

# Molecular Engineering Ph.D. Program at the University of Washington



## PROGRAM OVERVIEW

The Molecular Engineering (MoE) Ph.D. program is an interdisciplinary graduate program housed in the Graduate School and administered through the Molecular Engineering & Sciences Institute at the University of Washington.

The program accepts students with diverse backgrounds in engineering, science, or medicine, helping match their research interests with Institute faculty from departments in the College of Arts & Sciences, the School of Medicine, the College of Engineering, and the School of Pharmacy.

## Admissions Requirements

- ▶ BS/BA degree in the field of engineering or natural sciences.
- ▶ One undergraduate college course in Thermodynamics and/or Statistical Mechanics.
- ▶ Score of at least 159 (75th percentile) on the quantitative portion of the GRE.

## Core Curriculum

Fundamentals of Molecular Properties and Material Functionalities

Material Molecular Hierarchies and Assemblies

Material and Device Functionality Guided Molecular Synthesis

Synthetic Biosystem Engineering on the Molecular Scale

## Details and Application

- ▶ [www.MoES.washington.edu/PhD](http://www.MoES.washington.edu/PhD)

## Program Description

The Molecular Engineering Ph.D. program takes a rational approach to engineering highly-complex, multifunctional molecular systems, drawing on fundamental principles shared across various fields of engineering and sciences that develop materials with organic, biological or inorganic/organic hybrid molecular architecture. The interdisciplinary program trains students in the fundamental aspects of molecular engineering, including molecular design and synthesis, theory and computation, and molecular material characterization.

The program will train students to become experimentalists or theoreticians who can design and characterize molecules and systems of molecules, model molecular system behaviors and inspire new molecular designs, and recognize and exploit molecular and nanoscale system constraints that impact system functionalities.

- ▶ Customize an engineering degree program relevant to your research interests in clean technology or biotechnology that builds on your degree in engineering or natural science.
- ▶ Develop a systemic, rational approach to engineering molecular systems that can be applied in fields as diverse as energy, healthcare, or technology.
- ▶ Collaborate with distinguished faculty from departments and colleges across the UW.

## Join the Molecular Engineering & Sciences Research Community!

MoE Ph.D. students are part of a growing community of Molecular Engineering and Science researchers organized at the UW by the MoES Institute. Founded in 2011 to catalyze translational molecular-level research, the Institute has more than 120 faculty members from colleges and departments across the university.



- ▶ Meet nationally and internationally recognized experts in the developing field of molecular engineering, collaborative faculty, and like-minded colleagues.
- ▶ Access state-of-the-art facilities and instrumentation for molecular-scale analysis.
- ▶ Distinguish yourself as an expert in an interdisciplinary and cutting-edge research area, prepared for a leading career in molecular engineering and sciences – in industry, at a national lab, or within academia.



## Research Areas

The following are just a few areas of research students in the MoE PhD program have pursued while at the University of Washington:

### CleanTech Research

- ▶ Material and device functionality guided molecular synthesis
- ▶ Molecular structure and solid condensed phase assembly
- ▶ Structure effects on electronic and photonic material properties
- ▶ Optoelectronic properties such as light absorption, fluorescence, and phosphorescence
- ▶ Charge transport mechanisms in organic materials
- ▶ Organic light emitting diodes, field-effect transistors, and organic photovoltaic devices
- ▶ Electro-optical properties of organic systems
- ▶ Electrochemical Cells
- ▶ Energy Storage

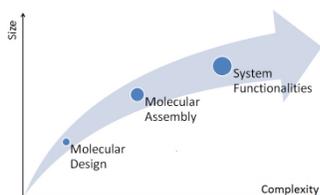
### BioTech Research

- ▶ Synthetic biosystem engineering on the molecular scale
- ▶ Design of bio-molecular building blocks
- ▶ Artificial biochemical reaction networks and devices
- ▶ Biomolecular engineering involving DNA and proteins
- ▶ Gene regulation and signaling
- ▶ Chemical kinetics/stochastic processes
- ▶ Hierarchical systems
- ▶ Metabolic functionalities

## Plan of Study

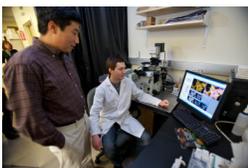
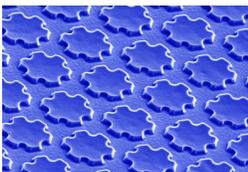
- ▶ Take core courses that cover molecular properties and material functionalities; material molecular hierarchies and assemblies; and molecular design principles. Students interested in cleantech applications will learn principles for developing functional materials and devices while those interested in biotechnology will focus on synthetic biosystem engineering.
- ▶ Choose elective courses to specialize in cleantech or biotech research areas and learn about molecular synthesis and design; characterization and analysis; and assembly and modeling.
- ▶ Attend interdisciplinary seminars with renowned experts in molecular engineering fields.
- ▶ Complete research in the lab of a participating member in the Molecular Engineering & Sciences (MoES) Institute .

## Molecular Engineering at the UW



The UW is leading the nation with its cutting edge degree program designed to provide students training that provide both breadth in its fundamental molecular description of matter (including synthesis, modeling and characterization) and depth in its specialization towards molecular systems. The program is administered by an interdisciplinary committee with representatives from Bioengineering, Chemical Engineering, Chemistry, Electrical Engineering, Computer Science, Physics, Materials Sciences, and Mechanical Engineering.

## State-of-the-Art Research Facilities



Supporting much of the molecular engineering research at the University of Washington are the Molecular Analysis Facility (MAF) and the Washington Nanofabrication Facilities (WNF). Together these facilities 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.

To learn more about how these facilities might benefit your research or schedule a tour, visit their web sites:

[www.wnf.washington.edu](http://www.wnf.washington.edu) and [www.moles.edu/MAF](http://www.moles.edu/MAF)



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& Sciences Institute**

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