Robots speed up path to discovery

July 12 2010, By Linda Shrieves

The work force at Lake Nona's Sanford-Burnham Institute includes 90 scientific staffers, 60 administrators and support personnel -- and a team of three robots. The trio is part of a $15 million investment from the National Institutes of Health, and occupies a large, glass-enclosed room on the bottom floor of Burnham's Lake Nona campus.

Although they resemble the robotic arms used in automobile assembly lines, these robots have a far different task: filling test-tubes faster than a human being. And that, scientists say, will speed up the process of scientific discovery.

"The robots are from the automobile industry," said Dr. Greg Roth, director of medicinal chemistry at Burnham's Conrad Prebys Center for Chemical Genomics. "We use them because of the accuracy and precision of their movements."

The robotic arms can fill miniature test-tube "wells" so tiny that 1,536 of them fit on a plate the size of an index card. Using such small test-tubes allows researchers to save money on chemicals and compounds.

After filling the wells, the robotic arms take a plate of the test tubes and subject them to numerous tests such as varying temperatures and pressures. The robots are connected to a main computer that compiles the data from the millions of tests.

Pharmaceutical companies developed the ultra-high throughput screening technology in the mid-1990s. But universities and non-profit

research institutions such as Burnham did not have access to the robots until recently.

Funded by NIH, the Burnham center and eight others around the country form the institute's Molecular Libraries Production Centers Network. This resource library and network assists scientists in research and allows results to be shared across the public and private sectors.

The reason for the federal government's interest? As the results of the Human Genome Project began pouring in, scientists found themselves with so many avenues to explore that they needed faster research procedures.

"My scientists like to say they can do more than a robot, but they can only do it for a day," said Michelle Palmer, director of screening for the Broad Institute at Harvard and the Massachusetts Institute of Technology.

"The humans can do it faster and better, but they can't sustain it. We need to sustain this over months of effort and get it done exactly the same way every time," Palmer said.

At Sanford-Burnham's Lake Nona campus, the robots can screen more than 1 million compounds each day -- determining if they are effectively changing targets such as one type of cancer cell or a specific protein.

When scientists discover a "hit" -- a chemical compound that alters a cell or a protein that is involved in a disease -- they are uncovering the building blocks of new drugs.

"Drug discovery is now part of our mission," said Dr. Stephen Gardell, who left a 20-year career in the pharmaceutical industry to help lead research at Sanford Burnham. "It used to be just understanding the

mechanisms of disease."

For Burnham scientists and those who apply to use the robotic system, there are plenty of advantages. In addition to speed, scientists can test any of the 300,000 compounds available from NIH's molecular library to see how they affect cells or proteins. And Burnham scientists also are testing from the 320,000 different compounds in their collection. All in search of a hit.

"Will it become a drug? We don't know," Roth said. "But it will help us find a drug -- by helping us find the exact gene that it's working on."

Standing in a room full of test plates -- containing thousands and thousands of test-tube wells -- Roth said discovering a new drug is like finding a needle in a haystack.

"And this," he said, looking around at the stacks and stacks of test plates, "is the haystack."