Hidden Before Our Eyes: Tiny World Makes Giant Leap to Silver Screen

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(PhysOrg.com) -- It's something of an understatement to say Shekhar Garde has an eye for detail. A global leader in his field, Garde works to shed new light on the hidden world of atoms and molecules. Equipped with state-of-the-art advanced imaging, molecular modeling, and computer simulation tools, he is a high-tech archeologist who scrutinizes nanoscale landscapes in search of clues, patterns, and systems that could lead to a better understanding of the most basic building blocks of life.

In the next few months Garde will unveil his latest simulations to the public and his fellow researchers. But instead of the more familiar setting of a classroom or academic conference, his molecules will come to life on silver screens in darkened IMAX movie theaters across the country.

Garde's simulations are at the heart of Molecules to the MAX, the new animated IMAX film set for release in early 2009. Carefully engineered to both entertain and educate, the movie follows the exploits of Oxy, Hydro, Hydra, and other characters who populate the world of Molecularium.

The atomic environment of nearly every shot in *Molecules to the MAX* is derived from simulations provided by Garde and his research team. Some are among the most ambitious and intricate simulations ever undertaken.

"When you watch a modern animated movie like Shrek, and you see the

fabric of the princess' dress move, it looks quite natural because animators have taken great pains to make those movements as physically realistic as possible," said Garde, head of the Department of Chemical and Biological Engineering at Rensselaer Polytechnic Institute. "In Molecules to the MAX, we've tried to push that accuracy all the way down to the level of atoms and molecules."

The first Molecularium movie, Riding Snowflakes, released in 2004, relied heavily on Garde's simulations. He said the longer 42-minute running time of the new IMAX film, along with emboldened animators and entertainers looking to push the boundaries of art and science, resulted in the need for larger, more involved simulations to flesh out the atomic environments of Molecules to the MAX.

"The artists didn't want to fake anything," Garde said. "They wanted as many simulations as possible. I've had at least 10 to 15 students over the past few years contribute to this project."

Along with the challenge of running the simulations, and working with animators to find a middle ground between their respective languages of art and science, Garde said seeing his work on the large screen added new facets to his own understanding and appreciation of the molecular world.

"When you watch a molecular trajectory rendered on a large screen, you begin to notice intricacies and patterns that aren't necessarily obvious when you're looking at it on a small computer screen," he said.

Garde submits that many of the animations that provide the basis for Molecules to the MAX were packed with "more information and detail than was probably necessary to make a given point." But it's these little details that will allow his colleagues around the world — mainly chemical engineers, chemists, and physicists — to appreciate the movie

on yet another level.

“It’s almost like an inside joke,” Garde said. “Like the lines in Shrek or Toy Story that go over the heads of many young people, but make the adults laugh.”

Massive computational power was required to bring Garde’s simulations and the animators’ vision to life on the big screen. Many of the complex scientific molecular simulations required hours, days, or even months of computer processing time to complete. Converting the raw data from those simulations into visual images for Molecules to the MAX was also time intensive. It took anywhere from a few minutes to a few hours to render a single frame the movie - with 24 frames per second, the new 42-minute IMAX movie is made up of nearly 60,000 frames. The render time will jump even higher when the film is re-formatted, later this year, to 3-D IMAX.

An early digital version of Molecules to the MAX was screened last autumn in New York at an industry convention, and the full IMAX version will be shown to theater owners and potential film buyers in California next month at the Giant Screen Cinema Association 2009 Film Expo. The Molecularium team and giant-screen movie distributor SK Films are working to build up a buzz and land deals to show the film in IMAX theaters across the country and around the world. Planning for a national public premiere later in the year is still under way.

Garde credits his research team of talented graduate and undergraduate Rensselaer students, collaborator and Rensselaer colleague Professor Angel E. Garcia, along with Molecules to the MAX production company Nanotoon Entertainment, and fellow Molecules to the MAX executive producers and Rensselaer faculty colleagues Linda Schadler and Richard Siegel for making the Molecularium project such an enjoyable endeavor. Their goal with the IMAX movie is to entertain audiences while tangibly

raising national and international science literacy with an important educational message.

Though he works closely with graduate and undergraduate students at Rensselaer, he knows it can be quite challenging to reach younger children. “If someone like me stands up to tell kids about molecules and atoms, it won’t be long before they fall asleep,” Garde said. “But Molecularium is different. It is an exciting place where molecular modeling, art, and entertainment meet education in a meaningful way. It’s a unique vehicle to tell the kind of story we’re trying to tell.”

Molecules to the MAX and Molecularium are owned and managed by Rensselaer, with additional support from the U.S. National Science Foundation. The new IMAX movie was made possible by a generous gift from Rensselaer Trustee Curtis Priem ’82, co-founder of NVIDIA, a world leader in visual computing technologies. Since Schadler first developed the idea for Molecularium in 2001, the program has become the flagship educational outreach project of Rensselaer’s NSF-funded Nanoscale Science and Engineering Center for Directed Assembly of Nanostructures.

The first Molecularium movie, Riding Snowflakes, was created to be projected in planetarium domes. The dome movie has won several awards, is still in distribution worldwide, and is in the process of being translated into several different languages. The Riding Snowflakes team returned to work on Molecules to the MAX. Garde, Schadler, and Siegel worked closely with the Nanotoon team, led by writer/director V. Owen Bush and writer/producer Kurt Przybilla.

The Molecularium team is also looking to bring Oxy, Hydra, and Hydro to the small screen. The group is in discussions to move the project forward and reach out to more people by bringing the new movie to television, creating new Molecularium shows for television, and also

making the new Molecularium content available on DVD.

As far as Garde is concerned, the more Molecularium content produced and available to the public, the better.

“My daughter is 2 years old, and right now she’d hooked on the cartoon Jungle Book,” he said. “But I hope it won’t be too long before she’s hooked on Oxy, Hydro, and Hydra in the Molecularium.”

For more information on Molecules to the MAX and the Molecularium project, visit: www.molecularium.com .

Provided by Rensselaer Polytechnic Institute