New self-assembly technique can help separate biological cells

NANOPARTICLES, *from A7*

to touch each other. A balance between these repulsive forces and the attractive capillary forces results in a situation where the particles remain at a specific distance from each other.

"That is how we can make a monolayer in which the distance between the particles is non-zero," Aubry said.

Not only can the precise distance between the particles be calculated, but the distance can also be changed by carefully manipulating the forces acting on the particles.

The applications of this new technique are numerous.

"The fact that we can control the gap between the particles means that we can also control the mass transfer of gas or liquid or other particles in the direction normal to the interface," Aubry said.

This property makes such materials extremely useful in drug delivery, the process of delivering pharmaceuticals to humans. Patches through which the medicines are delivered can be manufactured using materials like these.

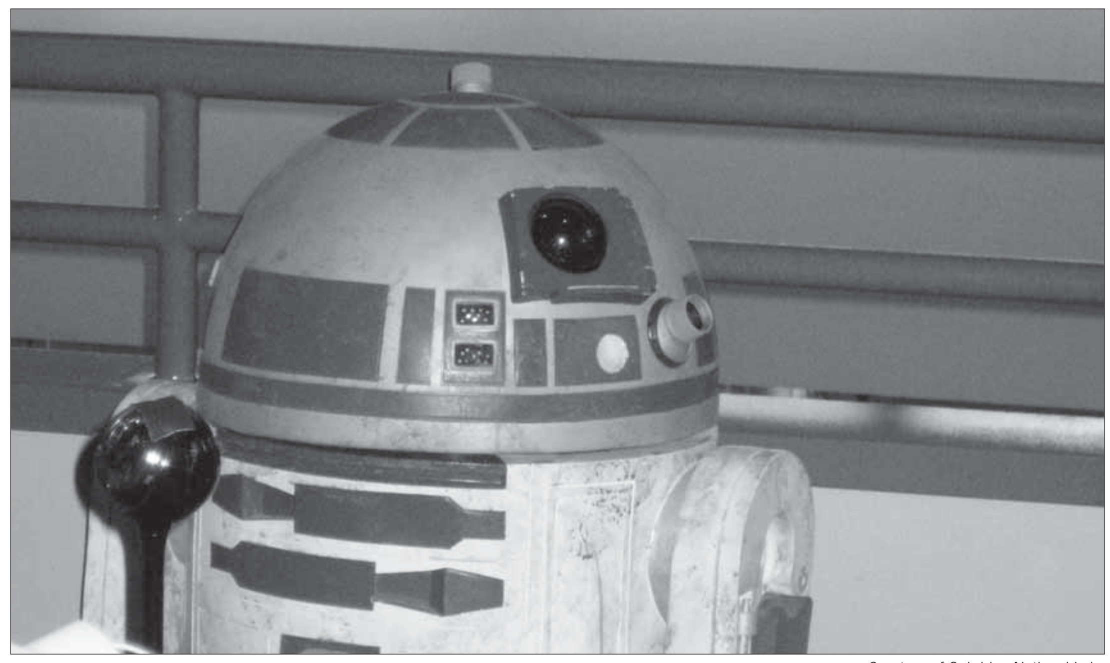
By controlling the distances between the particles, the speed at which drugs are delivered can be controlled.

Another application is in the field of optics. "[This technique] could be useful for making photonic materials. These are materials where the distance between the particles is comparable to the wavelength of light. So, you can manipulate light using these photonic materials," Singh said.

Although the development of this technique is a remarkable feat, the researchers intend to delve deeper into their area of study. Aubry mentioned that future projects include manipulating different kinds of particles like drops, biological cells, and particles with different shapes or sharp edges.

Aubry and Singh are also trying to use this technique to separate clustered biological cells, so that they can be viewed more easily and efficiently.

Popular science and science fiction robots appear at Robot Hall of Fame



Courtesy of Oakridge National Labs

R2-D2, the popularly acclaimed robot of *Star Wars*, was one of the many robots at the Robot Hall of Fame.

ROBOTS, *from A7*

play Spock in an upcoming *Star Trek* movie.

The Raibert Hopper is a one-legged robot developed by Marc Raibert, president of Boston Dynamics, in the Leg Laboratory, first at Carnegie Mellon and later at MIT. The Hopper hops around on one foot, is able to maintain balance, somersault, and jump over objects. It examines the principles of balance that have become central to agile movement by bipedal and quadrapedal robots.

Lars Nyengaard, director of innovation and education projects for LEGO Education, accepted an award for the induction of Mindstorms, a robotic kit that teaches people young and old to program and assemble robots, which make robots accessible to the masses.

Todd Jochem, a Ph.D. graduate of Carnegie Mellon's Robotics Institute, spoke on behalf of NavLab 5, an autonomous minivan developed at the Robotics Institute.

Jochem started working with robots in 1990 at Carnegie Mellon, working for Chuck Thorpe in the NavLab group. Jochem, who later founded Applied Perception Inc., was one of two students who rode in NavLab in 1995's "No Hands Across America" tour, on which NavLab 5 steered itself on public highways across the country.

Applied Perception Inc., which focused on the perception, planning, and control technologies for unmanned vehicles, was bought last year by Foster-Miller, the largest supplier of military robots. Jochem is currently the group director of Foster-Miller.

