JOINT SCHOOL OF NANOSCIENCE AND NANOENGINEERING

2907 East Lee Street, Greensboro, NC 27401 • 336-285-2800 • jsnn.ncat.uncg.edu/

Administration

James Ryan, Dean
Daniel Herr, Chair
Hemali Rathnayake, Director of Graduate Study

About

The Joint School of Nanoscience and Nanoengineering (JSNN) is a collaboration of North Carolina A&T State University and The University of North Carolina at Greensboro. JSNN’s research and educational programs focus on the emerging areas of nanoscience and nanoengineering. The strengths of the two universities in the basic sciences and in engineering make them ideal partners for this new, interdisciplinary school. JSNN faculty and students will be able to access laboratories and classrooms at NC A&T, UNCG as well as the leading edge JSNN faculty at the Gateway University Research Park.

Nanotechnology is often referred to as convergent technology because it utilizes knowledge from a diverse array of disciplines including biology, chemistry, physics, engineering, and technology. Nanotechnology is rapidly becoming a large part of the world’s economy, generating an array of materials, technologies, and new products. JSNN’s Professional Master of Science in nanoscience and PhD in nanoscience degree programs have been developed to meet the need for trained professionals in the emerging high technology industries using nanotechnology.

JSNN has six research focus areas—nanobioscience, nanometrology, nanomaterials (with special emphasis on nanocomposite materials), nanobioelectronics, nanoenergy, and computational nanotechnology. These technical areas will afford numerous opportunities for collaboration with industrial partners.

Mission Statement

The mission of the Nanoscience Department in the Joint School of Nanoscience and Nanoengineering is to prepare students from a variety of backgrounds to conduct interdisciplinary fundamental, applied, and translational Nanoscience research, and support a collaborative research environment that leverages transdisciplinary research platforms.

Faculty

Professors

Daniel Herr, Nanoelectronics, nanobioelectronics, designed materials and assembly, and optimization (Chair of Department). (E)
James Ryan, Thin films, nanoelectronics, semiconductor process technology (Dean). (E)

Associate Professors

Christopher Kepley, Nanomedicines, nanoimmunology, fullerenes, understanding ways to inhibit inflammatory diseases, designing new nano-based diagnostics and therapeutics for human disease. (E)

Dennis R. LaJeunesse, Biomimetic/bio-composite materials, mitochondrial morphology and muscle structure/function, modeling viral disease using the drosophila model system. (E)
Hemali Rathnayake, Organic materials (OLEDs, OPVs, and OTEGs), nanomaterials and polymer chemistry (Director of Graduate Study). (E)
Joseph Starobin, Application of methods of theoretical, mathematical and computational physics to cardiovascular research; electrophysiological data collection with MEMS and nano-enabled sensors. (E)
Jianjun Wei, Functional nanomaterials, nanoplasmonics & nanophotonics, bioelectronics & biomimetics, electron transfer studies, and applications in bio/sensing, biomedicine, energy and environments. (E)

• Nanoscience, M.S. (https://catalog.uncg.edu/nanoscience-nanoengineering/professional-nanoscience-ms)
• Nanoscience, M.S./Ph.D. (https://catalog.uncg.edu/nanoscience-nanoengineering/nanoscience-ms-phd)
• Nanoscience, Ph.D. (https://catalog.uncg.edu/nanoscience-nanoengineering/nanoscience-phd)

NAN 519 Introduction to Nanotechnology 3
This course introduces students to the emerging field of nanotechnology and exposes them to current research and topics that are being influenced by nanomaterials including biology, healthcare, and the environment.
Prerequisites: BIO 392, BIO 355, CHE 342, CHE 351, or permission of instructor.
Notes: Same as BIO 519.

NAN 601 Nanochemistry 3
Review of materials chemistry, synthesis of nanoparticles such as carbon nanotubes and fullerences, chemical reactions and a survey of medicinal chemistry for pharmaceutical applications.
Prerequisites: Graduate student in nanoscience or permission of instructor.

NAN 602 Nanobiology 3
Emphasis on cellular and intracellular mechanisms including biological self-assembly, cytoskeletal interactions, protein folding, membrane dynamics, biological energetics, and cell-cell interactions as well as biomaterials.
Prerequisites: Graduate student in nanoscience or permission of instructor.

NAN 603 Nanophysics 3
Emphasis on the areas of physics critical to nanoscience including solid state physics, statistical mechanics, quantum concepts, biophysics, chemical physics, and nanodevices based on semiconductors.
Prerequisites: Graduate student in nanoscience or permission of instructor.

