 2-3, pp. 161-174, Feb 2004
4. I. Younus, A. Ravindran, A. Savla and M. Ismail, " A reconfigurable baseband chain for 3G wireless receivers", "Wireless Communications: Circuits and Systems", Editor Yichuang Sun, IEE Press, 2004 .
5. K. Regester, J. Byun, Arindam Mukherjee and Arun Ravindran, "Implementing bioinformatics algorithms on Nallatech-configurable multi-FPGA systems", Xcell Journal., pp. 100-103 Second Quarter, 2005.

Other significant publications:

1. A. Ravindran, E. Vidal and M. Ismail, "A digitally generated exponential function for dB-linear CMOS variable gain amplifiers", 14th International Conference on Digital Signal Processing, July 2002.
2. A. Ravindran, A. Savla, I. Younus and M. Ismail, " A 0.8V CMOS filter based on a novel low voltage operational trans-resistance amplifier", 45th IEE MWSCAS, August 2002.
3. A. Savla, A. Ravindran and M. Ismail, " A Reconfigurable low power pipeline ADC for multi-standard wireless applications", IEE-Japan, Analog VLSI Workshop, September 2002.
4. A. Ravindran, A. Savla and J. Leonard, "Digital error correction and calibration of non-linearities in a pipelined ADC", ISCAS, May 2004.
5. A. Savla, A. Ravindran and J. Leonard, "A novel queuing architecture for background calibration in pipelined ADCs", ISCAS, May 2004.

D. SYNERGISTIC ACTIVITIES

1. Developed digital correction and calibration algorithms for high performance pipelined analog-to-digital converters
2. Developed ultra low power techniques for low speed moderate resolution analog-to-digital converters
3. Developed reconfigurable computing architectures for high performance bioinformatics
4. Established the BioVLSI laboratory at UNC Charlotte for FPGA based High Performance Acceleration of Bioinformatics and Bioengineering applications.
5. Active research participant and Faculty Fellow of the Global Institute of Energy and Environmental Sciences (GIEES) – an internationally reputed center of research, based at UNC Charlotte.

E. COLLABORATORS AND OTHER AFFILIATIONS

(a) Collaborators and Co-Editors
David Binkley, UNC Charlotte
Arindam Mukherjee, UNC Charlotte
Anup Savla, Intel Corp.
Eva Vidal, UPC Spain.
Thomas Weldon, UNC Charlotte
Helene Hilger, UNC Charlotte
Ivan Howitt, UNC Charlotte
Hilary Inyang, UNC Charlotte
Akira Yamazaki, Fuji Electric, Japan
Cynthia Gibas, UNC Charlotte
Anthony Wilkinson, UNC Charlotte

(b) Graduate Advisors
Mohammed Ismail, The Ohio State University
R. Sooryakumar, The Ohio State University

(c) Thesis Advisor and Post-grad Sponsor
Christopher Wichman, UNC Charlotte
Srikanth Mohan, UNC Charotte
Robert Crawford, UNC Charlotte
Leroy Calder, UNC Charlotte
Steven Tucker, UNC Charlotte
Jong-Ho Byun, UNC Charlotte
Sasa Cvijetic, UNC Charlotte

Curriculum Vitae

Name	John Marcus Risley
Address	Department of Chemistry The University of North Carolina at Charlotte 9201 University City Blvd. Charlotte, North Carolina 28223-0001 U.S.A. Telephone (704) 687-4844 FAX (704) 687-3151 Email jmrisley@email.uncc.edu
Present Position	Professor of Chemistry (tenured), Department of Chemistry, The University of North Carolina at Charlotte (Charlotte, NC), July 2002 - date
Previous Employment	Associate Professor of Chemistry (tenured), Department of Chemistry, The University of North Carolina at Charlotte (Charlotte, NC), July 1994 – June 2002 Assistant Professor of Chemistry, Department of Chemistry, The University of North Carolina at Charlotte (Charlotte, NC), August 1988 - June 1994 Visiting Assistant Professor of Chemistry, Department of Chemistry, Purdue University (West Lafayette, IN), January 1987 - August 1988; taught general chemistry, rewrote the laboratory experiments for the freshman, non-science majors, general chemistry course Assistant Research Scientist, Purdue University (West Lafayette, IN), September 1985 - December 1986; research in bio-organic chemistry Postdoctoral Research Associate with Dr. Robert L. Van Etten, Department of Chemistry, Biological Division, Purdue University (West Lafayette, IN), September 1980 - August 1985; research in bio-organic chemistry and physical organic chemistry Graduate Assistant in Research, Department of Chemistry, Biological Division, Purdue University (West Lafayette, IN), June 1977 - August 1980 Teaching Assistant, Department of Chemistry, Purdue University (West Lafayette, IN), August 1976 - May 1977 Laboratory Instructor and Research Assistant, Ball State University (Muncie, IN), June 1975 - August 1976
Research Interests	Bio/physical organic chemistry and Biochemistry: The enzymes of glycoprotein catabolism, Glycosylasparaginase. Structure and function of the carbohydrate moiety of glycoproteins. Biochemical mechanisms of diseases and abnormalities. Mechanisms and kinetics of enzyme and non-enzyme-catalyzed reactions. Application of the ^{18}O-isotope effect in ^{13}C NMR spectroscopy in various mechanistic and kinetic studies.
Graduate Education	In Chemistry (Biological Division) at Purdue University, 1976 - 1980; Ph.D degree completed August 1980, awarded December 1980
Undergraduate	Ball State University, Muncie, IN., September 1971 - May 1972 and June 1974 -

Education

July 1976; B.S. (Chemistry; minor - Mathematics) awarded July 1976 Cum Laude

University of Maryland - European Division, Baumholder, Federal Republic of Germany, January 1973 - May 1974

Central Texas College - Europe, Baumholder, Federal Republic of Germany, March - May 1974

Honors

Sigma Zeta, Honorary Science Society, elected 1975
Petroleum Institute Research Award, 1976
Sigma Pi Sigma, Physics Honorary, elected 1976
Phi Society, elected 1976
Society of the Sigma Xi (Purdue University) Student Research Award, 1979
Member, Sigma Xi, The Scientific Research Society, elected 1988

Awards

Recipient of Outstanding Faculty Award from The Office for Building Educational Strengths and Talents (B. E. S. T.), UNC Charlotte, 2005

Courses Taught (selected)

Chem 3175	Introductory Biochemistry
Chem 3175L	Introductory Biochemistry Laboratory
Chem 4165	Principles of Biochemistry I
Chem 4165L	Principles of Biochemistry I Laboratory
Chem 4166	Principles of Biochemistry II
Chem 4171	Biochemical Instrumentation
Chem 5090	Special Topics in Chemistry: Metabolic Biochemistry
Chem 6060	Special Topics in Chemistry: Biochemical Principles
Chem 6101/8101	Biochemical Principles (new course) (3 semesters)
Chem 6165/8165	Advanced Biochemistry - Mechanisms in Protein Chemistry (new course)
Chem 8080	Biochemical Principles
Biol 8800	Laboratory Rotation
LBST 2213	Science, Technology and Society

Committee Work

National

Project ChemLab Committee, Division of Chemical Education, American Chemical Society, 2001-date (Biochem reviewer and editor) (for the *Journal of Chemical Education*)

North Carolina

National Starch and Chemical Company “Touch the Future” Grants Committee, Salisbury, NC, 2004

Research Students

Undergraduate (40)
Post-Baccalaureate (1)
Graduate – Masters (10)
Graduate - Ph.D. (2)

Publications (selected)

A. Articles

D. H. Huang and J. M. Risley (2000) "Synthesis of N^4-(2-acetamido-2-deoxy-β-D-glucopyranosyl)-L-asparagine analogues: Succinamide, L-2-hydroxysuccinamide, and L-2-hydroxysuccinamic acid hydrazide analogues" Carbohydr. Res. 329, 487-493.

D. H. Huang and J. M. Risley (2001) Corrigendum to "Synthesis of N^4-(2-acetamido-2-deoxy-β-D-glucopyranosyl)-L-asparagine analogues: Succinamide, L-2- hydroxysuccinamide, and L-2 hydroxysuccinamic acid hydrazide analogues" Carbohydr.Res. 331, 225.

Y.-Q. Xia and J. M. Risley (2001) "Synthesis of N^4-(2-Acetamido-2-deoxy-β-D-glucopyranosyl) Asparagine Analogues. L-2-Chloro-, L-2-Bromo-, and D,L-2-Methylsuccinamic Acid Analogues" J. Carbohydr. Chem. 20, 45-55.

J. J. Malik and J. M. Risley (2001) "Synthesis of N^4-(2-acetamido-2-deoxy-β-D-glucopyranosyl)-L-asparagine analogues. Complete NMR assignments of chloroacetamide, bromoacetamide and glycinamide analogues" Magn. Reson. Chem. 39, 98-100. DOI: 10.1002/1097 458X(200102)39:2<101::AID-MRC797>3.0.CO;2-F

J. J. Kaylor and J. M. Risley (2001) "Synthesis of N^4-(2-acetamido-2-deoxy-β-D-glucopyranosyl)-L asparagine analogues: n-Butyramide, 3-chloropropionamide, 3-aminopropionamide, and isovaleramide analogues" Carbohydr. Res. 331, 439-444.

J. M. Risley, D. H. Huang, J. J. Kaylor, J. J. Malik, and Y.-Q. Xia (2001) "Glycosylasparaginase Inhibition Studies: Competitive Inhibitors, Transition State Mimics, Noncompetitive Inhibitors" J. Enzyme Inhib. 16, 269-274.

J. M. Risley, D. H. Huang, J. J. Kaylor, J. J. Malik, Y.-Q. Xia, and W. M. York (2001) "Glycosylasparaginase Activity Requires the α-Carboxyl Group, But Not the α-Amino Group, on N^4-(2-Acetamido-2-Deoxy-β-D-Glucopyranosyl)-L-Asparagine" Arch. Biochem. Biophys. 391, 165-170. DOI: 10.1006/abbi.2001.2416

J. M. Risley (2002) "Cholesterol Biosynthesis: Lanosterol to Cholesterol" J. Chem. Educ. 79, 377-384.

W. Du and J. M. Risley (2003) "Acylation is rate-limiting in glycosylasparaginase-catalyzed hydrolysis of *N*^{4}-(4´-substituted phenyl)-L-asparagines" Org. Biomol. Chem. 1, 1900-1905. DOI: 10.1039/b301513k

Research Funding (selected)

"Synthesis of Substrate Analogues and an Active Site Energetic Fingerprint of Aspartylglucosaminidase" Research Corporation, $21,718 (May 12, 1994 - May 11, 1996)

"Instrumentation for Student Instruction in Sedimentation and Fluorescence Spectroscopy" North Carolina Biotechnology Center - Educational Enhancement Grants Program, $85,000 (March 1, 1998 - July 31, 1999)

"Acquisition of Liquid Chromatography - Mass Spectrometry Instrumentation for the Regional Analytical Chemistry Laboratory" National Science Foundation - Major Research Instrumentation Program, $356,340 (September 15, 1998 - September 30, 2001) (Co-PI)

"Purchase of a 400 MHz NMR Spectrometer" National Science Foundation – MRI/RUI Program, $250,445 (July 1, 2003 – June 30, 2006) (Co-PI)

"Inhibition of Glycosylasparaginase" Sigma Xi Grants In Aid of Research for Jenna F. DuMond, $500 (January 9, 2004 – June 30, 2005)

THOMAS A. SCHMEDAKE
Assistant Professor
Department of Chemistry
The University of North Carolina at Charlotte
9201 University City Boulevard, Charlotte, NC 28223
phone: (704)687-4011, fax: (704)687-3151
e-mail: tschmeda@email.uncc.edu

Professional Preparation

Knox College	Chemistry	B.A., 1994
University of Wisconsin	Inorganic Chemistry	Ph.D., 2000
Univ. of California – San Diego	Materials Chemistry	2000-2002

Academic Appointments

2002 - present Assistant Professor, Chemistry Department, UNC-Charlotte

Selected Patents and Publications

1. "Optically Encoded Particles" International Publication Number: WO 03/067231, International Publication Date: **14, August 2003**, Inventors: Michael J. Sailor, Thomas Schmedake, Frederique Cunin, and Jamie Link.

2. J. C. Poler, T. A. Schmedake, W. J. Ye "Cross-sectional AFM study of etching kinetics of oxidized porous silicon", *Physica Status Solidi A-Applied Research,* **2004**, *201*, 756.

3. T. A. Schmedake, F. Cunin, J. R. Link, M. J. Sailor, "Standoff Detection of Chemicals Using Porous Silicon 'Smart-Dust' Particles", *Advanced Materials,* **2002**, *14*, 1270.

4. F. Cunin, T. A. Schmedake, J. R. Link, Y. Y. Li, J. Koh, S.N. Bhatia, M. J. Sailor, "Biomolecular screening with encoded porous-silicon photonic crystals", *Nature Materials,* **2002**, *1*, 39.

5. R. Liu, Y. Fainman, T. A. Schmedake, Y. Y. Li, M. J. Sailor, "Novel Porous Silicon Vapor Sensor based on Polarization Interferometry" *Sensors and Actuators B,* **2002**, *87*, 58.

6. International Patent: WO 03/067231 A1, "Optically encoded particles" M. J. Sailor, T. Schmedake, F. Cunin, J. Link, 14/Aug/2003.

7. M. Haaf, A. Schmiedl, T. A. Schmedake, D. R. Powell, A. J. Millevolte, M. Denk, R. West. "Synthesis and Reactivity of a Stable Silylene" *J. Am. Chem. Soc.* **1998**, *120*, 12714.

8. M. Haaf, T. A. Schmedake, R. West, "Stable Silylenes" *Acct. of Chem. Research,* **2000**, 33, 704.

9. T.A. Schmedake, M. Haaf, Y. Apeloig, T. Müller, S. S. Bukalov, R. West. "Reversible Transformation Between a Diaminosilylene and a Novel Disilene" *J. Am. Chem. Soc.* **1999**, 121, 9479.

10. T. A. Schmedake, M. Haaf, B. J. Paradise, D. R. Powell, R. West. "Two Trigonal Ni(Silylene)$_3$ Complexes" *Organometallics*, **2000**, 19, 3263.

Synergistic Activities

• Co-Chaired Nanoscale Science and Engineering Conference at UNC-Charlotte (Oct 24-25, 2005 Charlotte, NC)
• Chaired Nanotechnology session at the American Chemical Society National Meeting (March 13, 2005), Division of Inorganic Chemistry
• Co-chaired the Optical Materials Session of Optics in the Southeast (OISE) (Fall, 2003)
• Outreach: Gave a locally televised general lecture on Optical Materials research for a campus and city-wide audience (9/18/03)

Collaborators

Dr. Sangeeta Bhatia, Dr. Yeshaiahu Fainman, Dr. Rong Liu, Dr. Michael J. Sailor (University of California San Diego)
Dr. Jordan Poler, (University of North Carolina – Charlotte)
Dr. Michael Haaf, (Ithaca College, NY)
Dr. Larissa Leites, Dr. Sergei Bukalov (Russian Academy of Science)
Dr. Robert West, (University of Wisconsin)

Graduate and Postdoctoral Advisors

Dr. Robert West, University of Wisconsin
Dr. Michael J. Sailor, University of California – San Diego

Thesis Advisor and Postgraduate-Scholar Sponsor

Mr. Thomas Michael Barnard (2005)
Ms. Mitra Semiyari (2005)
Mr. Adam Jakob, current MS students, University of North Carolina at Charlotte

Biographical Sketch—Wade N. Sisk

The University of North Carolina at Charlotte
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Phone: (704) 687-4433; Fax: (704) 687-3151
email: wsisk@uncc.edu

a. Professional Preparation.