Jochem said that his work in the robot industry currently revolves around "making robots smarter and more useful." One of the industry's newest developments allows robots to help battlefield medics find and extract wounded soldiers. As of now, the robots have not been tested on an actual battlefield but "the ideas it has spawned will eventually help save lives," said Jochem.

This year's event, held at the Carnegie Science Center on April 9, was a red-carpet affair. As guests walked in, they were greeted by paparazzi, strobe lights, and soundtracks from *Star Wars*, *Star Trek*, and the like. The Entertainment Technology Center helped to pull of some of the glitz and glamour.

The interior of the Carnegie Science Center was decorated with robots and "I 'heart' robot" balloons. The guests mingled among the robots, scientists, researchers, friends, family, and robot enthusiasts.

Actor Anthony Daniels, who played C-3PO in all six *Star Wars* movies, was the master of ceremonies, as he has been since the start of the Robot Hall of Fame. He delighted the audience with his anecdotes and his enthusiastic personality.

Roboworld, a permanent robotics exhibit that will include the Robot Hall of Fame, is scheduled to open in the science center next spring. According to a Carnegie Science Center press release, the exhibition reportedly costs $3.4 million and will occupy a 6000-square-foot exhibit area on the second floor.

The Robotics Institute and the Entertainment Technology Center have also helped in the design and construction of the robotics exhibit, which will feature more than 30 hands-on, interactive exhibit stations focusing on robotic sensing, thinking, and acting.

Carnegie Mellon presents second annual Katayanagi prizes

Kristen Severson/Photo Staff

Hideo Aiso, president of TUT (left), and Randal E. Bryant, dean of the School of Computer Science (right).

PRIZES, *from A7*

and Takeo Igarashi, associate professor of computer science in the Graduate School of Information Science and Technology at the University of Tokyo.

Papadimitriou, an internationally acclaimed theorist of algorithms, received this year's Katayanagi Prize for Research Excellence, while Demaine walked away with the Katayanagi Emerging Leadership Prize in light of his extensive research in computational origami.

The awards ceremony took place Thursday in Wean Hall 7500 before a packed house of computer scientists, researchers, professors, and students.

TUT President Hideo Aiso said, "I am proud of this remarkable contribution that Christos Papadimitriou and Erik Demaine have made to high level education in computer science."

In his speech, Papadimitriou emphasized the importance of mathematics in scientific disciplines like physics, biology, and chemistry.

"The deepest and most fundamental problem [in science] is computation," Papadimitriou said.

He also shared how the computational perspective, when applied to various sciences, provides new insight into different areas of research. For example, life sciences such as biology can be approached in terms of algorithms.

"The algorithmic view is changing the sciences: mathematical, natural, life, and social. Computer science is placing itself at the center of scientific discourse and exchange of ideas," he said.

Papadimitriou, who has taught at some of the country's most prestigious schools, such as Harvard, MIT, and Stanford, specializes in analyzing and developing theories of algorithms and complexity. He uses his research in part to explore these theories' applications to databases, optimization, game theory, and natural science.

According to a Carnegie Mellon press release, Papadimitriou has authored five books, including a work of fiction, *Turing — A Novel about Computation*, which brings together love, history, and computational science in a unique amalgamation.

Sharing Papadimitriou's passion for algorithmic functions, Demaine took over the podium with his presentation, titled "Origami, Linkages, Polyhedra: Folding with Algorithms."

Demaine's work focuses on computational origami, the mathematical aspect of the centuries-old Japanese tradition of paper folding.

"[I want] to be able to answer questions that arise in science, engineering, and art reconfiguration. Folding is everywhere: in mechanics, robotics, graphics, and biology," Demaine said.

Demaine said that origami, once thought to be relatively simple, can now be approached through computational geometry.

Different forms of origami can be constructed by algorithms. Any 2-D or 3-D shape can be folded from a single square sheet of paper by measuring the required coordinates, then simulating and deriving the numerical data computationally.

This dynamic process can help computer scientists understand the procedure of folding and tackle the problems associated with it.

Also, according to Demaine, using a mix of discrete math, geometry, algorithms, equations, and graphs, even complex processes, like DNA folding and the configuration of deployable structures, can be enhanced.

"By solving folding problems, we may build reconfigurable robots from movies like *Transformers* or *Terminator 3*, hinging together a collection of pieces that reconfigure into arbitrary shapes," Demaine said.

Technical origami has become more popular in recent years due to a growing understanding of its mathematical and computational aspects, Demaine explained.

"We understand the math of building origami bases," Demaine said. "The algorithmic way of thinking makes more diverse forms of origami possible."

A collection of Demaine's artwork is currently on display in an exhibit titled *Design and the Elastic Mind* at the Museum of Modern Art in New York City. During his presentation, Demaine walked his audience through the creations of physicist Robert Lang, a student of origami for over 30 years.

"I have never seen anything like Demaine's research in Japan," Aiso said. He also added that Demaine's highly praised work in origami provides a new perspective to the Japanese culture of origami through computer science.

"I hope these prizes will grow in significance and size, and strengthen the partnership between TUT and Carnegie Mellon," Aiso said.

Dean Randal E. Bryant, along with many other distinguished members of the School of Computer Science, was also present at the awards ceremony. The award winners will present their work at TUT on May 23.