Kevin Maher, M.D., Pediatric Cardiologist and founding member of the Children’s Center for Pediatric Nanomedicine, said the application of nanotechnology to the medical field will be as profound as the invention of the light microscope was more than 300 years ago.

“Microscopes opened up a whole new world at that time because physicians could suddenly see the bacteria that were causing various illnesses and diseases,” said Dr. Maher. “Now, by applying nanotechnology to medical research, we can study and manipulate biologic systems at the sub-cellular level. Nanotechnology goes well beyond the limits of the light microscope, working at the scale of cellular machinery and molecules.”

Traditionally, basic science has approached atoms and molecules in bulk. However, nanotechnology attempts to manipulate individual atoms and molecules in ways that create new materials and functionalities. Another distinction is that medical research has, until now, relied on the expertise of clinicians and basic scientists, such as microbiologists and physiologists. In nanomedical research, engineers play a critical role as well. It’s a collaborative approach that will have far-reaching effects.

“Our teams will investigate the dynamics of cellular processes over time and detect disease in its earliest, most easily treatable stages,” said Gang Bao, Ph.D., Director of the Center for Pediatric Nanomedicine and Professor of the joint Georgia Tech-Emory biomedical engineering department. “Through these efforts, we’ll identify new non-invasive, early diagnosis methods for various diseases and create better treatment strategies through more precise medical devices.”

A far-reaching impact

So how will all of this look once it’s available for prime time? One foreseeable application is delivering chemotherapy drugs only to cancer cells (rather than the neighboring healthy cells too), which will drastically reduce the harsh side effects cancer patients experience. Dr Bao is working on nanotechnology that will allow for the repair of the gene defect that causes sickle cell disease, curing this chronic, debilitating disease. This would represent a major advance in medical science, and a wonderful improvement in the lives of tens of thousands of children with sickle cell disease. “The only disease that medical science has cured to date is smallpox,” said Dr. Maher. “Nanomedicine will bring new opportunities for the diagnosis and treatment of pediatric disease, with the real chance to cure some diseases.”

Paul Spearman, M.D., Chief Research Officer for Children’s and Vice Chair for Research in the Emory University Department of Pediatrics, agreed, adding that the Center for Pediatric Nanomedicine will be a research center like no other. “This is an area where we can really be out on the research forefront,” he said. “There are other areas where we’re getting up to speed, but in this instance, we will be in the lead right away.”
A new hub

Although nanotechnology still is very new, Atlanta already is emerging as a hub for leaders in the field. Georgia Tech has 140 nano-researchers on staff and Emory and Georgia Tech oversee two of the country’s 17 National Institutes of Health-funded adult nanomedicine centers.

“We’re doing very well in developing nanotechnologies for medicine,” said Dr. Bao. “Combining these efforts with those of the pediatric experts at Children’s is a natural extension of that.”

Engineers and physicians at the Center for Pediatric Nanomedicine will focus on five specific areas including: pediatric heart disease and thrombosis, infectious diseases, cancer, sickle cell disease and cystic fibrosis.

“The field of pediatric nanomedicine did not exist last year; we are in a unique position to develop this field of medicine and harness its potential. Children’s is very fortunate to have a world leader like Dr. Bao help us in this endeavor,” said Dr. Maher. “For me personally, it is very exciting. It will change the way we investigate, diagnose and treat pediatric disease.”

A seed grant program is under way that initially is funding eight research projects. The Center also held a workshop in May designed to highlight various pressing child health issues and initiate dialogue among the more than 100 engineers and pediatric clinicians who attended. For details on the grant program or future workshops, visit www.pedsresearch.org/centers/detail/pediatric-nanotechnology.

Dr. Spearman said the collaboration between clinicians and nanoengineers will open up many new opportunities. “Having a formal center such as this will help direct and focus their efforts. Even now, the technology continues to evolve—and we’ll be at the cutting edge of it as it moves forward,” he said. “It’s something that will draw a lot of attention from our peers and, more importantly, lead to incredible new discoveries.”

How Small is Small?

A nanoparticle of 5-10 nm in size is about:

- one thousandth the size of a red blood cell
- one millionth the size of a ladybug
- one ten-millionth the size of a baseball