The University of Iowa	Chemistry	B.S 1984
The University of California Berkeley	Physical Chemistry	Ph.D. 1990
Tokyo Institute of Technology	Photochemistry	1990-1991
Hitachi Research Laboratory	Organic Photoconductors	1991-1992
Brookhaven National Laboratory	Diode Laser Spectroscopy	1992-1993

b. Appointments.

University of North Carolina at Charlotte	Chemistry Associate Professor	2001-present
The Institute of Physical and Chemical Research RIKEN	Science and Technology Visiting Researcher	1997-1998
University of North Carolina at Charlotte	Chemistry Assistant Professor	1993-2001

c. Recent Publications.

1) "Energy transfer and photodegradation of Perylene Orange:LDS821 system in PMMA", W. N. Sisk and N. Tanaka, Applied Optics, *accepted for publication.*

2) "Photodegradation of Polymer-dispersed perylene diimide dyes", N. Tanaka, N. Barashkov, J. Heath, and W. N. Sisk, Applied Optics, *accepted for publication.*

3) "The photodegradation of Pyrromethene 567 and Pyrromethene 597 by Pyrromethene 546", Nobuaki Tanaka and Wade N. Sisk, J. Photochem. And Photobiol. A. 2005, 2005, 172 109-114.

4) "The concentration dependence of the normalized photostability of 1,3,5,7,8-pentamethyl-2,6-di-t-butylpyrromethene-difluoroborate complex (PM597) methanol solutions" W. N. Sisk and W. Sanders, J. Photochem. Photobio. A: Chem. **,** 2004, 167 185-189.

5) "Singlet oxygen quenching of Tris(8-hydroxyquinoline)aluminum (Alq_3) and N,N'-diphenyl-N,N'-bis(3-methylphenyl) -[1,1-biphenyl]- 4, 4-diamine (TPD)" W. N. Sisk and W. L. Lawrence, J. Photochem. Photobio. A: Chem. **,** 2004, 163 439-443.

d. Synergistic Activities.

1) Served on discussion panel for the Eighth Annual January Academic Bridge Program sponsored by PRODUCE, Jan. 7 2005. & Jan. 9, 2004.

2) Served on review panel for Ford Foundation Predoctoral Fellowship for Minorities – March 7-8, 2003, Arlington, VA.

3) Served as chair of a panel review section for the UNC Charlotte's 2001 Scholarship for Merit Interviews, February 15, 2002.

4) Served as a panelist to review applications for the National Science Foundation's (NSF) International Research Fellowship Program and Distinguished Research Fellowship, Feb. 7-8, 2002, Arlington, VA.

5) Developed Molecular Photochemistry and Photophysics (CHEM 6147/8147) with online lectures – approved as a formal course October 2004.

e. Collaborators & Other Affiliations

Collaborators:

- Dr. Tsuneo Fuji , Professor of chemistry, Shinshu University, Nagano, Japan
- Dr. Kenneth Gonsalves, Professor of Chemistry, The University of North Carolina, Charlotte
- Dr. Hisaharu Hayashi, Institute of Physical and Chemical Research (RIKEN), Japan.
- Dr. Shigeru Ikeda, Research Chemist, The Molecular Photochemistry Group, RIKEN
- Dr. Noboru Ono, Professor of Chemistry, Ehime University, Japan
- Dr. Nilmoni Sarkar, Indian Institute of Technology, Kharagpur, West Bengal, India
- Dr. Nobuaki Tanaka , Assistant professor of chemistry, Shinshu University, Nagano, Japan
- Dr. M. Wada, Associate Professor of Chemistry, Ehime University, Japan
- Dr. T. Yano, Associate Professor of Chemistry, Ehime University, Japan

Graduate and Postdoctoral Advisors:

- Doctoral thesis advisor: Professor Harold Johnston, Chemistry Department, University of California
- Postdoctoral Research Advisor: Professor Kinichi Obi, Tokyo Institute of Technology, Tokyo, Japan
- Postdoctoral Research Advisor: Dr. Toshiro Saito, Hitachi Research Laboratory, Ibaraki-ken, Japan
- Postdoctoral Research Advisor: Dr. Ralph Weston Jr., Brookhaven National Laboratory, Upton, NY

Thesis Advisor and Postgraduate-Scholar Sponsor:

- Graduate students = 4:
- Kwang-Sun Kang, - MS Chemistry (1996) & Ph.D. Materials Science (2001)
- Dong Hee Kang – MS Chemistry (1998)
- Stacey Henegar.- MS Chemistry (1998)
- Wesley Sanders – M.S. Chemistry (2005)

BIOGRAPHICAL SKETCH

Stuart Thomas Smith, BSc., PhD.
Department of Mechanical Engineering,
UNC Charlotte, NC 28223

Email; stusmith@uncc.edu

Professional preparation

1977 - 1981 Dunstable College,
1981 - 1987 The University of Warwick,

Qualifications;

First year City and Guilds certificates
I. T. B. (Industrial Training Board) First Year Training Certificate
I. T. B. Certificate of Engineering Craftsmanship
I. T. B. Certificate of Endorsement
Higher TEC Certificate
Maintenance Engineering Indentures (craft apprenticeship) (1977-1981)
Batchelor of Science Degree in Mechanical Engineering
(Bsc. class one) (1984)
Doctor of Philosophy Degree (Ph.D) with the title;
'Mechanical Systems in Nanometre Metrology' (1988)

Appointments

Aug. 1994 - present	Center for Precision Metrology, UNC Charlotte, NC 289223	Full Professor
Oct. 1992 - Oct. 1993	Ibid.	Royal Academy of Engineering (UK)
Oct.1987 - July 1994;	University Of Warwick, Coventry. CV4 7AL. UK	Senior lecturer (from 1994)
Oct.1985 - Mar.1986;	National Physical Laboratory, Teddington, Middlesex. TW11 0LW, UK	Tenure during PhD degree
Aug.1984 - Sept.1984;	Hawker Siddelley(Insumat Div.) Hucclecote, Gloucestershire, UK. Gloucestershire.	Planning Engineer
Aug.1983 - Sept.1983;	Walters Engineering(83) Stuart Place, Bath, Avon, UK	Machine Fitter
Aug.1977 - Aug.1981;	Miles Redfern Ltd London Road, Dunstable, Beds., UK	Apprentice

Publications

Selected journals

1. Schindel D.W., Hutchins D.A., Smith S.T. and Farahbakhsh B., 1994, High-temperature pulsed photoacoustic studies of surface waves on solids, *J. Acoust. Soc. Am.*, **95**(5), 2517-2524.
2. Smith S.T. and Howard L.P., 1994, A precision, low force balance and its application to atomic force probe characterisation, *Rev. Sci. Instrum.*, **65**(4), 903-909
3. Miller J.A., Hocken R.J., Smith S.T. and Harb S., 1996, X-ray calibrated tunneling system with a thermally stable nanometer positioner, *Precision Engineering*, **18**(2/3), 95-102
4. Dogaru T. and Smith S.T., 2000, Edge crack detection using a giant magnetoresistance based eddy current sensor, *NDT and E*, **16**, 31 - 53.
5. Woody S.C., **Smith S.T.**, Rehrig P.W. and Xiaoning J., 2005, Performance of single crystal $Pb(Mg_{1/3}Nb_{2/3})$-32%$PbTiO_3$ stacked actuators with application to adaptive structures, *Rev. Sci. Instrum.*, **76**, 075112 (8 pages).
6. Woody S.C. and **Smith S.T.**, 2005, Steering mirror design and dynamic controls for a dual-actuation platform using high-strain actuators, *Proc. AIAA*, (21 pages).
7. Woody S.C. and **Smith S.T**., 2006, Damping of a thin-walled honeycomb structure using energy absorbing foam, *J. Sound and Vibration*, **291**, 491-502.

Selected books

1. Smith S.T. and Chetwynd D.G., 1992, *Foundations of Ultraprecision Mechanism Design*, Gordon and Breach, London, 348 pages, ISBN 2-88124-840-3, 7th printing.
2. Smith S.T., 2000, *Flexures: Elements of Elastic Mechanisms*, Gordon and Breach, London, 426 pages, ISBN 90-5699-261-9, 2nd printing.

Synergistic activities

Dr. Smith has taught 12 university courses at all levels from neophyte to advanced graduate and has worked extensively with industry. In addition to his work as professor of mechanical engineering he is also President and co-founder of Albany Instruments Inc., a Charlotte based firm specializing in eddy current testing and fine motion control products. One patent directly resulting from research work has been licenced and marketed (the Rank Taylor Hobson 'Nanostep') and numerous other developments have been brought to the marketplace. Dr. Smith also delivers a industry tutorials every year at the annual meeting of the American Society of Precision Engineers and on location at individual companies. Dr. Smith was also the recipient of an Engineering Secondment Overseas for the period Oct. '92 to Oct. '93 to the University of North Carolina at Charlotte sponsored by the Royal Academy of Engineering (UK)

Collaborators and other affiliations

Collaborators

Vivek Badami, Tropel-Corning Corp., NY, Teodor Dogaru, UNCC, Robert Hocken, UNCC, Thomas Lebrun, NIST, Dave Schindel, University of Toronto, Ontario, Gurpreet Singh, Micromagnetics Corp., RI, Carl Smith, NVE, MN, Shane Woody, UNCC.

Graduate and postdoctoral advisors

Dr. Smith's graduate advisor's were Keith Bowen and Derek Chetwynd of the University of Warwick, UK.

Thesis advisor and post-graduate scholar sponsor

Dr. Stuart Smith has advised a total of 9 Ph.D students (2 not yet graduated) and numerous masters degree students.

Lecture courses given

1st Year level Concepts - Dealing with underlying modeling concepts in engineering including: Laws, linearity and assumptions; Measurements and errors; Fields concepts, potential, flux, flow, and general transport properties; Waves, reflection, interference (diffraction); Mechanics, resolution of forces, equilibrium, conservation of energy and least action principles; Thermodynamics as an engineering tool. This course is taught through demonstration and interactive discussion and continues through two semesters.

2nd Year level Mechanics - Resolving forces, energy methods, system response and vibration analysis, Rayleigh's method.
Introductory 12 lecture course

2nd Year level Product and Process Control - Statistics, control.
Introduction to statistical distributions, underlying principles of controller action (i.e PID) and mapping in frequency domains for assessment of stability. 12 lectures

2nd year Instrumentation and Reliability

3rd Year level Machines Technology - Principle of virtual work, Lagrange's equation, engine balance, response of second order systems, vibration isolation and absorbers, Rayleigh's method, matrix methods for multi-degree of freedom systems, complex eigenvalues and eigenvectors, continuous systems, whirling, half speed whirl, spectral analysis.
Analytic dynamics, 30 hours of lectures.

MSc. Precision mechanisms design. 12 lectures- Based almost exclusively on the book coauthored with D.G. Chetwynd.

MSc Advanced dynamics 12 lectures- This provides a general outline of rigid body dynamics and use of software packages for eigenvector and eigenvalue analysis as well as the continuous simulation language ACSL. Dynamical techniques include the principle of virtual work, Lagrange's equation, the method of Lagrange undetermined multipliers for nonholonomic systems and the Gibbs-Appell equation.

Advanced topics in dynamics. Graduate level looking at frequency response techniques, matrix analysis, Fourier transforms, rigid body dynamics.

Dynamic system analysis. Sophomore level lumped, linear systems analysis

Machine design and analysis I & II. A two semester course on machine design along the lines of J. E. Shigley.

Vibrations. Various courses taught at undergraduate, graduate and advanced levels.

Measurement and instrumentation. (2nd year) Undergraduate single semester course with concurrent laboratory comprising 9 exercizes.

Research awards (selected)

S.T. Smith, NDI of diffusion bonded joints, $30,000, Non-Volatile Electronics, MN, 2000.

S.T. Smith, Optimal design of a multi-degree of freedom flexure, NIST contract, $20,360, 2000 - 2001.

S.T. Smith, Characterization of eddy current probes, NVE contract, $25, 000, 2001.

S.T. Smith, Multi-degree of freedom fine motion stages, NIST, $81,623, 9-01 – 4-03

S.T. Smith, NIRT; NSF DMI #2975020172 $771,000, Aug. 2002 – 2005.

Society membership

Institute of Physics (UK) (member no. 562880)
American Institute of Physics (member no. 95011972)
American Society for Precision Engineering (member no. 10781)
American Society for Engineering Education (member no. 43761)

Curriculum vitae

Inna Sokolova

PERSONAL DATA

Last name	Sokolova
First name	Inna
Present position	Assistant Professor
Present affiliation	University of North Carolina at Charlotte
Present institutional address	Biology Dept., University of North Carolina at Charlotte 9201 University City Blvd. Charlotte NC 28223 USA Phone (704) 687 4060 FAX (704) 687 3128 E-mail: isokolov@email.uncc.edu or insokolo@uncc.edu
Present home address	10664 Hill Point Ct. Charlotte NC 28262 (704) 688 0442
Areas of scientific interests	Ecological and evolutionary physiology, metabolic physiology, ecological toxicology, marine biology

EDUCATIONAL BACKGROUND

Year	Degree	Major and main research topics	Name and place of the degree-granting Institution
1991	B.S. with Honors	Major: Biology-Parasitology Thesis: "Characteristics of reproduction and recruitment of populations of the White Sea mollusc *Littorina saxatilis* (Olivi)"	St. Petersburg (Leningrad) State University, St. Petersburg, Russia
1997	Ph.D.	Major: Zoology Dissertation: "Populational aspects of adaptation of the intertidal gastropods *Littorina saxatilis* to low salinity"	Zoological Institute of Russian Academy of Sciences, St. Petersburg, Russia
1999 – 2001	Post-doctoral fellow	Research area: Physiology and Biochemistry Main topic: Physiological mechanisms of tolerance to temperature and hypoxia in marine molluscs	Alfred-Wegener-Institute for Polar and Marine Research, Bremerhaven, Germany and Alexander von Humboldt Foundation, Germany
2001 – 2002	Post-doctoral fellow	Research area: Physiology and Molecular Genetics Main topic: Physiological and genetic differentiation in populations of marine molluscs	Dept. of Zoology, University of Guelph, Guelph, Canada

AWARDS/HONORS

2004	Award of the Ecological Society of America for outstanding achievements in mentoring students for the SEEDS Undergraduate Research Fellowship and the outstanding efforts to diversify the field of ecology.
2000	Award of the Academician V.E.Sokolov Foundation (Russian Academy of Sciences) for outstanding young researchers in the field of ecology
1999-2001	Alexander von Humboldt International Research Fellowship (Germany)
1998	Award of the European Marine Biology Society (EMBS) for the 3rd best presentation at the EMBS annual meeting
1996	Post-graduate Student Award from the International Science Foundation (Educational Program)
1995	Post-graduate Student Award from the International Science Foundation (Educational Program)
1995	International Award of the Otto Kinne Foundation (Germany) for outstanding young ecologists
1995	Promising Young Scientist Award of the General Biology Division of Russian Academy of Sciences
1991	A.V.Dogel Undergraduate Student Award of the Leningrad (St. Petersburg) Society of Naturalists (Russia) for excellence in research and studies

