

UNIVERSITY of HOUSTON

NSM

momentum

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DR. RIGOBERTO ADVINCULA USES RESEARCH TO TEACH*by Noelle Heinze***Dr. Rigoberto Advincula**Associate Professor of
Chemistry**IN THIS ISSUE**[Home](#)[Dean's Message](#)[NSM's First Graduate Stays
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Imagine a thin, flexible computer screen that rolls up like a sheet of paper, a blood test performed without the prick of a needle, and sensors that detect chemical and biochemical toxins before they can harm us. Dr. Rigoberto Advincula, associate professor of chemistry at UH, imagines these things and so do his students, and through a mutually beneficial mentor/student relationship, they are working on bionano polymer research to make these scenarios possible.

"I want to see the sparkle in their eyes, then I know these are the right students to work with," says Advincula, about his undergraduate and graduate students working in his chemistry lab. Spend a few moments with Advincula, and it is immediately clear that teaching is his passion, using research to teach is his vehicle, and producing scientists trained to be independent researchers is the result. As he describes it, "I push students to have to do the work themselves, creating a situation in which the instructor becomes observer, moving to the sidelines, and in most cases my students really surprise me." Through the Welch Summer Scholar Program, a five-week residential program designed to expose high school students to university-level research, Advincula also mentors high school students.

Using a multilevel approach to mentoring, Advincula divides several projects into portions an undergraduate or high school student can work on and assigns upper-level students to work with different groups. Then, as advisor, Advincula guides the groups in planning experiments and analyzing results. In this way "scientific skills are transferred," he says. In addition to personal attention, students receive practical training with computational programs to plot and analyze results, have access to sophisticated laboratory equipment to investigate materials, and hone communication skills by interacting with UH scientists and by presenting work in seminars and posters.

"I've always been curious about plastics," says Advincula with a soft laugh, "and when I started reading articles about how common polymers are to daily life, how such a field can combine chemistry, biology, and engineering, I realized polymer research is a widely applicable field." This realization, along with a desire to know "how to make long molecules versus small molecules," eventually brought Advincula to Houston, a city with a thriving polymer industry.

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In the Advincula lab, research focuses on ultrathin polymer films with applications in advanced electronics, display technology, and biomedical devices. One goal is to develop materials to create biosensors with polymer films made of dendrimers, highly branched polymer molecules shaped like a sphere. Visualize a strand of spaghetti chopped into pieces and arranged as small branches originating from a core; this is a dendrimer, which captures DNA in very high concentrations on surfaces. So, Advincula's films are the interface between instrument and environment and can be used for DNA chips to profile genetic makeup to identify disease, as glucose sensors to detect diabetes, and as detectors for biochemical poisons. In addition, these nanostructured films can be used as coatings for bioimplant devices, such as coating a heart stent to increase mechanical strength and decrease biocorrosion.

Advincula's research group has also developed polymer materials to make light-emitting diodes for polymer flexible display devices. These light-emitting diodes produce bright colored light, applicable for large or small displays. Possible uses include car stereo displays and dashboards, large-screen televisions, and maybe one day, computer screens that roll up.

Currently, five Ph.D. candidates and several undergraduates are working on polymer research in Advincula's lab. He has seen three Ph.D. students graduate, and he has had the pleasure of watching former high school students from the summer program continue their studies in the sciences. Perhaps Advincula's pleasure is best expressed when he reveals that the very first high school student he mentored, a female minority student, is now a science teacher.

In terms of teaching, Advincula sees his responsibilities to society going "beyond Houston, beyond Texas," and for a nation that faces a potential future shortage of scientists, Advincula's commitment to education and research at UH is beyond measure.