

Graduate Studies in Nanotechnology at the University of Washington



NANOTECH & MOLECULAR ENGINEERING RESEARCH

Our increasingly sophisticated ability to control the composition and morphology of matter on the atomic scale is advancing our understanding of the natural world and opening new pathways to develop novel processes and products.



Research topics are diverse, ranging the areas of biology and medicine, bio-inspired and functional materials, and nanoscale devices. For example:

- ▶ Synthesize smart nanoparticles that target cancerous tumors
- ▶ Use nanotools to study cellular mechanisms and diagnose diseases
- ▶ Develop low-cost materials for next generation solar cells and optoelectronic devices
- ▶ Learn how to engineer novel bioinspired nanomaterials

Nanoscale science and engineering is inherently interdisciplinary, blurring the traditional boundaries between chemical, physical, and biological sciences.

To learn more about the diverse faculty participating in the NTME program, or to apply, visit:

www.MoIES.washington.edu/NTME

NanoTechnology & Molecular Engineering (NTME) Dual-Titled Ph.D. Program

The NanoTechnology & Molecular Engineering (NTME) Program allows current UW graduate students in participating departments the opportunity to earn a dual-titled Ph.D. degree in their home department and nanotechnology. Students acquire intellectual depth by meeting all of the requirements for a Ph.D. in their home department while gaining breadth of experience by completing courses and laboratory rotations outside their department and defending a dissertation on an approved nanotechnology topic. Students may join the program after being admitted to pre-doctoral studies in one of the eleven participating departments:

- ▶ Biochemistry
- ▶ Bioengineering
- ▶ Chemical Engineering
- ▶ Chemistry
- ▶ Electrical Engineering
- ▶ Genome Sciences
- ▶ Materials Science & Engineering
- ▶ Mechanical Engineering
- ▶ Microbiology
- ▶ Physics
- ▶ Physiology and Biophysics

To date, there are over 40 students enrolled in the program. More than 50 students have earned a dual-titled Ph.D. in nanotechnology and are now enjoying successful careers in a wide range of academic, governmental, and industrial settings as faculty members, staff scientists, policy analysts, entrepreneurs, and research engineers.

Join the Molecular Engineering & Sciences Research Community!

Students in the NTME Program are part of a growing community of Molecular Engineering and Science researchers being organized at the UW by the MoIES Institute. Founded in 2011 to catalyze translational molecular-level research, the Institute also aims to foster innovative education programs that teach the fundamental aspects of molecular engineering.



- ▶ **Gain** research experience with faculty and students in other UW departments.
- ▶ **Build** on your interdisciplinary research interests in a structured way.
- ▶ **Connect** with distinguished seminar speakers and program alumni and learn about nanotechnology careers and opportunities with likeminded colleagues.
- ▶ **Distinguish** yourself as an expert in an interdisciplinary and cutting-edge research area and receive recognition of this activity on your transcript.



Nano and Molecular Analysis Instrumentation

NanoTech User Facility

- ▶ Optical & Confocal Scopes
- ▶ FEI Sirion SEM & Tecnai TEM
- ▶ Bruker X-ray Diffraction
- ▶ Renishaw inVia Confocal
- ▶ Raman Microscope
- ▶ EDAX X-ray Mapping
- ▶ AFM Microscope
- ▶ Ellipsometer
- ▶ Cell Culture

NESAC/BIO

- ▶ X-ray Photoelectron Spectroscopy (XPS)
- ▶ Time of Flight Secondary Ion Mass Spec
- ▶ Scanning Probe Microscopy
- ▶ Sum Frequency Generation Spectroscopy

Analytical Biopharmacy Core

- ▶ Biacore Surface Plasmon Resonance
- ▶ Analytical Centrifugation (AUC)
- ▶ Differential Scanning Calorimetry (DSC)
- ▶ Isothermal Titration Calorimetry (ITC)

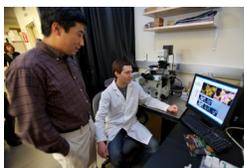
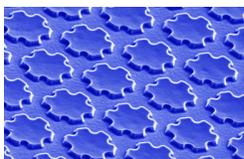
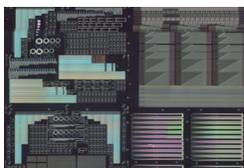
Microfabrication Facility

- ▶ E-beam and Optical Lithography
- ▶ JEOL EBL and SEM
- ▶ Physical Vapor Deposition (sputter/evap)
- ▶ Wet and Dry (Plasma Etching)
- ▶ Deep Reactive Ion Etching (DRIE)
- ▶ Plasma Enhanced Chemical Vapor Dep
- ▶ Thermal Oxidation and Diffusion
- ▶ Low Pressure CVD (Nitride and LTO)
- ▶ Rapid Thermal Annealing
- ▶ Non-contact and contact profilometry
- ▶ Thin film characterization
- ▶ Dicing, lapping, and polishing
- ▶ Electroplating
- ▶ Wire bonding, stud bumping, flip-chip

Explore Nanotechnology at the UW!

▶ Check out the characterization & nanofabrication resources on campus.

Much of the nanotech-related research at the UW takes place within the Nano & Molecular Analysis Facility (NMAF) – comprised of the Nanotech User Facility, NESAC/BIO, and Analytical Biopharmacy Core – and the Microfabrication Facility (MFF). Together the NMAF (housed in the MoIES Building) and the MFF (housed in Fluke Hall) provide state-of-the-art characterization, nanofabrication, and surface analysis instrumentation that allow users to characterize surface morphologies, measure fundamental properties of materials, and fabricate devices at the nanoscale. These instruments are provided for shared use by the UW and the Northwest's research, government, and high-tech business communities.



Combined capabilities include:

- Raman and Fluorescence Microscopy
- Scanning and Transmission Electron Microscopy
- Elemental and Surface Composition Analysis
- Materials and Crystallography Analysis
- Rapid Prototyping and Pilot Production
- Optical and Electron Beam Lithography (EBL)
- Soft Lithography and Microfluidics
- Plasma Etch and Deposition
- Thermal Processing
- Surface Micromachining
- Silicon and III-V Photonics Foundry
- Nano and Microelectronics Fabrication
- NEMS/MEMS Fabrication
- Die Depackaging and Failure Analysis Imaging
- Electronics Packaging and Assembly

Contact MoIES@uw.edu to arrange a tour!

▶ Join the Nano & Molecular Engineering Student Organization.

Connect with likeminded students eager to develop careers in nanotech fields and connect with the community through outreach. Attend formally organized activities and workshops as a general member or participate in planning, interacting with speakers, and networking as an active member. Contact NaNsa-o12@uw.edu for more information.

▶ Apply to the NTME Dual Ph.D. Program.

Current UW graduate students enrolled in one of the 11 participating predoctoral programs who are in good standing may apply for admission to the dual degree program. Visit www.MoIES.washington.edu/NTME for application and details.



**Molecular Engineering
& Sciences Institute**

www.MoIES.washington.edu/NTME

For more information about MoIES educational programs, contact:

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