PROFESSIONAL EXPERIENCE

Time	Position	Name and place of the Institution
1991 – 1993	Research trainee	White Sea Biological Station, Zoological Institute of Russian Academy of Sciences, St. Petersburg, Russia
1993	Research assistant	As above
1993 – 1996	Ph.D. student	As above
1996 – 1997	Junior research faculty	As above
1997 – 2001	Research faculty	As above
1999 –2001	Post-doctoral fellow	Alfred-Wegener-Institute for Polar and Marine Research, Bremerhaven, Germany
2001 – 2002	Senior post-doctoral fellow	Dept. of Zoology, University of Guelph, Guelph, Canada
2002 - present	Assistant Professor	Biology Dept., University of North Carolina at Charlotte, USA

TEACHING EXPERIENCE

Assistant Professor – University of North Carolina at Charlotte – 2002-present

- Primary courses taught
  1. BIOL3144 Ecology
  2. BIOL4000/5000 Ecotoxicology (new course)
  3. BIOL6000/8000 Ecotoxicology (new course)
  4. BIOL4600 Senior Seminar
- Other courses taught or guest lectured:
  1. BIOL2111L Cell Biology Laboratory
  2. BIOL 1000 Strategies for Success in Biology
  3. Ph.D. Colloquium

SERVICE COMMITTEES AND SYNERGISTIC ACTIVITIES

Professional Service

- Proposal reviewer for SEEDS (Strategies for Ecology Education, Development and Sustainability) program of the Ecological Society of America, 2004.
- Serve on the Reviewer Board for *Marine Ecology Progress Series*, 2003-2006.
- Panelist for "Frontiers in Disease Research" panel of National Sea Grant/NOAA Workshop "Oyster Research & Restoration in U.S. Coastal Waters: Developing Strategies for the Future", 2003.
- Grant reviewer for NSF/NIH EPSCoR (Experimental Program to Stimulate Competitive Research) Program and NSF Developmental and Evolutionary Biology Cluster, 2002-2004.
- Reviewer for *Marine Ecology Progress Series, Marine Biology, Comparative Biochemistry and Physiology, Biological Journal of the Linnean Society, Freshwater and Marine Research, Journal of Experimental Marine Biology and Ecology* and *Polar Biology*, 1999 – present.
- Member of the Organizing Committee for the 31st European Marine Biology Symposium, St. Petersburg, Russia, 1995.

FUNDING HISTORY

Active

Funding Agency: NSF
Title: "CAREER: Physiological and cellular mechanisms of action of temperature and trace metals on mitochondrial bioenergetics in marine mollusks"
Total Direct Cost: $545,349
Role: Principal Investigator (50% effort)
Project dates: 07/01/03-06/30/08

Funding Agency: North Carolina Sea Grant
Title: Preliminary identification of genetic markers of high resistance to *Perkinsus marinus* and *Vibrio vulnificus* in the Eastern oysters *Crassostrea virginica*
Total Direct Costs: $5,000
Role: Principal Investigator (15% effort)
Project dates: 03/01/03-07/01/04

Funding Agency: NIH
Title: R01 Genetic factors responsible for exercise endurance
Total Direct Cost: $1,250,000
Role: Co-PI (10% effort) (Dr. T. Lightfoot, Kinesiology, PI)
Project dates: 07/01/05-06/30/10

Funding Agency: Ecological Society of America
Title: Strategies for Ecology Education, Development and Sustainability, Charlotte Chapter (educational grant)
Total Direct Cost: $30,000
Role: Co-PI (50% effort) (Dr. J. Fail, Johnson C. Smith University, PI)
Project dates: 08/01/05-07/31/07

PUBLICATIONS (SELECTED)

1. Granovitch A.I., **Sokolova I.M.** (2001). *Littorina arcana* Hannaford Ellis, 1978 – a new record from the eastern Barents Sea. Sarsia 86: 241 – 243.
2. Sokolov, E.P., **Sokolova, I.M.,** Pörtner H.O. (2001). Composition and relative abundance of microsatellite repeats in genome of *Littorina saxatilis* (Olivi) (Gastropoda: Littorinidae). Journal of Molluscan Studies 67: 499 – 501.
3. **Sokolova, I.M.,** Pörtner, H.O. (2001). Adaptation to high shore life in *Littorina saxatilis* involves improved water conservation abilities and metabolic rate depression. Marine Ecology Progress ***Series*** 224: 171 - 186.
4. Sokolov, E.P., **Sokolova, I.M.,** Pörtner H.O. (2002). Polymorphic microsatellite DNA markers from the marine gastropod *Littorina saxatilis*. Molecular Ecology Notes 2: 27-29
5. **Sokolova, I.M.**, Pörtner, H.O. (2003). Metabolic plasticity and critical temperatures for aerobic scope in a eurythermal marine invertebrate (*Littorina saxatilis*, Gastropoda: Litorinidae) from different latitudes. Journal of Experimental Biology 206: 195-207
6. Sokolov, E.P., Pörtner H.O., Lucassen, M., **Sokolova, I.M.** (2003). Microscale adaptive differentiation is correlated with the restricted gene flow in White Sea snails *Littorina saxatilis* (Olivi). Journal of Molluscan Studies 69: 388-391.
7. **Sokolova I.M.,** Boulding E.G. (2004). A neutral DNA marker suggests that parallel physiological adaptations to open shore and salt marsh habitats have evolved more than once within two different species of gastropods. Marine Biology 145: 133-147
8. **Sokolova I.M.,** Boulding E.G. (2004). Length polymorphisms in an intron of aminopeptidase N provide a useful nuclear DNA marker for *Littorina* species (Caenogastropoda). Journal of Molluscan Studies 70: 165 - 172.
9. **Sokolova I.M.** (2004). Cadmium effects on mitochondrial function are enhanced by elevated temperatures in a marine poikilotherm, *Crassostrea virginica* Gmelin (Bivalvia: Ostreidae). Journal of Experimental Biology, 207: 2639-2648.
10. **Sokolova I.M.,** *Evans S.**, Hughes F.M. (2004). Cadmium-induced apoptosis in oyster hemocytes involves disturbance of cellular energy balance but no mitochondrial permeability transition. Journal of Experimental Biology, 207: 3369-3380.
11. **Sokolova I.M.,** Sokolov E.P. (2005). Evolution of mitochondrial uncoupling proteins: novel invertebrate UCP homologues suggest early evolutionary divergence of the UCP family. FEBS Letters 579: 313 – 317.
12. **Sokolova I.M.,** Sokolov E.P., *Ponnappa K.M.** (2005).Cadmium exposure affects mitochondrial bioenergetics and gene expression of key mitochondrial proteins in the eastern oyster *Crassostrea virginica* Gmelin (Bivalvia: Ostreidae). Aquatic Toxicology 73: 242- 255.
13. Sokolova I.M., Leamy L., *Harrison M.**, Oliver J.D. (2005). Intrapopulational variation in Vibrio vulnificus levels in *Crassostrea virginica* (Gmelin 1971) is associated with the host size but not with disease status or developmental stability. Journal of Shellfish Research 24: 503-508.
14. Sokolova I.M., Sokolov E.P., *Ponnappa K.M.** (2005).Cadmium exposure affects mitochondrial bioenergetics and gene expression of key mitochondrial proteins in the eastern oyster *Crassostrea virginica* Gmelin (Bivalvia: Ostreidae). Aquatic Toxicology 73: 242- 255.
15. *Cherkasov A.S.*, Biswas P.K., Ridings D.M., Ringwood A.H., Sokolova I.M. 2006. Effects of acclimation temperature and cadmium exposure on cellular energy budgets in a marine mollusk *Crassostrea virginica*: Linking cellular and mitochondrial responses. Journal of Experimental Biology 209:1274-1284.

BIOGRAPHICAL SKETCH

Name: Edward B. Stokes Phone: (704) 687-8425 E-mail: ebstokes@uncc.edu

PROFESSIONAL PREPARATION

University of NC Charlotte	Engineering Science	B.S.E.	1981
University of NC Charlotte	Physics	B.S.E.	1981
University of NC Charlotte	Engineering Science	M.S.E.	1984
Rensselaer Polytechnic Institute	Physics	Ph.D.	1996

APPOINTMENTS

Associate Professor: University of North Carolina at Charlotte, Department of Electrical and Computer Engineering, 9201 University City Blvd., Charlotte, NC (2002 to present)

Staff Scientist: General Electric Corporate Research and Development, Semiconductor Technology Laboratory, One Research Circle, Schenectady, NY 12309 (1986-2002)

PUBLICATIONS AND PATENTS MOST RELEVANT TO THIS PROPOSAL

J.G. Pagan, M.T. Ahrens, E.B. Stokes, B.A. Martin, and M.-A. Hasan, “Integration of CdSe quantum dots with GaN optoelectronic materials”, Phys. Stat. Sol. C 2, 2924 (2005).

E.B. Stokes, M-A Hasan, K. Sunderasan, and J.G. Pagan, U.S. Patent Application #20050051766, “Quantum dot optoelectronic devices with nanoscale epitaxial lateral overgrowth and methods of manufacture”, March 10, 2005.

P. Batoni, E.B. Stokes, S.F. LeBoeuf, N.V. Yang, J.G. Pagan, and R.A. Hudgins, “Enhanced UV emission by means of infrared optical pumping in UV light emitting diodes”, ECS Transactions, Vol. 1, No. 2, page 202 (2005).

X A Cao, E B Stokes, P M Sandvik, S F LeBoeuf, J Kretchmer, D M Walker, “Diffusion and tunneling currents in GaN/InGaN multiple quantum well light emitting diodes”, IEEE Electron Device Letters, 23, 535 (2002).

E B Stokes, D M Walker, S F LeBoeuf, X-A Cao, US Patent # 6,841,406: “Methods and apparatus for a semiconductor device”, 11 January 2005.

OTHER PUBLICATIONS AND PATENTS

E B Stokes, T F McNulty, D D Doxsee, A M Srivastava, L M Levinson, A R Duggal, US Patent # 6,791,259: “Solid state illumination system containing a light emitting diode, a light scattering material, and a luminescent material”, 14 September 2004.

E B Stokes, R F Karlicek Jr, US Patent # 6,670,820: “Method and apparatus for evaluating electroluminescence properties of semiconductor materials and devices”, 30 December 2003.

A Ebong, S Arthur, E Downey, EB Stokes, X A Cao, S F LeBoeuf, P M Sandvik, D M Walker, “Modeling and circuit simulation of GaN-based light emitting diodes for optimum efficiency through uniform current spreading”, Proc. SPIE, 4776 (2002).

X A Cao, E B Stokes, P M Sandvik, N Taskar, J Kretchmer, D M Walker, “Optimization of current spreading metal layer form GaN/InGaN-based light emitting diodes”, Solid State Electronics, 46, 1235 (2002).

E B Stokes, P D Persans, “Size dependence of superlinear photoluminescence of CdSSe nanocrystallites in glass”, Proc. ECS, PV97-11, 319 (1997).

SYNERGISTIC ACTIVITIES

DARPA phase II SBIR subcontract (from Dot Metrics Technologies): "Nanostructured active layers for deep-green light emitting diodes (LEDs)"

DARPA coorperative research program on ultraviolet LEDs with Army Research Lab and UNC Charlotte Optoelectronics Center

Member of Interdisciplinary Optics Faculty at UNC Charlotte, affiliated with UNC Charlotte Center for Optoelectronics and Optical Communications

Regular contributor, organizer, and editor for Electrochemical Society; Regular editor for Applied Physics Letters, Journal of Applied Physics, and Materials Research Society

Active promotion of diversity in university research; the Stokes group of 5 graduate and 10 undergraduate students includes one minority and four females

COLLABORATORS

Michael Ahrens, *UNC Charlotte*; Stephen Arthur, *GE Research Lab, Schenectady, NY*; Albert Baca, *Sandia National Laboratory, Albuquerque, NM*; Paolo Batoni, *UNC at Charlotte*; Noel Buckley, *University of Limerick, Ireland*; Xian-An Cao, *GE Research Lab, Schenectady, NY*; Pablo Chang, *Agilent Technologies, Santa Clara, CA*; Peter Codella, *GE Research Lab, Schenectady, NY*; Evan Downey, *General Electric Research Lab, Schenectady, NY*; Daniel Doxsee, *GELcore LLC, Independence, OH*; Abasifreke Ebong, *General Electric Research Lab*, *Schenectady, NY*; Robert Fitch, *Wright Patterson Air Force Base, Dayton, OH*; Jung Han, *Yale University, New Haven, CT*; Mohamed-Ali Hasan, *UNC Charlotte*; Hongxing Jiang, *Kansas State University, Manhattan KS;* Alain Kaloyeros*, State University of New York, Albany, NY*; Yasuo Koide, *Kyoto University, Kyoto, Japan*; Rose Kopf, *Lucent Technologies, Murray Hill, NJ*; James Kretchmer, *General Electric Research Lab, Schenectady, NY*; Steven LeBoeuf, *General Electric Research Lab, Schenectady, NY*; Jingyu Lin, *Kansas State University, Manhattan, KS*; Biemann Martin, *UNC Charlotte*; Thomas McNulty, *General Electric Research Lab, Schenectady, NY*; Danielle Merfeld, *GE Research Lab, Schenectady, NY*; Ted Moustakas, *Boston University, Boston MA*; Jennifer Pagan, *UNC Charlotte*; Steven Pearton, *University of Florida, Gainesville, FL*; Scott Prahl, *Oregon Graduate Institute, Portland, OR;* Fan Ren, *University of Florida, Gainesville, FL*; R. Ekwal Sah, *Fraunhofer Institute for Applied Solid State Physics, Freiburg, Germany*; Peter Sandvik, *General Electric Research Lab, Schenectady, NY*; Fatemeh Shahedipour-Sandvik, *State University of New York, Albany, NY*; Paul Shen, *Army Research Laboratory, Adelphi, MD*; Alok Srivastava, *General Electric Research Lab, Schenectady, NY*; Nikhil Taskar, *Nanocrystals Technology, Briarcliff Manor, NY*; Julie Teetsov, *GE Research Lab, Schenectady, NY*; Michael Wraback, *Army Research Laboratory, Adelphi, MD*

GRADUATE AND POST DOCTORAL ADVISORS

Ganesh P. Mohanty, graduate advisor (MSE), UNC Charlotte

Peter D Persans, graduate advisor (PhD), Rensselaer Polytechnic Institute

THESIS ADVISOR AND POSTGRADUATE-SCHOLAR SPONSOR

Total number of graduate research students: 8 (in progress): Michael Ahrens (MS completed Spring 2005), Paolo Batoni, Casey Burkhart, Vikram Iyengar, Kinnari Patel, Jennifer Pagan (PhD expected fall 2005), Vang Yang, Ayman Zohbi; University of North Carolina at Charlotte.

