Nanotechnology: Mystery Science or Small Materials Doing Big Things?

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Course Description

This is a Course-based Research Experience (CRE) class that will provide you with the chance to propose, design, and conduct your own research project, working on topics and seeking answers to questions that are currently unknown to this discipline.

This course is limited to students ages 16 to 18 by June 15, 2025.

This CRE course will be conducted in a Hybrid format. The first 2 weeks will be virtual with you researching your chosen topic and learning about various scientific techniques that can be used to test your hypothesis. There will be live sessions each week where we will discuss your projects and provide feedback on the experimental design. You will spend the next 3 weeks on campus at Brown conducting your research or performing your experiments in our facilities.

Nanotechnology, the science of small things, is a field that dates back to ancient Egyptians, who used nanoparticles to make colorful [illegible] are developing nanorobots that can roam your body and monitor disease [illegible] e forefront of every scientist's mind and is revolutionizing the world!

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In this course, you will make nanomaterials and explore why they are so exciting to so many fields. You will learn the fundamentals of nanotechnology and what makes these materials so special for so many applications, from medicine to energy. You will participate in interactive lectures aimed at learning the fundamental and applied science behind nanotechnology. Specifically, chemical bonding, grain size, crystallinity, energy, physics, and chemistry will be combined as you make nanoparticles and explore the multitude of products that currently contain nanoparticles. And since nanoparticles are too small to see individually with the naked eye, you will also learn state-of-the-art nanoparticle characterization techniques that can help scientists characterize nanomaterials.

As a CRE course, you will answer your own research questions. Specifically, you will design and fabricate a nanomaterial that can address a significant problem in today's society (for example, global warming, improved disease detection and treatment, or lack of clean water). You will compare your nanotechnology solution to what is used today, developing advantages and disadvantages of their approach. You will use the scientific process of developing a hypothesis, designing an experiment to make and test such nanoparticles, and analyze the results. Finally, you will present their work and findings to the class.

By the end of this course, you will:

- Understand what makes nanotechnology so unique for numerous scientific applications
- Be able to critically evaluate existing and new nanotechnology advances
- Understand how to characterize nanomaterials
- Utilize the scientific process to develop brand new nanomaterials to address a societal concern of your choosing
- Effectively communicate scientific findings and results in both oral and in written format

At the end of the course, you will have learned the fundamental and applied science that goes into nanotechnology for a diverse range of applications. You will also have learned a number of laboratory techniques in making and characterizing nanoparticles for specific applications. You will discover the process of designing, executing, and analyzing their own experiments. Further, through reading and analyzing journal articles, you will have learned state-of-the-art nanotechnology for addressing society's largest concerns.

Since this course will take place in a laboratory and/or involve project-based work, Brown's Department of Environmental Health and Safety has developed a dress code aimed at protecting the safety and well-being of the campus community. You will need to adhere to these attire guidelines for the duration of this course.

This course requires a laptop for course-related programming, games/simulations, etc. Please note that some devices (e.g., Chromebooks) do not allow software downloads onto a desktop and so will not accommodate the specific [illegible] ou have questions about this requirement please reach out to prec

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Prerequisites

Students completing grades 10 to 12, ages 16 to 18 by June 15, 2025. Students will be most successful in this course if they have a strong interest in science and in solving diverse, real world problems using critical thinking, hypothesis driven experiments, and data analysis.

Course Information