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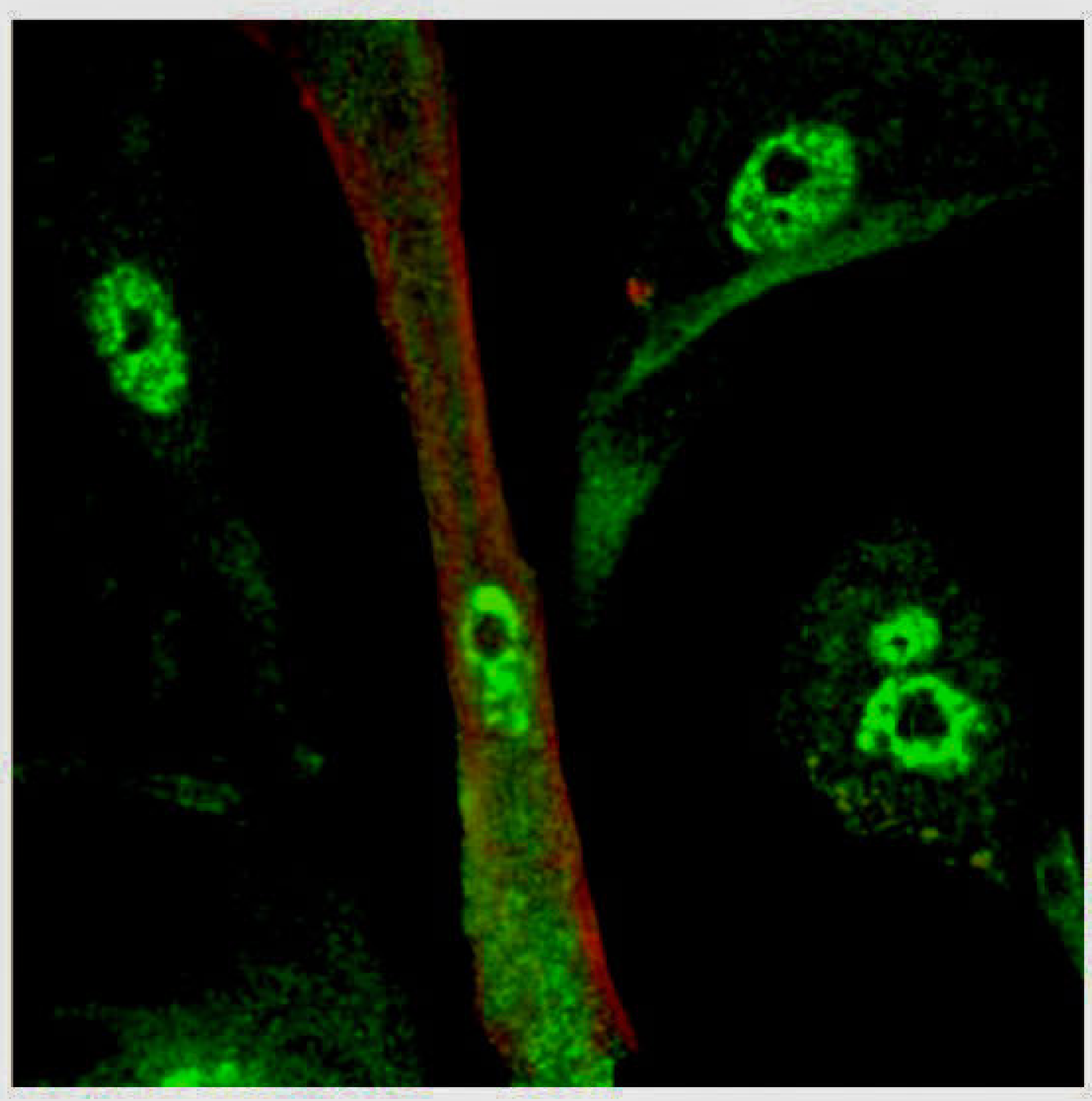
When brain meets heart...

FOR the past decade, researchers have tried to reprogram the identity of all kinds of cell types. Heart cells are one of the most sought-after cells in regenerative medicine because researchers anticipate that they may help to repair injured hearts by replacing lost tissue. Now, researchers at the Perelman School of Medicine at the University of Pennsylvania are the first to demonstrate the direct conversion of a non-heart cell type into a heart cell by RNA transfer.