Total number of undergraduate research students: 2 (in progress)

Thomas J. Suleski

Department of Physics and Optical Science
University of North Carolina at Charlotte
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Charlotte, NC 28223-0001
Phone: (704) 687-2040
Fax: (704) 687-3160
E-mail: tsuleski@uncc.edu

Research Interests and Expertise

- Diffractive optics and refractive micro-optics
- Fabrication, integration, and characterization methods for micro/nano-optics and microsystems.
- Design and synthesis of light fields in one, two, and three dimensions as a basis for interferometric fabrication of micro- and nano-structures
- Nanoreplication and nanomanufacturing
- Applications of micro-and nano-structures in multiple areas, including optical sensors, imaging systems, and biophotonics.

Education

- Ph.D., Physics; Georgia Institute of Technology, Atlanta, Georgia. "*The Talbot effect: Fresnel diffraction of amplitude and phase gratings*." Research advisor: Dr. Donald O'Shea. (1996)
- M.S., Physics; Georgia Institute of Technology, Atlanta, Georgia (1993)
- B.S., Physics; University of Toledo, Toledo, Ohio. Graduated *Magna Cum Laude* with College Honors and Honors in Physics. Thesis: *Raman studies of wet-spun films of Na-hyaluronate*, Advisor: Dr. Scott Lee. (1991)

Professional Experience

Department of Physics & Optical Science, University of North Carolina at Charlotte

- Assistant Professor (2003 – present)
- Adjunct Assistant Professor (1999-2003)

Digital Optics Corporation, Charlotte, NC

- Manager, New Technology (2001 – 2003)
- Senior Research Engineer/ New Technology Group Leader (1997 – 2001)
- Applications Engineer (1996 – 1997)

Selected Honors and Awards

- 1995-96 CETL/AMOCO Graduate Teaching Assistant Award, Georgia Inst. of Technology
- 1995-96 Outstanding Graduate Teaching Assistant Award, School of Physics, Georgia Tech
- President's Graduate Fellowship, Georgia Institute of Technology, 1991-1995.
- 1991 Outstanding Undergraduate Research Award, Dept. of Physics, University of Toledo

- Ohio Board of Regents Academic Scholarship
- National Merit Finalist

TEACHING AND STUDENT ADVISING

Courses Taught at UNC Charlotte

- PHYS 3141: *Introduction to Modern Physics* (Fall 2003 and 2004, Spring 2004 and 2005)
- PHYS 4271: *Waves and Optics* (Fall 2004 and 2005)
- OPTI 6102/8102: *Principles of Geometrical and Physical Optics* (Fall 2004 and 2005)

Current Graduate Advising

- Thesis Advising (Optical Science and Engineering)
    - Yi-Chen Chuang, (2004 – present) (Ph.D)
    - David J. Spivey (2004 – present) (Ph.D)
    - Brent Bergner (2004 – present) (Ph.D)

Additional Teaching Experience

- Extensively involved in development and teaching of a 3 1/2 day short course on diffractive optic design, fabrication, and testing presented 7 times from 1993 – 1998 at Georgia Tech to over 100 participants from academia and industry. Aided in the creation of lab modules on microfabrication, and taught all hands-on modules on photolithography and etching.
- Short Course Instruction, “Process Technologies for Micro-optics Manufacturing”, for SPIE. Taught 4 times to date, (Photonics West 2002-2004, SPIE Annual 2003).
- While at Digital Optics, I created a 12 hour internal training series on micro-optical technologies for all employees. Personally taught multiple sessions on micro-optical design, fabrication, test, and applications. "Micro-Optics 101"
- As a graduate student at Georgia Tech, I taught algebra-based, sophomore-level physics; Mechanics (5 quarters) and Electricity & Magnetism (4 quarters), with complete responsibility for course planning and execution. Ten quarters of general Graduate Teaching Assistant experience (recitation and labs). I received the 1995-96 Outstanding Graduate Teaching Assistant Award (School of Physics) and the 1995-96 CETL/AMOCO Graduate Teaching Assistant Award (for Georgia Tech as a whole).

SPONSORED RESEARCH ACTIVITIES

Sponsored Research Funding (selected)

- Supervising PI (with Dr. Robert Hocken), NSF/UCLA SINAM Graduate Young Investigator Program, “Compact Scatterometer for Integrated Process Control on the Ultra-Molding Imprint Lithography (UMIL) System," $30,000, award period July 2005 through June 2006.
- Supervising PI, Charlotte Research Institute, Duke Energy Fellowship Program, “Compact Scatterometer for Integrated Process Control," $40,000, award period May 2005 - May 2007.
- Co-PI, DARPA/Duke University, “Compressive Optical MONTAGE Photography Initiative (COMP-I),” UNC Charlotte funding $392,500, award period July 1, 2004 through June 30, 2007.
- PI, Charlotte Research Institute, Wachovia Faculty Fellowship, "Replication of optical devices and microsystems with integrated functionality," $1,000, awarded June 2004.

- PI, Spiricon Inc., Academic Equipment Grant, "Near-field characterization of diffractive phase elements," $2,000, awarded May 2004.
- Co-PI, NSF, "GOALI: A Symmetry-Based Group Theory Approach to Data Reduction for Micro-Optics Manufacturing," $236,249; award period September 2003 through August 2006.

PROFESSIONAL SERVICE ACTIVITIES

Professional Society Leadership Positions

- Group Chair for Holography and Diffractive Optics, Optical Society of America, Science and Engineering Council (2004 – present). Served as Vice-Chair, October 2003-October 2004.
- President, Optical Society of America, Charlotte Chapter, (2001-2002)
- President Pro-tem, Optical Society of America, Charlotte Chapter, (2000-2001)

Service to Professional Journals

- Senior Editor (Microfabrication), SPIE *Journal of Microlithography, Microfabrication and Microsystem*s. (2004 – Present). Served as Associate Editor (2001-2004).
- Guest Editor of Special Topical Issue on "Micro-optics for Photonic Networks," SPIE *Journal of Microlithography, Microfabrication and Microsystem*s, published in October 2003.
- Served on SPIE subcommittee evaluating needs and providing recommendations on creation of a new journal on micro-fabrication and micro-systems (2000). First issue of new journal (*Journal of Microlithography, Microfabrication and Microsystems*) published April 2002.
- Reviewer for multiple archival journals, including *Applied Optics, Optics Letters, J. Opt. Society of America A, Optics Communications, Optical Engineering, Journal of Microlithography, Microfabrication, and Microsystems, Optics Express,* and *Journal of Lightwave Technology.*

PUBLICATIONS

Refereed Archival Journals (selected)

1. T.J. Suleski and R.D. Te Kolste, "Fabrication trends for free-space micro-optics", J. Lightwave Tech., **23**(2), 633-646 (2005). (Invited Tutorial)
2. T.J. Suleski. "Micro-optics for photonic networks," J. Microlith. Microfab. and Microsystems. **2**(4) 292 (2003).
3. I. Reineck, J. DeAnna, T.J. Suleski, S.A. Lee, and A. Rupprecht, "A Raman Study of the Hydration of Wet-Spun Films of Li-hyaluronate," J. of Biomolecular Structure & Dynamics, **21**(1), 153-157 (2003).
4. E.G. Johnson, J. Stack, T.J. Suleski, C. Koehler, and W. Delaney, "Fabrication of micro optics on coreless fiber segments," Appl. Opt. **42**, 785-791 **(**2003).
5. T. J. Suleski, B. Baggett, W. F. Delaney, C. Koehler, and E. G. Johnson, "Fabrication of high-spatial-frequency gratings through computer-generated near-field holography," Opt. Lett. **24**, 602-604 (1999).
6. T.J. Suleski, "Generation of Lohmann images from binary phase Talbot array illuminators," Appl. Opt. **36**, 4686-4691 (1997).
7. K. Tatah, A. Fukumoto, T.J. Suleski, and D.C. O'Shea, "Photoablation and lens damage from fractional Talbot images of Dammann gratings," Appl. Opt. **36**, 3577-3580 (1997).
8. T.J. Suleski and D. C. O'Shea, "Gray-scale masks for diffractive-optics fabrication: I. Commercial slide imagers," Appl. Opt. **34**, 7507-7517 (1995).
9. T.J. Suleski and D. C. O'Shea, "Fidelity of PostScript generated masks for diffractive optics fabrication," Appl. Opt. **34,** 627-635 (1995).

Books, Book Chapters, and Edited Volumes (selected)

10. *Micromachining Technology for Micro-Optics and Nano-Optics IV,* with E.G. Johnson and G.P. Nordin, Proceedings of SPIE (Bellingham, WA), Vol. 6110 (2006).
11. *Micromachining Technology for Micro-Optics and Nano-Optics III,* with E.G. Johnson and G.P. Nordin, Proceedings of SPIE (Bellingham, WA), Vol. 5720 (2005).
12. *Diffractive Optics: Design, Fabrication, and Test,* with D.C. O'Shea, A.D. Kathman, and D. Prather, (SPIE Press, Bellingham, WA), (2003).
13. "Diffractive Optics Fabrication," in *Encyclopedia of Optical Engineering,* R.G. Driggers, Ed., (Marcel Dekker, New York), pp. 374-387 (2003).

PATENTS AND PATENTS PENDING

U.S. Patents 9 US patents issued, 1 US patents currently pending. Author of >30 invention disclosures.

1. 6,952,507, *Multi-mode fiber coupler, system and associated methods,* E.G. Johnson, M.R. Feldman, and T.J. Suleski (2005).
2. 6,869,754, *Transfer of optical element patterns on a same side of a substrate already having a feature thereon,* T.J. Suleski, R.R. Boye, W.F. Delaney, H. Miller, Harris, J. Morris, H. Han, and J. Mathews (2005)
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4. 6,683,295, *Reduced noise wavelength locker module*, A. Cruz-Cabrera, T.J. Suleski, and J. B. Hammond (2004).
5. 6,638,667, *Fabricating optical elements using a photoresist formed using a gray level mask,* T.J. Suleski, W.F. Delaney, and M.R. Feldman (2003).
6. 6,530,697, *Multi-mode fiber coupler, system and associated methods,* E.G. Johnson, M.R. Feldman, and T.J. Suleski (2003).
7. 6,420,073, *Fabricating optical elements using a photoresist formed from proximity printing of a gray level mask,* T.J. Suleski, W.F. Delaney, and M.R. Feldman (2002).
8. 6,071,652, *Fabricating optical elements using a photoresist formed from contact printing of a gray level mask,* M.R. Feldman, T.J. Suleski, and W.F. Delaney, and (2000).
9. 6,027,595, *Method of making optical replicas by stamping in photoresist and replicas formed thereby*, T.J. Suleski, B. Baggett, and B. Harden (2000).

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1. Provisional patent application, *Novel methods and applications of 1D, 2D, and 3D nanofabrication*, T.J. Suleski (2005)
2. 20050094276, *Transfer of optical element patterns on a same side of a substrate already having a feature thereon,* T.J. Suleski, R.R. Boye, W.F. Delaney, H. Miller, Harris, J. Morris, H. Han, and J. Mathews (2005)

RAPHAEL TSU – DISTINGUISHED PROF. UNC-Charlotte, BS-Dayton, M S. & Ph. D - Ohio State U

Experience: Dr. Ray Tsu started his career at the Bell Telephone Laboratories, Murray Hill, NJ, working on the theory and experiments related to electron-phonon interaction in piezoelectric solids. He later joined IBM T.J. Watson Research Center working on theory and experiments of optical- and transport-properties, band structures in solids, and material characterization. He became a close collaborator of Leo Esaki and in 1969, jointly conceived the man-made semiconductor superlattice and modulation doping (doping in the energy barrier with carriers in the energy wells). This initial concept and proposal led to a rapid development of man-made quantum materials and quantum devices. His formulation of tunneling through multiple man-made heterojunctions set the stage in nearly all aspects of resonant tunneling devices reaching Tera-Hertz operation today. The theory and experiments of man-made superlattices and resonant tunneling through a quantum well led to his outstanding contribution award from IBM Research in 1975 and later in 1985, to sharing the International New Materials Prize of the American Physical Society with Esaki and Chang. In 1979, he became the head of Materials Research at Energy Conversion Devices, Inc. (ECD), in charge of the study on the formation and structure of amorphous silicon. His major contributions involve the determination of bond-angle distribution from Raman scattering and optical absorption measurements and experimental determination of conductivity percolation. In 1985, he became the head of the Photovoltaic Group at the Solar Energy Research Institute (now NREL) as a principal scientist, working on amorphous Si/Ge and Si/C alloys, showing that the famous Tauc's plot may be theoretically derived without adjustable parameters. In 1975, as the recipient of the Alexander von Humboldt award, he took a year sabbatical at Max Planck Institute for Solid State Physics in Stuttgart, Germany. In 1977, he took a year of sabbatical as a Professor Titular at the Physics Institute, Campinas, Brazil. While at ECD, he took a sabbatical at the University of Sao Paulo at Sao Carlos, Brazil, where he refocused his attention back to Man-made quantum structures because the realization that the field he devoted has taken a new turn into nanostructures and nanoelectronics. Since 1988, he became professor, and in 1996, the Distinguished Professor of the ECE Department at UNC-Charlotte, directing research in quantum confinement and nanoscale structures and devices in optoelectronic, and field emission of electron via resonant tunneling. Among the issues he devoted his attention; include the physics of dielectric function and capacitance of quantum dots. Recently, he introduced a new type of superlattices, the epitaxially grown Si/O superlattices (Si with monolayers of oxygen), and the Si/molecular superlattices. While writing a book, Superlattice and Nanoelectronics, published by Elsevier 2005, he recognized that the so-called quantum conductance should be treated as a wave impedance for electrons similar to the wave impedance of electromagnetic waves. Recognizing that before the device structures reach the quantum regime requiring the dealing with the phase of the electron wave functions, the discreteness of the electronic charge would create new features in devices even without quantum mechanics. This new regime should be dictated by device size which is already within the current research efforts. Therefore the effects of the discreteness of the electronic charge in electronics occupy his current attention.

Honors: Outstanding Contribution Award -IBM 1975; Alexander von Humboldt Award – 1975; Fellow of Am. Phys. Soc. - 1980; Am. Phys. Soc. International New Materials Prize – 1985.

US-China exchange: In 1972, he organized a group and invited by the Chinese Science Academy resulted in a first report on the technology in China published in Scientific American, contributing to the subsequent visit by the first Chinese Scientific Delegation to the US, invited by the US-China Relations Committee of the US Academy of Science. During the visit by the first Chinese Scientific Delegation to USA in November 1972, he worked with the US State Department for the program and logistics on the East Coast. This effort contributed to the opening of scientific exchanges between United States and China.