NAN 604 Nanotechniques 3
Fundamental techniques used in nanotechnology, including methods for nanofabrication, nanocharacterization, and nanomanipulation.
Prerequisites: Graduate student in nanoscience or permission of instructor.

NAN 605 Mathematical Methods in Nanoscience and Nanoengineering 3
An emphasis of this required course will be on the areas of mathematics critical to nanoscience and nanoengineering including application of differential equations to numerical and analytical modeling of nanostructures.
Prerequisites: Graduate student in Nanoscience or permission of instructor.
NAN 609 Nanosafety 3
An interdisciplinary course utilizing variety of academic disciplines (chemistry, physics, biology). Addresses the impact of nanomaterials through the range of organization that exists within living systems (molecular to societal).

NAN 611 Nanoscience Laboratory Rotation 1
A 7-week laboratory rotation intended to develop skills with scientific equipment and provide initial experience with nanoscale research. Four distinct laboratory rotations are required for the PhD in nanoscience.
**Prerequisites:** Graduate student in nanoscience or permission of instructor.
**Notes:** May be repeated for credit.

NAN 612 Food and Agricultural Nanotechnology 3
Prerequisite: Graduate students in the Nanoscience Master’s program, Nanoeengineering Master’s and PhD program, food and agricultural science graduates and professionals, or by permission of instructor.

NAN 615 Introduction to Spectroscopy Methods in Nanoscience 3
This course will introduce spectroscopy methods that, widely used in physics, chemistry, and biological sciences, provide knowledge for estimating applicability ranges of various methods, and teach basics of spectroscopy instruments and data analysis.
**Prerequisites:** NAN 601, NAN 603, NAN 605.

NAN 620 Immunology 3
A study of the molecular and cellular basis of the immune system. Topics include the properties of antigens and immunoglobulins, the development and regulation of humoral and cell-mediated immunity, resistance and immunization to infectious diseases, allergies, and autoimmune and immunodeficiency disorders.
**Prerequisites:** UNCG graduate student in sciences.

NAN 621 Professional Development Seminar I 1
Workplace issues including ethics, confidentiality, writing and presentation skills, innovation, entrepreneurship, and emerging issues in nanotechnology.
**Prerequisites:** Graduate student in nanoscience or permission of instructor.

NAN 622 Professional Development Seminar II 1
Workplace issues including business plans, globalization, emerging issues in nanotechnology, and further development of writing and presentation skills, innovation, and entrepreneurship.
**Prerequisites:** Graduate student in nanoscience or permission of instructor.

NAN 623 Optical Microscopy for Nanoscience 4
This course presents the fundamental principles underlying modern optical microscopy in the context of nanoscience and the demonstrated application and practice of advanced optical microscopy techniques in the context of laboratory experiences.
**Prerequisites:** NAN 604 for Nanoscience students or permission of instructor for students in other programs.
**Notes:** Registration restricted to science majors (Nanoscience, Chemistry, Biology, Nutrition, or related majors).

NAN 625 Molecular Biology in Nanosciences 3
A lecture and laboratory course introducing graduate level science students to the principles and practices of molecular biology with emphasis on its application and integration with nanoscience.
**Prerequisites:** Graduate students in nanoscience or other program with permission of instructor. Must have taken Basic Biology (Biology 111-112) and chemistry classes (Chem 111-115) or equivalent.

NAN 626 Introduction to Stem Cell Biology and Ethics 3
Fundamental issues, experimental approaches, and emerging areas in stem cell research accompanied by an understanding of the attendant ethical issues that arise from their use in healthcare applications.
**Prerequisites:** UNCG graduate student in sciences.

NAN 630 Advances in Bio-Sensors 3
Interdisciplinary cutting-edge advances in biosensors with nanoperspectives; specific emphasis on fundamentals, principles and progresses of various types of nanobiosensors, and applications in disease diagnosis, biomedicines, life science and environmental monitoring.
**Prerequisites:** NAN 601, NAN 602, NAN 603, or equivalent courses.
**Corequisites:** Graduate students at UNCG or JSNN or permission of instructors.

NAN 655 Biometrics and Biomaterials 3
Prerequisite: NAN 602, NAN 604, or permission of instructor;
**Notes:** Emphasizes the biomimetic and biological materials development and characterization. Topics range from natural to synthetic biomaterials, characterization of biomaterial properties, and discovery and application of novel biologically inspired materials.