Working on the idea that the signature of a cell is defined by molecules called messenger RNAs (mRNAs), which contain the chemical blueprint for how to make a protein, the investigators changed two different cell types, an astrocyte (a star-shaped brain cell) and a fibroblast (a skin cell), into a heart cell, using mRNAs.

James Eberwine, PhD, the Elmer Holmes Bobst Professor of Pharmacology, Tae Kyung Kim, PhD, post-doctoral fellow, and colleagues report their findings online in the Proceedings of the National Academy of Sciences. This approach offers the possibility for cell-based therapy for cardiovascular diseases.

"What's new about this approach for heart-cell generation is that we directly converted one cell type to another using RNA, without an intermediate step," explains Eberwine. The scientists put an excess of heart cell mRNAs into either astrocytes or fibroblasts using lipid-mediated transfection, and the host cell does the rest. These RNA populations (through translation or by modulation of the expression of other RNAs) direct DNA in the host nucleus to change the cell's RNA populations to that of the destination cell type (heart cell, or tCardiomyocyte), which in turn changes the phenotype of the host cell into the destination cell.



Cardiomyocyte (center), showing protein distribution (green and red colors) indicative of a young cardiomyocyte.

The method the group used, called Transcriptome Induced Phenotype Remodeling, or TIPeR, is distinct from the induced pluripotent stem cell (iPS) approach used by many labs in that host cells do not have to be dedifferentiated to a pluripotent state and then redifferentiated with growth factors to the destination cell type. TIPeR is more similar to prior nuclear transfer work in which the nucleus of one cell is transferred into another cell where upon the transferred nucleus then directs the cell to change its phenotype based upon the RNAs that are made. The tCardiomyocyte work follows directly from earlier work from the Eberwine lab, where neurons were converted into tAstrocytes using the TIPeR process.

The team first extracted mRNA from a heart cell, then put it into host cells. Because there are now so many more heart-cell mRNAs versus astrocyte or fibroblast mRNAs, they take over the indigenous RNA population. The heart-cell mRNAs are translated into heart-cell proteins in the cell cytoplasm. These heart-cell proteins then influence gene expression in the host nucleus so that heart-cell genes are turned on and heart-cell-enriched proteins are made.

To track the change from an astrocyte to heart cell, the team looked at the new cells' RNA profile using single cell microarray analysis; cell shape; and immunological and electrical properties. While TIPeR-generated tCardiomyocytes are of significant use in fundamental science it is easy to envision their potential use to screen for heart cell therapeutics, say the study authors. What's more, creation of tCardiomyocytes from patients would permit personalized screening for efficacy of drug treatments; screening of new drugs; and potentially as a cellular therapeutic.

These studies were enabled through the collaboration of a number of investigators spanning multiple disciplines including Vickas Patel, MD and Nataliya Peternko from the Division of Cardiovascular Medicine, Miler Lee, PhD and Junhyong Kim, PhD from the Department of Biology and Jai-Yoon Sul, PhD and Jae Hee Lee, PhD also from the Department of Pharmacology, all from Penn. This work was funded by grants from the W. M. Keck Foundation, the National Institutes of Health Director's Office, and the Commonwealth of Pennsylvania