Books :

(1) *Superlattice to Nanoelectronics,* R. Tsu, (Elsevier, 2006, ISBN 0 08 044377 X)

Chapter 1 The birth of the man-made superlattice**,** origins of NDC and the Type-II superlattices. **Chapter 2** Conductance from Tsu – Esaki formula**,** tunneling time, Green's function for a damped quantum well, and instability in RTD. **Chapter 3** Phonons and polariton modes, Raman scattering and experimental confirmation of zone-folding in a superlattice. **Chapter 4** Longitudinal and transverse dielectric constants in quantum wells and superlattices. Doping a superlattice. **Chapter 5** Optical properties and Density of states of quantum steps. Electroreflectance from a quantum step. Activation energy in quantum wells. **Chapter 6** Silicon-based quantum wells**:** Silicon–oxygen superlattice, Amorphous Silicon/Oxide Superlattice**.** Band-edge alignment using atomic states and with HOMO–LUMO. Strain from a Ball and Stick model. Charge transfer on Strain-layer epitaxy. **Chapter 7** Energy states and Resonant tunneling in silicon quantum dots**.** Slow oscillations and hysteresis**. Chapter 8** Quantum mechanical and classical calculations of the dielectric constant, doping, and capacitance of a silicon quantum dot. **Chapter 9** Light emission and applications of Porous silicon**. Chapter 10** Cold cathodes with resonant tunneling. Low power saturation of PbS quantum dots, Heterojunction Multipole-electrode Hybrid Structures. Some fundamental Issues of nanoelectronics and comments on quantum computing. **Chapter 11** Landauer's conductance formula. Quantum Wave Impedance of electrons – 1D to 3D. Open and closed systems. Issues in quantum systems. **Chapter 12** Nanoelectronics, where are you?

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56 *Reasons to Believe Pulsed Laser Annealing of Si Does Not Involve Simple Thermal Melting*, J. A. Van Vechten, R. Tsu, F. W. Saris and D. Hoonhout, Phys. Lett. **74A(6),** 417 (1979).

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129 *Doping of a Quantum Dot*, R. Tsu and D. Babic, Appl. Phys. Lett. **64**, 1806 (1994).

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158. *Ultra-stable Visible Electroluminescence from c-Si/O Superlattice*, Q.Zhang, A.Filios, C Lofgren and R. Tsu, Physica-E **8**, 365 (2000)

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Curriculum Vitae

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EDUCATION

Ph. D.	**Materials Science and Engineering, North Carolina State University (Advisor: Professor J. Narayan)**	**1998**
M.Erg.	**Northwestern Polytechnic University, PR China**	**1988**
B. S.	**Northwestern Polytechnic University, PR China**	**1984**

PROFESSIONAL EXPERIENCE

Assistant Professor	**Department of Mechanical Engineering University of North Carolina-Charlotte**	**July, 2005-**
Visiting Assistant Professor	**Center for Advanced Metallic and Ceramic Systems, The Johns Hopkins Univ.**	**Aug. 2005-**
Associate Research Scientist	**Center for Advanced Metallic and Ceramic Systems/Department of Mechanical Engineering, The Johns Hopkins University**	**2002-2005**
Visiting Scientist	**Center for Advanced Metallic and Ceramic Systems/Department of Mechanical Engineering, The Johns Hopkins University**	**2001-2002**
Research Scientist	**NSF-CAMSS, NC State Univ./NC A&T State Univ.**	**1999-2001**
Visiting Scientist	**Dept. Chemical Engineering and Materials Science, Columbia University (New York)**	**1993**
Research Fellow	**Dept. Physical Chemistry, University of Science and Technology Beijing**	**1991-1993**
Instructor	**Chengdu College of Aeronautic Technology**	**1984-1985**

PUBLICATIONS

Journal Papers (sorted according to areas)

Metals and Alloys (Nano-structured and Conventional)

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7. Q. Wei, K. T. Ramesh, E. Ma, L. J. Kesckes, R. Dowding, V.U. Kazykhanov and R. Z. Valiev, "Plastic localization in bulk tungsten with ultrafine microstructure", Appl. Phys. Lett. **86**, 101907 (2005).
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2. H. Wang, A. Sharma, A. Kvit, Q. Wei, J. Narayan, "Mechanical properties of nanocrystalline and epitaxial TiN films on (100) silicon", J. Mater. Res. **16** (9), 2733-2738 (2001)
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9. Q. Wei, R. J. Narayan, A. K. Sharma, J. Sankar and J. Narayan, "Preparation and mechanical properties of composite diamond-like carbon thin films", J. Vac. Sci. Technol. **A17** (6), 3406-3414 (1999).

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1. Q. Wei, J. Sankar and J. Narayan, "Microstructural changes due to heat-treatment of annealing and their effect on the creep behavior of self-reinforced silicon nitride ceramics", Mater. Sci. Eng. **A299**, 141-151 (2001).
2. Q. Wei, J. Sankar, A. K. Kelkar and J. Narayan, "Microstructure evolution accompanying high temperature uniaxial tensile creep of self-reinforced silicon nitride ceramics", Mater. Sci. Eng. **A272**, 380-388 (1999).
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3. Q. Wei, Zhigang Xu and J. Sankar, "Processing of yttria stabilized zirconia thin films by liquid fuel combustion chemical vapor deposition", Mater. Res. Soc. Symp. Proc., Vol. **672**, p O8.29.1-O8.29.6 (2001).
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7. Q. Wei, A. K. Sharma, S. Yarmolenko, J. Sankar and J. Narayan, "Electrical behavior of pure and copper doped diamondlike carbon prepared by pulsed laser deposition", Mater. Res. Soc. Symp. Proc., Vol. **593**, 377-382 (2000).
8. Q. Wei, S. Yarmolenko, J. Sankar, A. K. Sharma, Y. Yamagata and J. Narayan, "Microstructure and nano-mechanical properties of diamondlike carbon thin films prepared by pulsed laser deposition in various atmospheres", Mater. Res. Soc. Symp. Proc., Vol. **616**, 217-222 (2000).

9. Q. Wei, S. Yarmolenko, J. Sankar, A. K. Sharma and J. Narayan, "Preparation of superhard functionally graded tetrahedral amorphous carbon coatings by pulsed laser deposition", Mater. Res. Soc. Symp. Proc., Vol. **617**, J771-J776(2000).
10. Q. Wei, J. Sankar, J. Narayan and K. Liu, "Microstructure and creep behavior of self-sintered silicon nitride ceramics heat-treated by furnace and microwave annealing", 41st IAA/ASME/ASCE/AHS/ASC SDM Conf., paper number 2000-1603, April 2000, Atlanta, GA.
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12. Q. Wei, A. K. Sharma, R. J. Narayan, N. M. Ravindra, S. Oktyabrasky, J. Sankar, J. F. Muth, R. M. Kolbas and J. Narayan, "Microstructure and IR Range Optical Properties of Pure DLC and DLC Containing Dopants Prepared by Pulsed Laser Deposition", in Advances in Laser Ablation of Materials, eds. by R. Singh, et al., Mater. Res. Soc. Proc., Vol. **526**, PA, pp. 331-336 (1998).
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15. R. J. Narayan, Q. Wei, A. K. Sharma, K. Jagannadham and J. Narayan, "Pulsed Laser and Magnetron Sputtering Deposition of Diamondlike, Carbon Nitride, and Titanium Nitride Biocompatible Coatings", in Advances in Laser Ablation of Materials, eds. by R. Singh, et al., Mater. Res. Soc. Proc., Vol. **526**, PA, 355-360 (1998).
16. Q. Wei, J. Sankar, J. Narayan and A. Kelkar, "Transmission Electron Microscopy of the Microstructural Changes of a Sintered Si_3N_4 Associated with High Temperature Soaking in Air", Collection of Technical Papers (AIAA/ASME/ASCE/AHS/ASC-Structures, Structural Dynamics and Materials, Vol. **3**, 1998, AIAA, New York, NY, USA, pp. 1721-1729.
17. Q. Wei, J. Sankar, J. Narayan and A. Kelkar, "Morphology Changes Accompanying Creep of Sintered Si_3N_4 for hot turbine Engine Application", Collection of Technical Papers (AIAA/ASME/ASCE/AHS/ASC -Structures, Structural Dynamics and Materials, Vol. 2, 1997, AIAA, New York, NY, USA, pp. 983-991.

Presentations:

1. Q. Wei, B. E. Schuster, K. T. Ramesh, E. Ma, L. J. Laszlo, R. J. Dowding, K. Cho and R. Z. Valiev, "Dynamic flow localization in commercial purity tungsten with ultrafine grained and nanocrystalline microstructures", MRS 2005 Fall Meeting, Symp. AA6, Boston, MA, November 30, 2005.
2. B. E. Schuster, Q. Wei, K. T. Ramesh, "Micro-compression of nanocrystalline and bimodal metals", MRS 2005 Fall Meeting, Symp. AA7, Boston, MA, November 30, 2005.
3. Q. Wei, K. T. Ramesh, E. Ma* et al., "Plastic flow localization and shear banding in tungsten", 2005 TMS Spring Meeting, JCM Lee Symposium. (invited)
4. Q. Wei, T. Jiao, E. Ma and K. T. Ramesh, "Processing and Mechanical Properties of nano-structured vanadium under quasi-static and dynamic loading", ASME 2003 Winter Meeting, Nov. 2003, Washington DC.

5. Q. Wei, D. Jia, K. T. Ramesh and E. Ma, "Effect of grain size on the shear localization of iron", Blacksburg Conference of Applied Mechanics, 2002.
6. Q. Wei, K. T. Ramesh and E. Ma, "High strain rate response of ultrafine grained metals", ICM9, Geneva, 2003
7. Q. Wei, T. Jiao, K. T. Ramesh and E. Ma, "Processing and mechanical properties of nano-structured vanadium", MRS 2003 Fall Meeting, Boston.
8. Q. Wei, J. Sankar and J. Narayan, "Effect of heat-treatment on creep behavior of self-reinforced silicon nitride", American Ceramic Soc. Annual Conf., January 2000, Cocoa Beach, FA.
9. A. K. Sharma, Q. Wei, R. J. Narayan, S. Oktyabrsky and J. Narayan, "Diagnostics of the Laser Carbon Plasma in Different Environments During DLC Deposition", Intern. Conf. On Plasma Sci., June 1-4, 1998, Raleigh, NC, USA.
10. R. J. Narayan, Q. Wei, A. K. Sharma, K. Jagannandham and J. Narayan, "Superhard Biocompatible Coatings", in Hard Coating Based on Borides, Carbides and Nitrides: Synthesis, Characterization and Application, TMS, 1998, Warrendale, PA, USA, pp.301-308.
11. Q. Wei, J. Sankar, A. D. Kelkar and J. Narayan, "High Temperature Uniaxial Creep Behavior of a Sintered in situ Reinforced Silicon Nitride Ceramics", 23rd Cocoa Beach Annual Conf of the American Ceramic Society.
12. Q. Wei, A. K. Sharma, R. J. Narayan, S. Oktysbrsky and J. Narayan, "Synthesis of Carbon Onionlike Structures by HFCVD Reactor", presented in MRS 1998 Fall Meeting held in Boston, MA, 1998.
13. Q. Wei, J. Sankar, A. D. Kelkar and J. Narayan, "Microstructure Changes Associated with Tensile Creep of an in situ Self-reinforced Silicon Nitride", presented in MRS 1998 Fall Meeting, Boston.
14. R. J. Narayan, Q. Wei, A. K. Sharma and J. Narayan, "Functionally Gradient Diamondlike Coatings", Fifth International Conference on Composites Engineering, July 5-11, 1998, Las Vegas, Nevada, pp. 649-650.
15. A. K. Sharma, R. Kalyanraman, Q. Wei, R. J. Narayan, S. Oktyabrsky and J. Narayan, "Synthesis and Structural Characterization of Superhard DLC and CNx Films on Si(100) and Ti-6A1-4V Alloy", Fifth International Conference on Composites Engineering, July 5-11, 1998, Las Vegas, Nevada, pp. 809-810.
16. Q. Wei, R. Narayan, A. K. Sharma J. Sankar and J. Narayan, "Preparation and Characterization of Diamondlike Carbon/Metal Composite Films", Fifth International Conference on Composites Engineering, July 5-11, 1998, Las Vegas, Nevada, pp. 945-946.

Patent:

"Shear localization in nanostructured and/or ultrafine grained heavy metals and the method to make the same", US Patent pending.

PROPOSAL

Beyond Strength: The Mechanical Behavior of Nanostructured Metals (with K. T. Ramesh), National Science Foundation (NSF), Division of Civil and Mechanical Systems (CMS)-Solid Mechanics and Materials Engineering (SMME). $411,868. July 1, 2005-June 30, 2008. (declined)

TEACHING

Courses Taught:

1. Materials Engineering; Chengdu College of Aeronautic Technology (Undergraduate)
2. MEEN885 (Coatings and Tribology); NC A&T State University (Graduate)
3. MEGR 3161 (Introduction to Engineering Materials), Fall 2005

Supervision of Graduate Students:

Gang Li, UNC-Charlotte; Zhigang Xu (PhD, 2002), Donald Sweeper (MS), and Maurice Heath (MS), NC A&T State University

SYNERGISTIC ACTIVITIES

Proposal Reviewer: U.S. Civilian Research and Development Foundation (CRDF)

International Journal Reviewer:

- Thin Solid Films (Elsevier Science Publications)
- Surface and Coatings Technology (Elsevier Science Publications)
- Acta Materialia (Elsevier Science Publications)
- Metallurgical and Materials Transactions (TMS & ASM)
- Journal of Vacuum Science and Technology (Vacuum Society, American Institute of Physics)

International Conference Reviewer:

- Materials Research Society (MRS)
- International Conference on Metallic Coatings and Thin Films (ICMCTF).
- International Conferences for Composite Engineering (ICCE).
- Annual Conferences of American Ceramic Society.
- Annual Conference of American Vacuum Society.

Membership

- Alpha Sigma Mu
- Materials Research Society
- American Electron Microscopy Society
- International Institute of Electrical and Electronic Engineering (IEEE)
- The American Institute of Aeronautics and Astronautics (AIAA)

Consulting:

Thomas Bus Inc.

HONORS, AWARDS

1993	National Education Committee Prize for Advancements in Science and Technology (China)	Outstanding contribution in R&D of advanced steel design
1989	Second Place Prize awarded by The Metal Society of Shaanxi Province (China)	Microstructure and Properties of the HAZ of Low Carbon Bainitic Steels

COMMUNITY ACTIVITIES

1996-1997	Vice President	Chinese Scholars and Students Association, North Carolina State University
2000	Deacon	Chinese Christian Church of Greensboro, North Carolina
2001-2003	Deacon	Chinese Christian Church of Baltimore, Maryland

Robert G. Wilhelm

Executive Director, Charlotte Research Institute

Professor of Mechanical Engineering and Engineering Science

University of North Carolina at Charlotte

(704) 687-8284, rgwilhel@uncc.edu, www.charlotteresearchinstitute.org

Education

University of Illinois	1992	Ph.D.	Mechanical Engineering
Purdue University	1984	M.S.	Industrial Engineering
Leicester University	1981-82		History of Science & Technology
Wichita State University	1981	B.S.	Industrial Engineering
West Virginia University	1977-79		Civil Engineering

Professional Experience

OpSource, Founding partner in 2001 of a high-technology manufacturing company
University of North Carolina at Charlotte,1993-present.
Rockwell International Science Center, Palo Alto Laboratory, 1990-1992.
Cincinnati Milacron, 1984-1987.

