Tapia Math-Science Scholars Program
Enhancement Speakers-Week 4
July 27, 2015: Jeffrey Nittouer, Professor in Earth Science, nittouer@rice.edu

Nittouer received his B.S. in Geology (2003) at the University of Washington, M.S. Earth and Environmental Sciences (2006) at Tulane University, and PhD in Geological Sciences (2010) at the University of Texas at Austin. His research examines sediment transport, hydrology, basin evolution, and stratigraphy of lowland river systems, in order to understand how physical processes interact to shape the Earth's surface, over modern to geological timescales. He collaborates with earth scientists, engineers, ecologists, and social scientists to evaluate broader environmental and societal applications of my research.

July 28, 2015: Francisco Vargas, Chemical and Biomolecular Engineering, fvargas@rice.edu

Mathematical modeling for oil and gas applications
One of the most important challenges that humanity will face in the near future is the need for continuous access to reliable sources of energy. Despite the tremendous efforts and important achievements in the area of renewables, fossil fuels are expected to dominate the generation of energy at least for several more decades. However, the industry requires technology to produce the residual oil that was left in the ground during primary production or from ultra deep waters. Important research has been devoted to better understand the behavior of petroleum systems at high pressures and temperatures, to predict the properties and anticipate any challenges that may occur during production. The mathematical modeling of these processes in recent years has proven extremely valuable for their contributions to find cost/effective solutions to these problems. In this talk, I will introduce the fundamentals of the mathematical modeling of these important systems. I will

Dr. Vargas holds a Ph.D. degree from Rice University, and M.S. and B.S. from Monterrey Tech, in Mexico. Vargas has been the recipient and co-recipient of several teaching and research awards in Mexico, US and UAE. His research group is focused on developing innovative experimental approaches and simulation tools to understand and predict the structure, phase behavior and thermodynamic and transport properties of complex fluids, at high temperatures and pressures.
July 29, 2015: Angel Marti, Chemistry, Bioengineering, and Material Sciences and NanoEngineering, aam4@rice.edu

New Materials from Very Small Building Blocks

The manipulation of nanometer-sized objects into ordered arrays is of fundamental importance to the design and synthesis of new materials. These materials generally possess new or amplified properties in comparison with disordered bulk systems. The organization of carbon nanotubes (small tubes made of carbon a 100 million times smaller than a pencil) to form new materials is an intense area of research in nanotechnology and important for the development of technologies based on carbon nanotubes (CNTs). Important applications of such materials involve the fabrication of improved sensors, ultrastrong materials, drug delivery, light activated therapy, gas storage, and artificial photosynthesis, among others. This presentation will show how basic principles of molecular self-assembly can be used to produce ordered arrays of carbon nanotubes and manufacture fibers with advanced optical, mechanical, and electronic properties.

Professor Marti received his B.S. Chemistry (1999) and a Ph.D. in Inorganic Chemistry (2004) at the University of Puerto Rico. He was a Postdoctoral Research Associate (2004-2008) at Columbia University, NY.

July 30, 2015: George Phillips, Ralph and Dorothy Looney Professor of BioSciences and Professor of Chemistry, georgep@rice.edu

Looking at the molecules of life: How we can see atoms and what we learn.

We use microscopes to see things with magnifications up to about 2000 times bigger than how they normally look. Electron microscopes usually go up to about 100,000 times for the magnifying power. To go beyond that, scientists have developed a technique called X-ray crystallography, that uses X-rays shined on crystals to deduce the arrangements of atoms. The method uses a lot of mathematics and physics that was developed over a hundred years ago, but the method is still used widely today. I will explain simply how it works and show some examples of 3D-printed molecules based on crystallography and relate the structures to biology and medicine.

Professor Phillips received his B.A in Biochemistry and Chemistry (1974) and Ph.D. in Biochemistry (1976) at Rice University. The overall goal of the research in his laboratory is to relate the three-dimensional structure and dynamics of proteins to their biological functions. He uses techniques of X-ray crystallography and other biophysical methods to elucidate the molecular structures, dynamics, and functions of proteins. Extensive use is made of modern computational methods to analyze the structures and their dynamics.