Source: Science Daily

BAY WATCH

Threats from the Bay

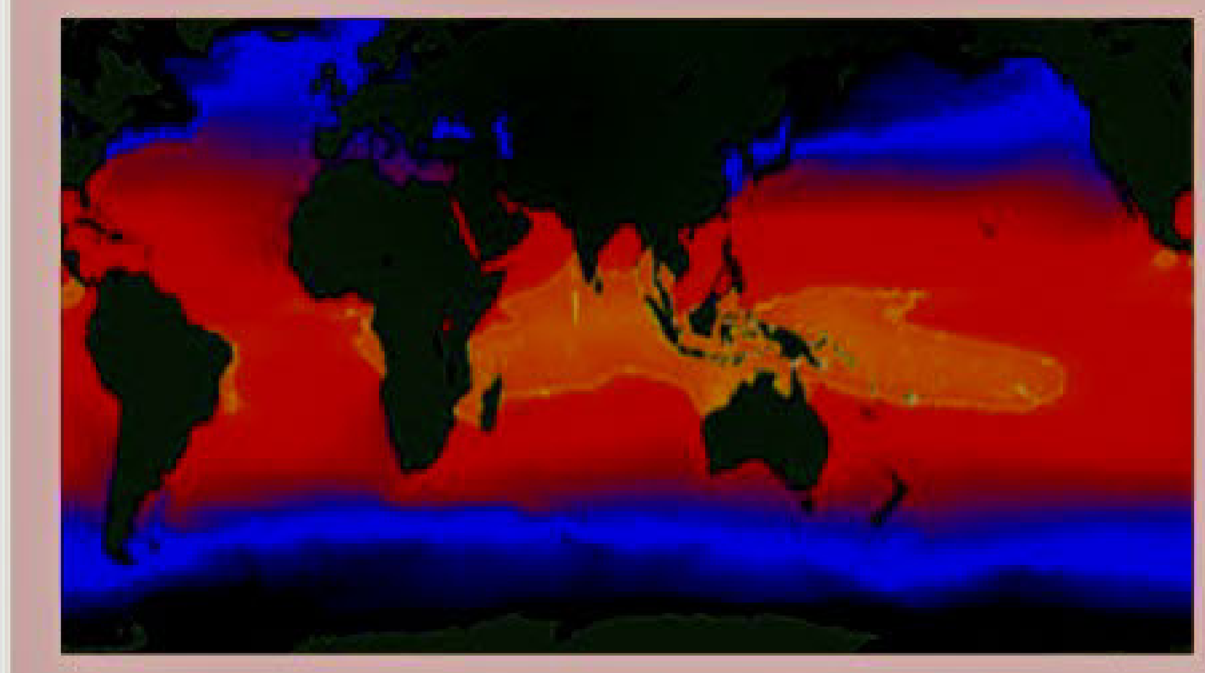
ENGR. NOMANA INTEKHAB HADI

DAY by Day Bangladesh is turning into a submerged landmass. According to The United Nations Intergovernmental Panel on Climate Change it has been predicted that the rising sea levels will devour 17 per cent of Bangladesh by 2050, displacing at least 20 million people where more than 155 million people live in the country. Lack of proper ocean observing system, 2012 might be the centenary of the sinking titanic of the low lands of Bangladesh The National Oceanic and Atmospheric Administration of Bangladesh, should focus on the exciting progress to date also shows the size of the remaining opportunity. We have measurably and pathetically few measurements of the oceans relative to their importance to life on Earth and the extent to which we rely on them for energy, weather, food and recreation. As it clearly has found the devastating impacts of Sea Surface Temperature (SST) rise and sea-level rise (SLR) on cyclonic storm surge flooding in Bangladesh. The rising of uneven sea levels do threaten to the residents in densely populated coastal areas near to Bay of Bengal.

According to Climate System Model of Bay of Bengal it can be illustrated that the heating by about 1 degree Fahrenheit, or 0.5 degrees Celsius, in the past 50 years, was occurred due to human-generated emissions of greenhouses gases and many more. The Quantifying of heat and fresh water balance, as well as the large-scale circulation changes, warm pool through the use of observations and numerical models can be crucial to understanding the subtle sea-level changes occurring in that region, The Bangladesh non-governmental organization Coastal Watch report claims of losing homes of an average of 11 Bangladeshis to rising waters every hour. Moreover, 15 per cent of Sundarbans region on the northern shore of the Bay of Bengal will also be submerged by 2020. More frequent and extreme storms are likely to experience as the sea-water temperature in the Bay of Bengal rises due to global warming. Particular changes in monsoonal rain patterns which can alter river flows and land subsidence were all contributing to the inundation of land in the northern Bay of Bengal.

To reduce the possible losses due to global warming , rising in sea level it has become a burning requirement to promote a central forecasting system to describing, understanding, and predicting the Bay of Bengal's climate system is observation. Implementing such an approach requires the capability to routinely and rapidly detect and predict changes in the state of the coastal environment.