Selected Publications

R.G. Wilhelm, “Geometric Tolerances for Three Dimensional Profiles”, Engineering Design and Automation, 2(4):231-242, 1996.
R. Edgeworth and R.G. Wilhelm, “Adaptive Sampling for Coordinate Metrology”, Precision Engineering, 23(3)144-154, 1999.
S. Bapat and R.G. Wilhelm, “A Complete and Efficient Algorithm That Identifies All Valid Planar Datums”, Transactions of NAMRI, SME, 28:335-340, 2000.
R.G. Wilhelm, R. Hocken, and H. Schwenke, “Task Specific Uncertainty in Coordinate Measurement”, Keynote Paper, Annals of CIRP, 50(2)553-563, 2001.
T. M. Kethara Pasupathy, R.G. Wilhelm, E.P. Morse, “A Survey of Mathematical Methods for the Construction of Tolerance Zones, ASME Transactions, Journal of Computing & Information Science in Engineering, 3(1): 64-75, 2003.
R. Edgeworth and R.G. Wilhelm, “Characterization Of Workpiece Form Uncertainty For Uniform Sampling Patterns”, Transactions of the North American Manufacturing Research Institute of SME, 33:501-507, 2005.
T. M. Kethara Pasupathy, X. Zhao, and R.G. Wilhelm, “Flexible Tools for Specifying Design Variation”, The International Journal of Advanced Manufacturing Technology, 28(7-8): 659-664, 2006.

Dissertations Directed

R. Sun, Sensitivity Analysis of Constraint-based Factory Scheduling, 1999
R. Edgeworth, Applications of Surface Normal Measurements to Coordinate Metrology, 2000
T.M. K. Pasupathy, Profile Tolerance Definitions for Function and Measurability, 2003
J. Liu, Tolerance Synthesis Techniques for CAD Systems, 2003
O. Martin, Information Models and Tasks for Integrated Metrology and CAD, 2003
X-P. Zhao, Software Frameworks for Integrated Measurement Processes, 2006

Terry T. Xu
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The University of North Carolina at Charlotte
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Charlotte, NC 28223-0001
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A. EDUCATION BACKGROUND

- Shanghai University, Materials Science and Engineering, B.Eng., 1995
- Hong Kong University of Science & Technology, Mechanical Engineering, M.Phil., 1998
- Northwestern University, Mechanical Engineering, Ph.D., 2004

B. RESEARCH EXPERIENCE

- Assistant Professor, Department of Mechanical Engineering & Engineering Science, The University of North Carolina at Charlotte, Aug. 2004 – current
  - Synthesis and characterization of one-dimensional (1D) nanomaterials, mechanical properties of 1D nanomaterials, nanocomposites fabrication and properties
- Research Assistant, Department of Mechanical Engineering, Northwestern University, Sept. 2000 - Aug. 2004
  - Synthesis and characterization of light-element nanomaterials
- Process Engineer, Research and Development, ASM Assembly Automation Ltd., June 1998 - Aug. 2000
  - Study of materials-related problems during electronic packaging processes
- Research Assistant, Department of Mechanical Engineering, Hong Kong University of Science & Technology, Sept. 1995 – June 1998
  - Study of deformation of CuAlNi single crystalline shape memory alloy by Moiré Interferometry

C. TEACHING EXPERIENCE

- Assistant Professor, Department of Mechanical Engineering & Engineering Science, The University of North Carolina at Charlotte, Aug. 2004 - current
  - Courses: Introduction to Materials Science and Engineering (Junior-level)
    Mechanical Behavior of Materials (Graduate-level)
- Teaching Assistant, Department of Mechanical Engineering, Northwestern University, Sept. 2000 - Aug. 2004
  - Courses: Introduction to Nanoscale Science and Engineering (Senior-level)
    Advanced Topics on Nanoscale Science and Engineering (Graduate-level)
- Teaching Assistant, Department of Mechanical Engineering, Hong Kong University of Science & Technology, Sept. 1995 - June 1998
  - Courses: Strength of Materials (Freshman-level)

D. PUBLICATIONS

1. Amin, S. S, Nicholls, A. W. and Xu, T. T., "Straightforward Synthesis of Rutile TiO_2 Nanowires", to be submitted, (2006).
2. Xu, T. T., Nicholls, A. W. and Ruoff, R. S., "Boron Nanowires and Novel Tube-Catalyst Particle-

Wire Hybrid Boron Nanostructures", submitted, (2006).

3. Xu, T. T., Zheng, J. G., Nicholls, A. W., Stankovich, S., Piner, R. D., and Ruoff, R. S., "Single Crystal Calcium Hexaboride Nanowires: Synthesis and Characterization", *Nano Letters*, ***4(10)***, 2051-2055, (2004).
4. Xu, T. T., Zheng, J. G., Wu, N. Q., Nicholls, A. W., Roth, J. R., Dikin, D. A., and Ruoff, R. S., "Crystalline Boron Nanoribbons: Synthesis and Characterization", *Nano Letters*, ***4(5)***, 963-968, (2004) (featured cover).
5. Xu, T. T., Fisher F. T., Brinson, L. C., and Ruoff, R. S., "Bone-shaped nanomaterials for nanocomposite applications", *Nano Letters*, ***3(8)***, 1135-1139, (2003).
6. Xu, T. T., Piner, R. D., and Ruoff, R. S. "An improved method to strip aluminum from porous anodic alumina films", *Langmuir*, ***19(4)***, 1443-1445, (2003).
7. Piner, R. D., Xu, T. T., Fisher F. T., Qiao, Y. and Ruoff, R. S., "Atomic force microscopy study of clay nanoplatelets and their impurities", *Langmuir*, ***19(19)***, 7995-8001, (2003).
8. Sun, Q. P., Xu, T. T. and Zhang, X. Y., "On deformation of A-M interface in single crystal Shape Memory Alloy and some related issues", *Journal of Engineering Materials & Technology-Transactions of the ASME*, ***121(1)***, 38-43, (1999).
9. Sun, Q.P., Zhang, X. Y. and Xu, T. T., "Some recent advances in experimental study of Shape Memory Alloys", *Solid Mechanics and Its Applications*, ***62*** (IUTAM symposium on macro- and micro- aspects of thermoplasticity, 1997*)*, 407-416, (1999).
10. Zhang, X. Y., Xu, T. T. Sun, Q. P. and Tong, P., "On the full-field deformation of single crystal CuAlNi Shape Memory Alloy — stress-induced $\beta_1 \rightarrow \gamma_1$' martensitic transformation", *Journal de Physique IV*, ***7 (C5)***, 555-560, (1997).
11. Sun, Q.P., Xu, T.T., Zhang, X. Y. and Tong, P., "A quantitative micro-deformation field study of Shape Memory Alloys by high sensitivity Moiré", *Materials Research Society Symposium Proceedings*, ***459*** (Materials for Smart Systems II), 495-500, (1996).

E. SYNERGISTIC ACTIVITES

1. Session Chair, 1st Symposium on Nanoscale Science & Engineering: Convergence of the Top Down and Bottom Up Approaches, UNC Charlotte, October, 2005.
2. Panel reviewer, National Science Foundation, April 2005.
3. Journal paper reviewer: Journal of Biomedical Materials Research, Journal of Vacuum Science & Technology, Physical Review B, Chemistry – A European Journal
4. American Vacuum Society (AVS) Graduate Research Award, 2004.
5. Member of APS, AVS, MRS, ASME, SWE and IEEE.

F. COLLABORATORS AND OTHER AFFILICATIONS

Collaborators and Co-Editors:

Frank Fisher (Stevens Institute of Technology), Tsing-Hua Her (UNC Charlotte), Deyu Li (Vanderbilt University), An-ping Li (Oak Ridge National Lab).

Graduate and Postdoctocal Advisors

- Ph.D. advisor — Prof. Rod Ruoff, Department of Mechanical Engineering, Northwestern University, USA.
- M.Phil. advisor — Prof. Qing-ping Sun, Department of Mechanical Engineering, Hong Kong University of Science & Technology, Hong Kong.

Student Advisees

- Syed Amin, Ph.D. student, Mechanical Engineering, UNC Charlotte, Aug. 2004 - present
- Xiaoxia Wu, Ph.D. student, Mechanical Engineering, UNC Charlotte, Jan. 2006 - present
- Yaroslav Maksymiv, undergraduate student, Mechanical Engineering, UNC Charlotte, Aug. 2005 - present

Curriculum Vitae

Christopher M. Yengo, M.S., Ph.D.
Assistant Professor
University of North Carolina at Charlotte
Department of Biology
9201 University City Blvd.
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Tel: (704) 687-8530
Fax: (215) 687-3218
cmyengo@email.uncc.edu

Professional Experience

2004-pres.	Assistant Professor Department of Biology University of North Carolina at Charlotte Charlotte, NC
2000-2003	Postdoctoral Fellow: Structure/function studies on muscle and non-muscle myosins. Advisor: Dr. H. Lee Sweeney University of Pennsylvania School of Medicine Dept. of Physiology and Pennsylvania Muscle Institute Philadelphia, PA

Education:

May 2000	University of Vermont, Burlington, VT Ph.D., Molecular Physiology and Biophysics Graduate Teaching Fellow
August 1996	University of Wyoming, Laramie, WY M.S., Exercise Physiology Graduate Teaching Assistant
May 1991	Indiana University, Bloomington, IN B.S., Exercise Science

External Funding

2005	NIH R03 (4/1/05 – 3/31/07, $62.5K per year) – Enzymatic and motor properties of myosin III.
2004	American Heart Association, Scientist Development Grant. (1/1/04-12/31/07, $65K per year). Mechanism of energy transduction in myosin.
2001	NIH Post-Doctoral Fellowship (3 years), National Research Service Award – Mechanism of Myosin IX Motility

Selected Peer-reviewed Publications

1) Sun, M., Oakes, J.L., Ananthanarayanan, S.K., Hawley, K.H., Tsien, R.Y., Adams, S.R., and **Yengo, C.M.** (2006). Dynamics of the upper 50 kDa domain of myosin V examined with fluorescence resonance energy transfer. *J. Biol. Chem.* (In Press).
2) Menetrey J., Bahloul A., Wells A.L., **Yengo C.M**., Morris C.A., Sweeney H.L., Houdusse A. (2005). The structure of the myosin VI motor reveals the mechanism of directionality reversal. *Nature* 435, 779-785.
3) Wallace, K.N., Dolan, A.C., Seiler, C., Smith, E.M., Yusuff, S., Chaille-Arnold, L., Judson, B., Sierk, R., **Yengo, C.,** Sweeney, H.L., Pack, M. (2005). Mutation of smooth muscle myosin causes invasion and cystic expansion of the zebrafish intestine. *Dev. Cell 8*, 717-726.
4) Ramamurthy, B., **Yengo, C.M.**, Straight, A.F., Mitchison T.J., Sweeney, H.L. (2004) Kinetic mechanism of blebbistatin inhibition of nonmuscle myosin IIB. *Biochemistry 43*, 14832-14839.
5) **Yengo, C.M.** and Sweeney, H.L. (2004). Functional role of loop 2 in myosin V. *Biochemistry 43*, 2605-2612.
6) Chakrabarty, T., **Yengo, C.**, Sweeney, H.L. and Selvin, P. (2003) Does the S2 rod of Myosin II uncoil upon two-headed binding to actin? A leucine-zippered HMM study. *Biochemistry 42*, 12886-92
7) Coureux, P.D., Wells, A.L., Ménétrey, J., **Yengo, C.M.**, Morris, C.A., Sweeney, H.L., and Houdusse, A (2003). The myosin V motor visualized at 2.0Å without bound nucleotide reveals a new structural state of myosin. *Nature 425*, 419-23.
8) **Yengo, C.M.**, De La Cruz, E.M., Safer, D., Ostap, E.M., and Sweeney, H.L. (2002). Kinetic characterization of the weak binding states of myosin V. *Biochemistry 41*, 8508-8517.
9) **Yengo, C.M.**, De La Cruz, E.M., Chrin, L., and Berger, C.L. (2002) Actin-induced closure of the actin binding cleft of smooth muscle myosin. *J. Biol. Chem. 277*, 24114-24119.
10) **Yengo, C.M.**, Chrin, L., Rovner, A.S. and Berger, C.L. (2000) Tryptophan 512 is sensitive to structural changes in the rigid relay loop of smooth muscle myosin during the MgATPase cycle. *J. Biol. Chem. 275*, 25481-25487.
11) **Yengo, C.M.**, Chrin, L.R., and Berger, C.L. Interaction of Lys-553 of myosin with the C-terminus and DNAse I binding loop of actin examined by fluorescence resonance energy transfer. (2000) *J. Structural Biology 131,187-196*.
12) **Yengo, C.M.**, Chrin, L., Rovner, A.S. and Berger, C.L. (1999). Intrinsic tryptophan fluorescence identifies specific conformational changes at the actomyosin interface upon actin-binding and ADP-release. *Biochemistry 38*, 14515-14523.
13) **Yengo, C.M.**, Fagnant, P.M., Chrin, L., Rovner, A.S. and Berger, C.L. (1998). Smooth muscle myosin mutants containing a single tryptophan reveal molecular interactions at the actin-binding interface. *Proc. Natl. Acad. Sci. U.S.A. 95*, 12944-12940.

Thesis Advisor and Postgraduate-Scholar Sponsor:
Minna Sun, Biology Ph.D. Student
Judy Moore, Biology M.S. Student

Appendix E

Proposed Catalog Copy for Ph.D. in Nanoscale Science

Ph.D. in Nanoscale Science

The Ph.D. in Nanoscale Science at UNC Charlotte is an interdisciplinary program that addresses the development, manipulation, and use of materials and devices on the scale of roughly 1-100 nanometers in length, and the study of phenomena that occur on this size scale. The program prepares students to become scholarly, practicing scientists who possess the critical thinking, methodological, and communication skills required to advance and disseminate knowledge of fundamental and applied nanoscale science.

The many challenges and opportunities that nanoscale science presents to society require collaborative, interdisciplinary approaches to research. Students enrolled in UNC Charlotte's Ph.D. program in Nanoscale Science learn about this exciting field from the perspectives of faculty members of a variety of disciplines and develop an advanced knowledge base of a selected science or engineering discipline. All of the NANO courses are team taught and/or co-developed by teams of faculty members from multiple disciplines. This approach provides students trained in a specific science or engineering field at the undergraduate or master's level with the tools needed to work effectively with scientists and engineers from other disciplines on cutting-edge research projects.

Students in the program acquire the knowledge and skills needed to compete effectively for positions in academic, industrial, or government lab settings by completing interdisciplinary nanoscale science courses and elective courses, participating in program colloquia and seminars, working as a member of a team on projects and research proposals, and making research contributions independently and as part of a team.

Admission Requirements

The following are general guidelines for successful admission into the Ph.D. program in Nanoscale Science:

1. A bachelor's or master's degree in a science or engineering field relevant to nanoscale science is required for admission to full standing in the Ph.D. in Nanoscale Science.

2. A minimum undergraduate grade point average of 3.0 or, if the applicant is currently enrolled in a graduate program or has earned a master's degree, a minimum grade point average of 3.0 in a relevant science or engineering master's program.

3. Admission to the program will require strong scores on the verbal, quantitative, and analytical sections of the Graduate Record Examination. The Graduate Record Examination is a required part of the application package.

4. Three strong, positive letters of recommendation, at least two of which must come from faculty in the applicant's current or previous academic program. All letters should be written by individuals in a position to judge the applicant's likely success in a Ph.D. level program. Letters should address the applicant's suitability for a Ph.D. program and ability to complete the program in a timely fashion.