NAN 692 Directed Studies in Nanoscience 1-4
This course gives students flexibility in guided readings, research, and individual project work under direction of a staff member that compliments their graduate project related to nanoscience.
**Prerequisites:** Permission of the Director of Graduate Study in Nanoscience and the professor who will supervise the study.
**Notes:** Repeatable up to 4 credits.

NAN 698 Professional MS in Nanoscience Internship 6
Prerequisite: Graduate student in nanoscience or permission of instructor;
**Notes:** Grade: Satisfactory/Unsatisfactory (S/U).

NAN 699 Thesis 1-6

NAN 705 Macromolecular and Supramolecular Chemistry 3
This course provides the fundamental concepts of macromolecular and supramolecular chemistry, self-assembly methodologies for supramolecular architectures, synthesis of hybrid nanomaterials and their applications in nanoscience and nanoengineering.
**Prerequisites:** Nanochemistry (NAN 601) or Advanced Organic Chemistry course (CHE 553) or equivalent.

NAN 710 Scientific Integrity 1
Explores contemporary issues related to scientific integrity and responsible conduct in research. Case-driven topics expose students to the issues that arise in scientific research and ways to handle these issues.
**Prerequisites:** Student at UNCG or JSNN or Permission of Instructor.

NAN 711A ExCr: Molecular Modeling Mthds 3
The course will focus on the structure and function of biomolecules as a basis for nanomolecular design, via the use of computer modeling/simulation, including in-class assembly of a 3D-modeling workstation.

NAN 711C ExpCrs: Nanoscale Reactions 3
A comprehensive introduction to principles, mechanisms and applications of homo- and heterogeneous chemical-reactions from nanoscale perspective incorporating recent research activities from selected peer-reviewed articles.

NAN 711D ExCr:Thn Fm Dpstn Etg Nnmdl Ap 4
This course reviews techniques used for thin film deposition and patterning and discusses applications in the nanobiomedical space.
NAN 711E ExpCrs: Single-Molecule Biophys 3
Experimental methodologies and theoretical underpinnings of single-molecule biophysics research, with a focus on the role of such studies in nanoscience. Topics include widely-used preparations, techniques, and models for interpreting results.

NAN 711F ExpCrs: Scientific Integrity 1
Explores contemporary issues relating to scientific integrity and responsible conduct in research (RCR). Topics expose students to the issues that arise in scientific research such as authorship on publications, use of animals and human subjects, conflicts of interest, etc. and ways to handle these issues.

NAN 711X EC: Nanotechnology in Drug Delivery 1
This course is designed to provide students with an understanding of the current state of the art for advanced drug delivery with particular focus on nanotechnology and highlight several areas of opportunity where current and emerging nanotechnologies could enable entirely novel classes of therapeutics.

NAN 724 Nanoscale Reactions 3
A comprehensive introduction to principles, mechanisms and applications of homo- and heterogeneous chemical or physical-reactions from nano-scale perspective incorporating recent research activities from selected peer-reviewed articles.

NAN 730 Nanoscale Reactions 3
A comprehensive introduction to principles, mechanisms and applications of homo- and heterogeneous chemical or physical-reactions from nano-scale perspective incorporating recent research activities from selected peer-reviewed articles.

Prerequisites: NAN 601, NAN 602, NAN 603 or equivalent courses.
Corequisites: Graduate student at UNCG or JSNN or permission of instructors.

Notes: Nanoscience, chemistry, biology and physics graduate students.

NAN 735 Nanomaterials and Reactions by Design 3
Prerequisite: Graduate student in nanoscience or permission of instructor. Nanoscience graduate students must have completed JSNN's Fundamentals of Nanoscience Courses, i.e. NAN 601, 602, 603, 604 or NAN 701, or their equivalent.

NAN 740 Nonlinear Waves in Biological Excitable Media 3
Dynamics of reaction-diffusion waves and implementation of theoretical methods to the analysis of these waves in cardiac muscle and nerves.
Prerequisites: Graduate student in nanoscience or permission of instructor.

NAN 745 NanoImaging 3
Use of nanoparticles for in vivo diagnostic medical imaging and therapy.
Prerequisites: Graduate student in nanoscience or permission of instructor.

NAN 750 Nanomedicine 3
General underlying mechanisms leading to inflammation, infectious disease, cancer, and autoimmune disease and the potential nanotechnology has on diagnosing, preventing, and treating these diseases.
Prerequisites: Graduate student in nanoscience or permission of instructor. Basic biology.

NAN 771 Computational Quantum Nanochemistry 3
Fundamentals of computational quantum mechanics and related computational methods applicable to nanoscience. Includes hands-on computer exercises.
Prerequisites: Graduate student in nanoscience or permission of instructor.