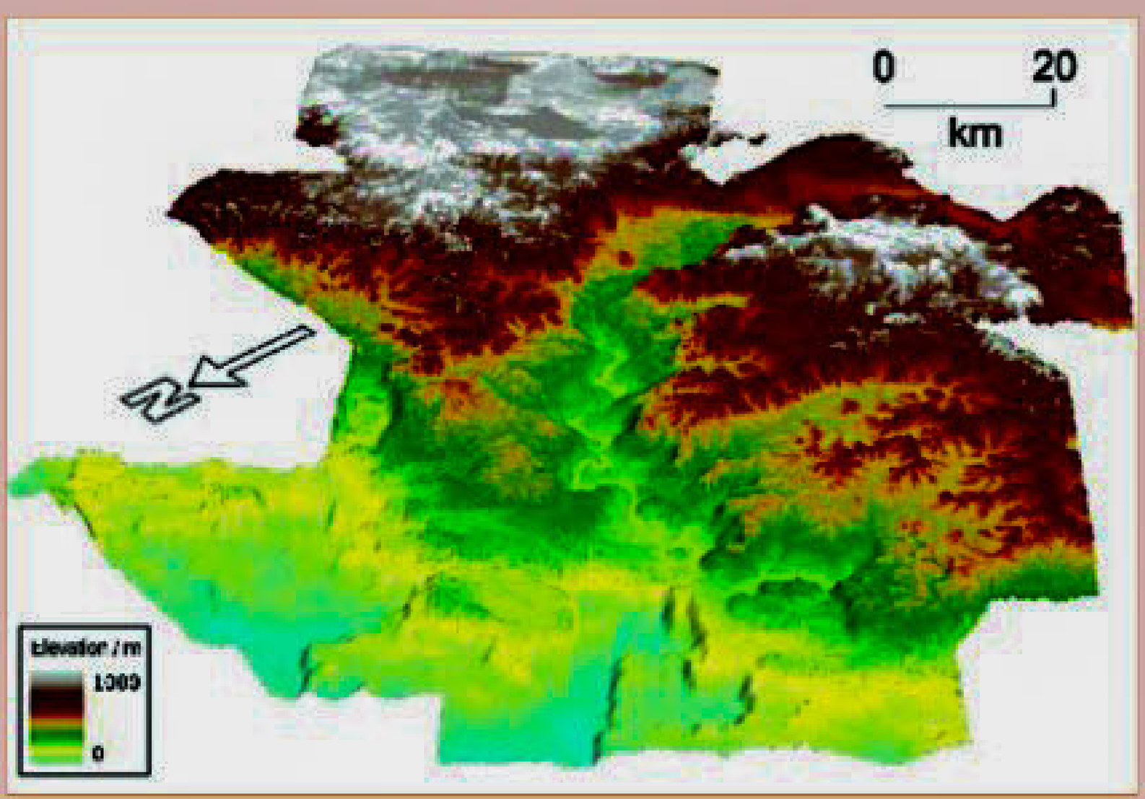
The writer is a PhD Student at Massachusetts Institute of Technology (MIT), USA.



Bay of Bengal is at warm region where there the waters of the warm pool are warmer than any those of any other open ocean on Earth. The warm pool has a large effect on the climate of surrounding lands

LOST WORLD

Atlantis discovered?



This image of the ancient buried landscape was discovered deep beneath the sediment of the North Atlantic Ocean

BURIED deep beneath the sediment of the North Atlantic Ocean lies an ancient, lost landscape with furrows cut by rivers and peaks that once belonged to mountains. Geologists recently discovered this roughly 56-million-year-old landscape using data gathered for oil companies.

"It looks for all the world like a map of a bit of a country onshore," said Nicky White, the senior researcher. "It is like an ancient fossil landscape preserved 2 kilometers (1.2 miles) beneath the seabed."

So far, the data have revealed a landscape about 3,861 square miles (10,000 square km) west of the Orkney-Shetland Islands that stretched above sea level by almost as much as 0.6 miles (1 km). White and colleagues suspect it is part of a larger region that merged with what is now Scotland and may have extended toward Norway in a hot, prehuman world.

The discovery emerged from data collected by a seismic contracting company using an advanced echo-sounding technique. High pressured air is released from metal cylinders, producing sound waves that travel to the ocean floor and beneath it, through layers of sediment. Every time these sound waves encounter a change in the material through which they are traveling, say, from mudstone to sandstone, an echo bounces back. Microphones trailing behind the ship on cables record these echoes, and the information they contain can be used to construct three-dimensional images of the sedimentary rock below, explained White, a geologist at the University of Cambridge in Britain.