5. Admission to the program of students who are not native English speakers will require strong scores on the TOEFL exam. The TOEFL exam is a required part of the application for non-native English speakers.

- **Documents to be submitted for application for admission**
  1. Official transcripts from all colleges and universities attended.
  2. Official GRE scores (verbal, quantitative, and analytical)
  3. The UNC Charlotte application for graduate admission form
  4. Three letters of reference from academics who have taught or worked directly with the applicant.
  5. An essay that addresses professional goals and motivation for pursuing the degree, suitability for the program, and career goals following the program.
  6. TOEFL scores (if the applicant is not a native English speaker)

- **Admission assessment**

An admissions committee will review applications and recommend to the Program Director whether each applicant should be admitted and, if so, under what conditions.

- **Student responsibility**

Students entering the program must provide an official copy of their undergraduate transcript, indicating completion of a bachelor's degree in a relevant science or engineering discipline.

Admission to Candidacy Requirements

After completing the appropriate core courses and at least three elective courses, each student delivers and defends an oral presentation that addresses research completed or in progress, plus proposed research for completion of the dissertation. The presentation/defense is delivered to the student's dissertation committee. The student is questioned by the committee about his/her research, plus material from any relevant graduate level courses the student has completed. Students who fail the exam on the first attempt will be provided a second opportunity to pass it, and will be advised by the committee on how to better prepare for the second attempt. Students who do not pass on the second attempt will be offered the option of obtaining a master's degree in an appropriate discipline (depending on which electives the student has completed) but will not be allowed to continue on to the Ph.D. degree. Under normal circumstances, students are expected to pass the qualifying exam prior to the sixth semester in residence.

Degree Requirements

The Ph.D. in Nanoscale Science requires 72 credit hours. Core courses account for at least 30 hours, and elective courses account for at least 9 hours. The remaining credit hours are fulfilled by enrolling in Dissertation Research (NANO 8900).

- **Core Courses**

  The Ph.D. program in Nanoscale Science requires the following core courses:

NANO 8001	Perspectives in Nanoscale Science
NANO 8101	Introduction to Instrumentation and Processing at the Nanoscale
NANO 8102	Nanoscale Phenomena
NANO 8103	Synthesis and Characterization of Nanomaterials
ENGR 8104	Fabrication of Nanomaterials
NANO 8201	Research Group Rotations
NANO 8202	Interdisciplinary Team Project
NANO 8203	Collaborative Research Proposal
NANO 8681	Nanoscale Science Seminar*
NANO 8682	Nanoscale Science Colloquium**

  * Students enroll in NANO 8681 during every semester in residence.

  ** Students enroll in NANO 8682 during every semester in residence, except during the semester in which they enroll in NANO 8001.

- **Elective Courses**

  Students complete a minimum of nine credit hours of elective coursework in a chosen science or engineering discipline (selected from biology, chemistry, electrical and computer engineering, mechanical engineering and engineering science, or physics and optical science), in addition to completing the core courses. Elective courses are selected in consultation with the student's advisor or dissertation advisor and dissertation committee to best meet the student's needs and interests.

- **Cumulative Exams**

  Students must pass six exams (four if done during the first year) covering announced topics in nanoscale science. The exams require knowledge of basic principles of nanoscale science and current literature and will be administered monthly. Each student is expected to take the cumulative exam each time it is offered until (s)he passes the required number of exams.

- **General Science Proficiency Exam (GSPE)**

  The purpose of the GSPE is to ensure that students possess a *working knowledge* of material needed to master concepts in nanoscale science. The exam will cover introductory material in chemistry, physics and mathematics (including calculus). The web page for the Ph.D. in Nanoscale Science contains detailed information about the exam, including a list of topics to be covered and sample questions, to assist students in preparing for the exam. The exam will be administered three times per year, in August,

January and May. Students are expected to take the GSPE each time it is offered until they pass it. Each student will discuss his/her performance on the GSPE with the Program Director regardless of whether (s)he passes the exam. The Program Director will indicate to the student any material he/she should study in greater detail and which faculty member the student should consult if he/she requires assistance in learning specific material. Students who do not pass the GSPE by the end of their first year enrolled in the program will be terminated from the program.

Advising/Committees

Students will be assigned to an advisor upon enrolling in the Program and will work closely with that advisor on suggested schedules of classes, research options, and other issues important to success. Upon selecting a research advisor, students will form a dissertation committee, and will then consult with the research advisor/dissertation committee on program matters.

Grades Required

Graduate students must have a GPA of 3.2 or higher to graduate from the program. Two grades of C or one grade of U will result in termination from the program.

Transfer Credit

Students who have taken graduate coursework but have not earned a graduate degree may transfer up to six semester hours of coursework. Students who have earned a master's degree may transfer up to 30 semester hours.

Language Requirement

There is no foreign language requirement.

Application for Degree

Students must apply for the degree when they are close to completing the program. After successful defense of the dissertation, a student will be conferred with the doctoral degree.

Residency Requirement

Students must satisfy the residency requirement for the program by completing 21 hours of continuous enrollment, such as coursework or dissertation credits. Residence is considered continuous if the student is enrolled in one or more courses in successive semesters until 21 hours are earned.

Time Limits for Completion

The student must achieve admission to candidacy within six years after admission to the program. All requirements for the degree must be completed within eight years after first registration as a doctoral student. These time limits are maximums; full-time students will typically be expected to complete the degree requirements within 4-5 years.

Courses in Nanoscale Science

NANO 8001 Perspectives at the Nanoscale. (2)
NANO program faculty members present and discuss their research in nanoscale science to: (1) demonstrate how scientists from different disciplines approach problem-solving at the nanoscale, and (2) expose students to research opportunities for dissertation work. Students submit for grading summaries of the presentations.

NANO 8101 Introduction to Instrumentation and Processing at the Nanoscale. (3) Methods of manipulating, engineering, and characterizing nanoscale materials are introduced; applications and principles of their operation are discussed. Students acquire hands-on experience with selected laboratory methods in preparation for dissertation research. Topics include, but are not limited to, scanning probe and electron microscopy methods, cleanroom technology, nanoscale optical and e-beam lithography, nuclear magnetic resonance, mass spectrometry, luminescence methods, interferometry, gel permeation chromatography, surface area analysis, and small-angle x-ray and neutron scattering.

NANO 8102 Nanoscale Phenomena. (3)
Topics include, but are not limited to, scaling phenomena; nano-optics (near-field optics, limits of lithography masks, nano-dots and nanoscale optical interactions); nanoscale mechanics; nanotribology; biological and biologically-inspired machines.

NANO 8103 Synthesis and Characterization of Nanomaterials. (3)
Topics include, but are not limited to, quantum dots, metallic nanoparticles, carbon nanostructured materials and nanotubes, zeolites, organic-inorganic polymers, composite materials, solution-phase colloids, sol-gel process, silica spheres, porous silicon, photonic crystals. Prerequisites: NANO 8101 and NANO 8102.

ENGR 8104 Fabrication of Nanomaterials. (3)
Lithographic methods (CVD, PVD, e-beam, ion beam, magnetron, evaporation, spin coating, mask fabrication, developing resists); microelectromechanical systems and nanoelectromechanical systems; limits of conventional mechanical processing, electroforming, growth mechanisms (organic, inorganic, thermal); powders. Prerequisite: NANO 8101.

NANO 8201 Research Group Rotations. (1)
Students interact on a regular basis with selected research groups in nanoscale science from at least three different departments at UNC Charlotte. Specific activities range from meeting with the group's professor and/or other group members, attending group meetings, and observing laboratory experiments and procedures. Research groups are chosen so that each student is exposed to an array of research activities of the Nanoscale Science faculty. At the end of each rotation, the visiting student delivers a presentation to the visited research group, describing what the student learned about the visited group's research activities.

NANO 8202 Interdisciplinary Team Project. (2)
An encapsulated, semester-long research experience designed to introduce students to laboratory work in nanoscale science. Students work, in interdisciplinary teams of 2-4 students, on a short

research project and present their results during a meeting of the *Nanoscale Science Colloquium*. Corequisite: NANO 8682.

NANO 8203 Collaborative Research Proposal. (3)
Effective strategies for designing and writing research proposals are presented by program faculty members, and staff from proposal development offices on campus. Students work in teams of 2-3 to prepare an original, interdisciplinary research proposal on a topic in nanoscale science. The proposal conforms to regulations of a selected funding agency and must address a topic that is supported by that agency. Each team consults regularly with a panel of 2-3 faculty members who collectively approve the proposal topic, provide feedback during the development of the proposal, and ultimately evaluate the proposal. The course is designed to increase the ability of students to relate research ideas to fundamental concepts in science and engineering, to help students learn to develop effective methods of presenting ideas and defending them, to help students develop self confidence in their abilities to present and defend ideas, and to improve oral and written communication skills.

NANO 8681 Nanoscale Science Seminar. (1)
Students attend weekly seminars of visiting speakers of the Nanoscale Science program or other approved programs on campus. Seminars are selected to best meet the educational needs of the individual student. Students submit for grading summaries of the seminars attended. (May be repeated for credit.)

NANO 8682 Nanoscale Science Colloquium. (1)
Students present seminars on current topics in nanoscale science to the faculty and student participants of the program. Presentations address dissertation research, the current literature, group projects, and special topics. The colloquium provides an opportunity for students to discuss topics in Nanoscale Science with faculty from all of the participating disciplines. (May be repeated for credit)

ENGR 8104 Fabrication of Nanomaterials. (3)
Lithographic methods (CVD, PVD, e-beam, ion beam, magnetron, evaporation, spin coating, mask fabrication, developing resists); microelectromechanical systems and nanoelectromechanical systems; limits of conventional mechanical processing, electroforming, growth mechanisms (organic, inorganic, thermal); powders. Prerequisite: NANO 8101 (Introduction to Instrumentation and Processing at the Nanoscale).

NANO 8900 Dissertation Research. (1-4) Research for the dissertation. (May be repeated for credit).

Appendix F

Full Text of Assessment of Library Holdings

J. MURREY ATKINS LIBRARY
LIBRARY CONSULTATION FOR
COURSE AND/OR CURRICULUM PROPOSAL

Date: February 1, 2006

To: Dr. Bernadette Donovan-Merkert, Chair
Chemistry Department

From: Barbara Tierney, Library Liaison to the Department of Chemistry

Re: Ph.D. in Nanoscale Science Program which includes the following topics:

Theoretical Aspects of Nanoscale science

- Development of methods to model, synthesize, characterize, simulate and evaluate complex materials including photonic crystals, photonic devices and other complex materials such as high temperature superconductors and plasmonic devices.
- Modeling and predicting quantum effects that become significant in nanoscale materials, and to utilize these effects in new materials and applications (including quantum dots, quantum wires, nanotubes, and photon confined materials).
- Identification, understanding, and utilization of the concepts applicable to the controlled assembly of self-organizing nanomaterials, including polymers, dendrimers, nanotube-based materials, nanocatalysts at surfaces (including electrode surfaces), and assemblies of biopolymers.

Biomolecular Nanotechnology

- Design, fabrication, and optimization of biomaterials and devices for tissue growth and repair
- Elucidating the structures of complex biomolecules and understanding interactions between biomolecules

Building Nanoscale Materials

- Development and utilization of nanoscale lithographic processes
- Synthesis of materials at the nanoscale, including: polymers, dendrimers, supramolecular complexes, quantum dots, quantum wells, carbon nanotubes, molecular material hybrids, high energy/high density compounds, and nanoporous materials.
- Development of synthetic methodology and mechanistic studies
- Fabrication of nanopatterned surfaces and nanostructured metal composites for chemical and biological sensing

Instrumental Methods for Nanotechnology

- Development of instrumentation and procedures for the machining, manipulation, and replication of materials with nanometer precision
- Intertwining material development with cutting-edge nanoscale analytical techniques, including surface probe techniques with atomic resolution and novel metrology methods.

The adequacy of library holdings to support the above proposed Ph.D program when it is implemented is evaluated by the Reference Librarian as follows:

1. Holdings are superior: _____
2. **Holdings are adequate: ___X_____**
3. Holdings are adequate only if department purchases additional materials: _____
4. Holdings are inadequate: _____

Comments:
Science Liaison Librarian Barbara Tierney has completed a thorough search of the Atkins Library's online catalog to evaluate the extent and currency of library holdings that support the proposed new interdisciplinary Ph.D program in Nanoscale Science. Ms. Tierney finds that the Library has sufficient resources to support this new program.

Ms. Tierney does recommend, however, that the participating academic departments designate a total of approximately $25,000.00 of their program funding for the purchase of new relevant library materials to further support and update library collections in this subject area. To this end, an electronic search of "Books in Print" and "World Catalog" has been appended to this evaluation to aid faculty in the selection of updated library resources.

Please see the following Summary Tables for detailed Library holdings information.

Table 1: Atkins Library Holdings Relevant to Nanotechnology
This table shows that Atkins Library holdings include 4042 titles specific to the topic of Nanotechnology. Of these, 1461 or approximately 36% were published since 1998, making this collection reflective of the current technology; 223 are periodicals; 920 are electronic resources.

Individual articles or books not available in-house may be requested through the Library's Interlibrary Loan Service.

Table 1: Atkins Library Holdings Relevant to Nanotechnology

Keyword/Subject Heading	Holdings	Post-1998	Periodicals	E-Resources
Atom* and Force and Microscop*	23	15	1	1
Atom* and Manipulat*	9	5	0	2
Biopolymer*	18	4	1	2
Complex and Membrane*	8	6	0	1
Fullerene*	22	15	2	3
Giant and Magnetoresistan*	2	2	0	0
High and Temperature* and Superconductor*	28	8	0	2
Material* and Characteriz*	164	73	2	19
MEMS (microelectrical mechanical system)	6	6	0	1

Mesoscopic*	22	18	0	0
Microelectromechanic* and System*	20	15	2	7
Microelectronic*	533	47	3	57
Microinstrument*	1	0	0	0
Micromachin*	18	10	0	3
Miniature and Electronic*	21	7	4	7
Molecular and Beam and Epitaxy	11	4	0	1
Molecular and Biology	847	286	64	208
Molecular and Chemistry	314	87	4	25
Molecular and Confine*	4	4	0	0
Molecular and Electronic*	474	246	80	395
Molecular and Logic	10	8	0	1
Molecular and Manipulat*	25	15	2	4
Molecular and Robot*	4	3	0	2
Molecular and Self-Assembl*	17	17	1	3
Molecular and Theor*	211	75	5	12
Nanobiotechnology	4	3	3	3
Nanobioscience	1	1	1	1
Nanocomposite*	10	10	0	0
Nanocrystal*	11	11	0	1
Nanoindent*	4	4	0	0
Nanometer*	12	8	1	2
Nanomaterial*	6	6	0	1
Nanometric*	4	2	0	1
Nanoparticle*	20	17	3	4
Nanoscale*	23	18	2	4
Nanoscience*	18	17	3	5
Nanostructur*	67	41	5	17
Nanotechnolog*	23	14	9	23
Nanotribolog*	1	1	0	1
Nanotube*	7	6	3	7
Nanowire*	1	1	0	1
Photonic and Crystal*	1	1	0	1
Photonic and Device*	3	2	0	3
Protein and Interact*	6	5	4	6
Quantum and Comput*	72	53	1	8
Quantum and Restrict*	41	20	1	41
Scanning and Probe and Microscop*	0	0	0	0
Scanning and Tunnel* and Microscop*	3	3	3	3
Quantum and Theor*	820	190	6	19
Self-Assembl*	30	25	2	4
Self-Replicat*	3	3	0	0
Spintronics	1	1	0	1
Supramolecular and Chemi*	35	24	2	4
Supramolecular and Science*	3	3	3	3
Ultraprecision and Mechani*	0	0	0	0
Totals	**4042**	**1461**	**223**	**920**

Table 2: Atkins Library Sample Listing of Journals Relevant to Nanotechnology The following table gives a sample listing of relevant journals to which Atkins Library has access (electronic or paper) either from institutional subscriptions (such as from the American Institute of Physics or the Institute of Physics, Great Britain) or from publisher or aggregator databases (such as IEEE Xplore, Science Direct, Springer-Verlag Link and Wiley Insterscience). This list compares Atkins holdings to the holdings of the University of Washington (an institution which has been identified by the UNCC Chemistry Dept. as having a similar multidisciplinary education program).