Source: Live Science

NANOCUT

How to cut a nanotube

DEBASHISH CHAKRABARTY

A pipefitter knows how to make an exact cut on a metal rod. But it's far harder to imagine getting a precise cut on a carbon nanotube, with a diameter 1/50,000th the thickness of a human hair.

In a paper published this month in the British journal Proceedings of the Royal Society A, researchers at Brown University and in Korea document for the first time how single-walled carbon nanotubes are cut, a finding that could lead to producing more precise, and higher-quality nanotubes. Such manufacturing improvements likely would make the nanotubes more attractive for use in automotive, biomedicine, electronics, energy, optics and many other fields.

"We can now design the cutting rate and the diameters we want to cut," said Kyung-Suk Kim, professor of engineering in the School of Engineering at Brown and the corresponding author on the paper.

The basics of carbon nanotube manufacturing are known. Single-atom thin graphene sheets are immersed in solution (usually water), causing them to look like a plate of tangled spaghetti. The jumbled bundle of nanotubes is then blasted by high-intensity sound waves that create cavities (or partial vacuums) in the solution. The bubbles that arise from these cavities expand and collapse so violently that the heat in each bubble's core can reach more than 5,000 degrees Kelvin, close to the temperature on the surface of the sun. Meanwhile, each bubble compresses at an acceleration 100 billion times greater than gravity. Considering the terrific energy involved, it's hardly surprising that the tubes come out at random lengths. Technicians use sieves to get tubes of the desired length. The technique is inexact partly because no one was sure what caused the tubes to fracture.

Materials scientists initially thought the super-hot temperatures caused the nanotubes to tear. A group of German researchers proposed that it was the sonic boomlets caused by collapsing bubbles that pulled the tubes apart, like a rope tugged so violently at each end that it eventually rips.

Kim, Brown postdoctoral researcher Huck Beng Chew, and engineers at the Korea Institute of Science and Technology decided to investigate further. They crafted complex molecular dynamics simulations using an array of supercomputers to tease out what caused the carbon nanotubes to break. They found that rather than being pulled apart, as the German researchers had thought, the tubes were being compressed mightily from both ends. This caused a buckling in a roughly five-nanometer section along the tubes called the compression-concentration zone. In that zone, the tube is twisted into alternating 90-degree-angle folds, so that it fairly resembles a helix.

That discovery still did not explain fully how the tubes are cut. Through more computerized simulations, the group learned the mighty force exerted by the bubbles' sonic booms caused atoms to be shot off the tube's lattice-like foundation like bullets from a machine gun.