Table 2: Atkins Library Sample Listing of Journals Relevant to Nanotechnology

Nanotechnology Journals	**UNCC**	**University of Washington**
Biopolymers	Yes	Yes
E-Journal of Surface Science and Nanotechnology (Surface Science Society of Japan)	No	Yes
Foresight Update (Foresight Institute, Palo Alto,CA)	No	Yes
IEE Proceedings. Nanobiotechnology	Yes	Yes
IEEE Transactions on Nanobioscience	Yes	Yes
IEEE Transactions on Nanotechnology	Yes	Yes
Internet Journal of Nanotechnology	No	Yes
Journal of Nanoengineering and Nanosystems	No	Yes
Journal of Nanoparticle Research	Yes	Yes
Journal of Nanobiotechnology	Yes	Yes
Journal of Nanotechnology	No	Yes
Journal of Vacuum Science & Technology B. Microelectronics and Nanometer Structures Processing, Measurement and Phenomena: an Official Pub. Of the American Vacuum Society	Yes	Yes
Materials Science & Engineering C. Miomimetic and Supramolecular	Yes	No

Systems		
Microfluidics and Nanofluidics	Yes	Yes
Micro Engineering and Nanotechnology News	Yes	Yes
Microsystem Technologies: Sensors, Actuators, Systems Integration	Yes	No
Molecular Diversity	Yes	Yes
Nano Letters	Yes	Yes
Nanostructured Materials	Yes	Yes
Nanotechnology	Yes	Yes
Physica E. Low-dimensional Systems	Yes	Yes
Probe Microscopy	Yes	No
Proceedings of the Institute of Mechanical Engineers. Part N. Journal of Nanoengineering and Nanosystems	Yes	No
Small	Yes	Yes
Supramolecular Science	Yes	No
Virtual Journal of Nanoscale Science & Technology	No	Yes

Table 3: Atkins Library Sample Listing of Indexes and Databases Relevant to Nanotechnology The following table gives a sample listing of relevant indexes and databases to which Atkins Library has access. This list compares Atkins holdings to the holdings of the University of Washington (an institution which has been identified by the UNCC Chemistry Dept. as having a similar multidisciplinary education program).

Table 3: Atkins Library Sample Listing of Indexes and Databases Relevant to Nanotechnology

Indexes & Databases relevant to Nanotechnology	**UNCC**	**University of Washington**
Aluminum Industry Abstracts	Yes (electronic)	Yes (electronic)
Bioengineering Abstracts	Yes (electronic)	No
Biotechnology Abstracts	Yes (electronic)	Yes (electronic)
Ceramic Abstracts/World Ceramics Abstracts	Yes (electronic)	Yes (electronic)
Compendex	Yes (electronic)	Yes (electronic)
Conference Papers Index	Yes (electronic)	Yes (electroic)
CRC Engineering Handbooks (electronic)	Yes (electronic)	Yes (paper format only)
Electronics & Communications Abstracts	Yes (electronic)	Yes (electronic)
Engineered Materials Abstracts	Yes (electronic)	Yes (electronic)
IEEE Xplore	Yes (electronic)	Yes (electronic)
Institute of Physics	Yes (electronic)	Yes (electronic)
Materials Business File	Yes (electronic)	Yes (electronic)
Mechanical Engineering Abstracts	Yes (electronic)	Yes (electronic)
METADEX	Yes (electronic)	Yes (electronic)
MicroPatent Materials Patents	Yes (electronic)	Yes (electronic**)**
Science Direct (Elsevier electronic journals)	Yes (electronic)	Yes (electronic)
SciFinder Scholar (electronic Chem.Abstracts)	Yes (electronic)	Yes (electronic)
Scitation	Yes (electronic)	Yes (electronic)
Solid State and Superconductivity Abstracts	Yes (electronic)	Yes (electronic)
Springer-Verlag Link (Springer-Verlag electronic	Yes (electronic)	Yes (electronic)

journals)		
U.S. Patents	Yes (electronic)	Yes (electronic)
Web of Science	Yes (electronic)	Yes (electronic)
Wiley Interscience	Yes (electronic)	Yes (electronic)

Purchasing additional library resources to support this program:

It is suggested that the participating academic departments designate a total of approximately $25,000. of their program funding for the purchase of new library materials to further support and update library collections in this subject area. To this end, an electronic search of "Books in Print" and "World Catalog" has been appended to this evaluation to aid faculty in the selection of updated library resources.

Barbara Tierney *Barbara Tierney*

February 1, 2006

Evaluator's Signature **Date**

Appendix G

Equipment Available at UNC Charlotte for Research and Teaching in Nanoscale Science

Facilities available through the Optoelectronics Center
(Items designated with an asterisk (*) are on order)

Lithography

- Raith 150 E-Beam Lithography System
- Laurell Spin Processors*
- Quintel Q 4000-6 NUV Mask Aligner
- Molecular Imprint Nanoimprint System*

Molecular Deposition and Etching

- Rapid Thermal Process System
- Omicron STM/AFM System
- AJA International ATC 1500-F Ion Mill System
- AJA International ATC 1800-F Sputter Deposition System
- IEI ICP Compound Semiconductor Etch System
- ICP Dielectric Etch System*
- ICP Deep Silicon Etch System*
- PECVD*
- MOCVD
- Microautomation Dicing Saw*
- Evaporator*
- Flip-chip Bonder*
- Supercritical Drying Station*

Metrology

- Tencor Instruments Alpha-step 200 Surface Profilometer
- X-Ray Interferometer
- Zygo 4" Interferometer
- Veeco General Purpose Phase Shifting Interferometer
- Fisba-Optik Micro Interferometer

Imaging and Characterization

- Z-scan Apparatus
- Nano Alignment Systems
- JEOL JSM-646LV Scanning Electron Microscope
- Veeco Nanoscope IV AFM
- Tektronix Semiconductor Parameter Tester
- Woolam WVASE32 Spectrascopic Ellipsometer
- Veeco Nanoscope IV SPM Control Station

- Spectrometers and Microscopes
- STN Probe Station
- Cathodoluminescence
- EDAX
- Deep Level Transient Spectroscopy

Facilities available through the Microelectronics Fabrication Laboratory

- 3000 square feet of Class 1000 clean room with class 10 or better conditions under individual laminar flow work stations
- 18 megaohm deionized water throughout the clean room
- Complete chemical cleaning/etching capability with fume exhaust and laminar air flow
- High temperature operations including gate and field oxides with TCA gettering, n-type, and p-type doping using Corso-Gray, Thermco, and Lindberg furnaces
- Photolithography using a HTG contact mask aligner and Solitec and Headway spin coaters
- Pattern generation on masks or substrates with a Research Devices optical pattern generator
- Etching with a RIE (reactive ion etch) tool designed by IBM
- Plasma operations using a Technics Micro-Plasma 900 plasma deposition tool and a Texas Instruments A-24-D PECVD tool
- Thin film evaporation using a Cooke thermal evaporator, Cooke e-beam evaporator, Varian 3125 4 pocket e-beam evaporator, or a CHA Mark 50 rf induction evaporator
- Sputtering using a CVC AST-601 3 target sputtering tool
- Thin film profiles using an Alpha Step 200 or Dektak IIA
- Thin film thickness measurements using a Nanometrics Nanospec AFT 200 automatic film thickness tool
- Inspections with a Cambridge SEM (scanning electron microscope) and optical microscopes with both video and digital cameras
- 4 MBE (molecular beam epitaxy) systems - 1 Physical Electronics and 3 VG Scientific for the fabrication of III-V and II-VI compound semiconductors
- SiC (silicon carbide) PECVD system
- Electrical measurements including low temperature @ 10K using a Micromanipulator probe station, Tektronix 576 curve tracer, and low temperature vacuum probe station
- Substrate cutting using a Microautomation 1100 diamond dicing saw
- Wire bonding using a K&S 4125 gold wire ball bonder

Instruments available through the Center for Precision Metrology

- 5 computer controlled coordinate measuring machines (CMMs)
- Surface metrology equipment including: Taylor-Hobson Form Talysurf 120L, Mahr Federal Perthometer PRK, Zygo NewView 5000, Somicromic Surfascan 3C, WYKO RST
- Flatness interferometers
- Roundness/cylindricity instruments

- ID/OD gage
- Gage block comparator
- Gage block interferometer

Equipment Available through the Department of Physics and Optical Science

- Optics Laboratories for high resolution imaging and spectroscopy including near-field scanning optical microscopy, and fiber sensor development.

Equipment Available through the Department of Mechanical Engineering

- Videomicroscopy system capable of cryo
- Fluorescence, polarized light, DIC, and brightfield microscopy
- Image analysis software
- Differential scanning calorimetry system for materials characterization
- Laminar flow hood for tissue culture

Equipment Available through the Department of Chemistry

- Dynamic Light Scattering System (on order)
- FTIR with PM-IRRAS bench, microscope and step scan capability
- Dynamic light scattering system (on order)
- UV-Vis spectrometers
- Fluorescence spectrometer with a micro well plate reader
- Fourier transform NIR Raman
- Dispersive Raman
- MicroRaman system with 532nm and 632nm excitation lasers
- Pulsed laser systems including N2, Nd:YAG, and dye lasers
- Circular dichroism spectrometer
- Atomic absorption spectrometer, flame and graphite furnace
- Ultra-centrifuge
- Ultra high vacuum STM
- Cold room
- PAR 273 Potentiostat/Galvanostats
- Portable vacuum line with turbo-pump and mass analyzer
- BET automated surface area analyzer
- Metal plasma deposition system (metal sputter coater)
- TGA (Thermogravimetric Analysis)
- TMA (ThermoMechanical Analyzer)
- DSC (Differential Scanning Calorimeter)
- State-of-the-art multinuclear 500 MHz spectrometer with gradient shimming used for 2D and multinuclear experiments. NMR is equipped with autosampler and auto tuning.
- Three 300 MHz spectrometers typically used for ^{1}H and ^{13}C spectra.
- Solid state probe for 300 MHz Spectrometer
- Electrospray time of flight mass spectrometer
- MALDI time of flight mass spectrometer

- Two quadrupole GC mass spectrometers Ion trap GC/MS with direct insertion probe and chemical ionization
- HP 1050 HPLC with autosampler and photodiode array detection
- Waters HPLC with duel wavelength detection
- GPC
- CZE (Capillary Zone Electrophoresis) with diode array detection
- CE-LIF (Capillary Electrophoresis with Laser-Induced Fluorescence Detection)
- Preparative scale automated flash chromatography system
- Capillary HPLC with variable wavelength detection (can be coupled to the
- Electrospray mass spectrometer)
- Preparative gel electrophoresis apparatus
- GC-IR
- Other various capillary GC's
- Vacuum speed evaporator (Speed Vac)
- ESR spectrometer
- Molecular and materials modeling using Origin 300 and an eight R1400 500 MHz processor computer system
- Solvent purification system (water and oxygen free) dimethyl formamide, tetrahydrofuran, ethyl ether, acetonitrile, dichloromethane, toluene and pentane

Equipment available through the Department of Biology

- Imaging Core Facility
- DNA Sequencing Core Facility
- *Microarray Core Facility* at CMC with workstations in the Cameron Applied Research Center.
- State-of-the-art vivarium
- low speed, high speed and ultra centrifuges
- Scintillation and gamma counters
- Tissue culture facilities
- Spectrophotometers
- Thermal cyclers
- Gel analysis hardware and software
- Standard upright and inverted microscopes with fluorescence
- *In vivo* video microscopes with analysis software for quantitative fluorescence
- Confocal microscope
- Complete equipment for physiologic monitoring
- Cryostat
- HPLC
- FACS and gas chromatograph

Appendix H

UNC Charlotte Conference on Nanoscale Science and Engineering: Convergence of the Top-Down and Bottom-Up Approaches

Organizer: Professor Kenneth E. Gonsalves
Co-Organizer: Professor Thomas A. Schmedake

List of Invited Speakers

- James Murday (Naval Research Labs): "The National Nanotechnology Initiative: a new strategic plan and anticipated impact on national defense and homeland security"
- Jeffery Schloss (NIH): "Nanoscience and Nanotechnology Research for Biology and Medicine"
- Douglas Lowndes (Oak Ridge National Laboratories): "ORNL's New Center for Nanophase Materials Sciences (CNMS): A Catalyst for 21st Century Science"
- Fraser Stoddart (UCLA): "An Integrated Systems-Oriented Approach to Molecular Electronics"
- Thomas Mallouk (Penn State): "Nanoscale Building Blocks for Mesoscopic Materials"
- Chris Toumey (USC Nanocenter - University of South Carolina) "Reading Feynman into nanotech: does nanotechnology descend from Richard Feynman's 1959 talk?"
- Richard Siegel (Rensselaer Polytechnic Institute): "Assembling Materials and devices from Nanoscale Building Blocks."
- Seth Marder (Georgia Institute of Technology): "Materials for the Microfabrication of Complex 3- Dimensional Structure Using Two-Photon Activated Processes"
- Robert Shull (NIST): "Nanomagnetism: A New Materials Frontier."
- Edwin L. Thomas (MIT): "Templated Self Assembly of Block Copolymers: Top Down Meets Bottom Up"
- Ray Tsu (UNC-Charlotte): "The Fundamentals of Quantum Dots and Devices"
- Dr Robert K. McMahan (Senior Advisor to the Governor NC for Science and Technology): "Innovation Capacity: North Carolina's Science and Technology Based Economy and the Impact of Nanotechnology"
- Jennifer West (Rice University): "Quantum Dots for Cancer Therapy"

- Rudy Juliano (UNC-Chapel Hill): "Macromolecular Therapeutics; A Promising Application for Nano-technology"

- Scott McNeil (NCI): "NCI - National Cancer Institute and Nanomedicine"

- Nigel Walker (National Institute of Environmental Health Sciences, NIEHS): "Evaluating the safety of nanoscale materials: Current challenges and future directions"

- Bob Hocken (UNC-Charlotte): "Precision Metrology"

- Mark L. Schattenburg (MIT): "Patterning ultra-precision gratings for dimensional metrology."

Appendix I

Members of the Planning Committee

Ph.D. in Nanoscale Science
UNC Charlotte

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