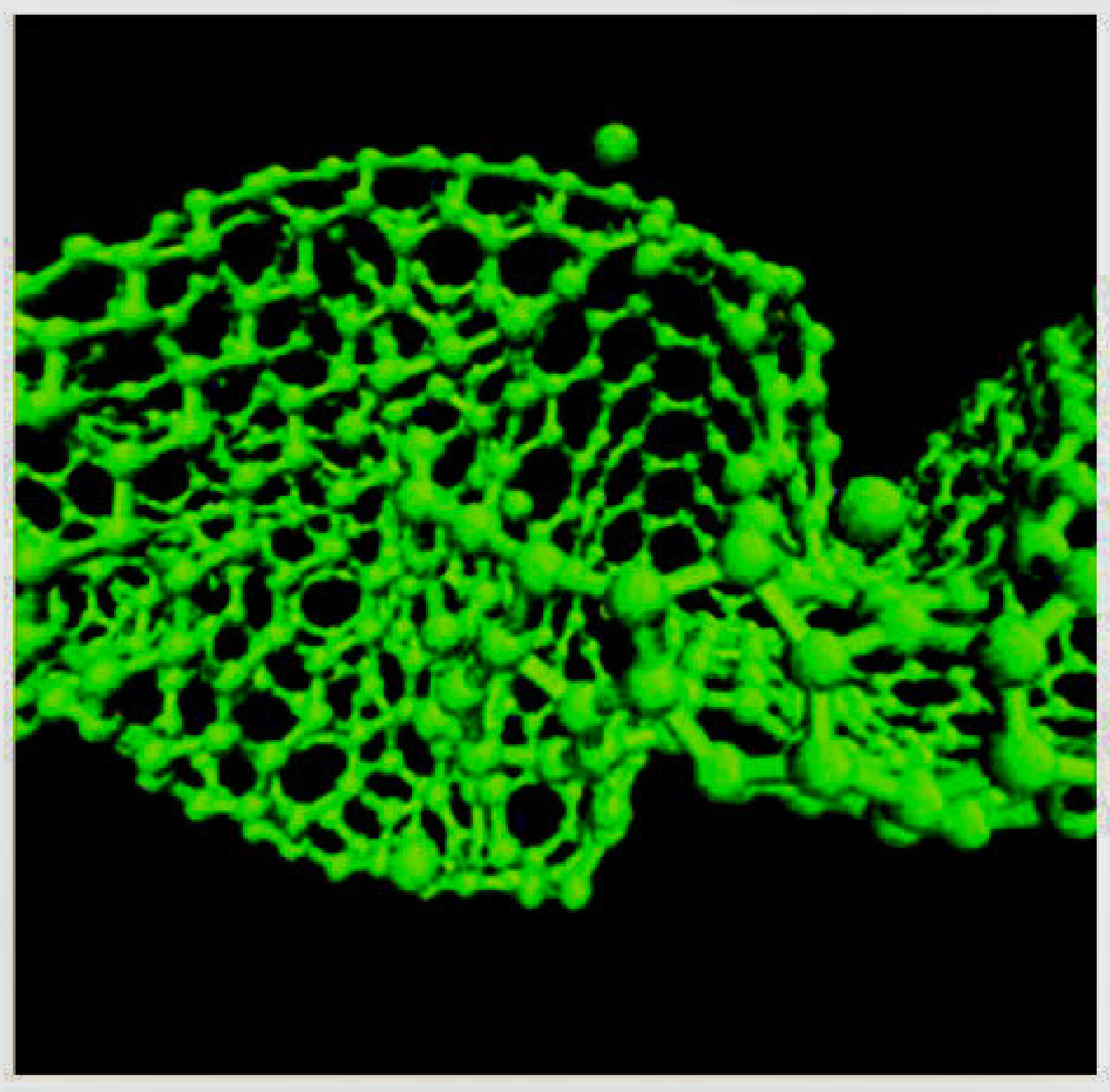
"It's almost as if an orange is being squeezed, and the liquid is shooting out sideways," Kim said. "This kind of fracture by compressive atom ejection has never been observed before in any kind of materials."

The team confirmed the computerized simulations through laboratory tests involving sonication and electron microscopy of single-walled carbon nanotubes.

The group also learned that cutting single-walled carbon nanotubes using sound waves in water creates multiple kinks, or bent areas, along the tubes' length. The kinks are "highly attractive intramolecular junctions for building molecular-scale electronics," the researchers wrote.

Huck Beng Chew, a postdoctoral researcher in Brown's School of Engineering, is the first author on the paper. Myoung-Woon Moon and Kwang Ryul Lee, from the Korea Institute of Science and Technology, contributed to the research. The U.S. National Science Foundation and the Korea Institute of Science and Technology funded the work.

The writer studies at Department of Computer Science and Engineering BRAC University.



Science festival at BUET

RAFIQUL ISLAM

A two-day science festival was organised on June 22, at the Engineering University Higher Secondary School (EUHSS).

In the Group A, a Wind regulated water aerator project from Vikarunnesa Noon School and College was adjudged the first, while Passive Air Condition from (EUHSS) got second position and Conserving Biodiversity by in vitro culture by Dhaka Imperial college won the third place.

In the group B, Green House Effect by EUHSS won first, Elevated Express Way from St. Joseph Higher Secondary School got the second place, while Magic Switch model, a switch model designed to prevent sparking in circuit, from Engineering University Girls school, came out as the third.

In Group C, Management of house trash was adjudged first, Digital Bangladesh Mission-2021 second, while Program to protect Environment pollution got third position.

The Vice-chancellor of BUET handed over the prizes among the winners as the chief guest.

The writer is a student of Rajuk Uttara Model College

EVOLUTIONARY TRICK

Shining sea snails

Source: Live Science

The marine snail Hinea brasiliana produces bright green flashes of light as an alarm when other creatures rub past its shell. Also known as the clusterwink snail, the H. brasiliana can typically be found in tight groups at rocky shorelines. When something startles the snail, it retreats into its shell and produces a flashing light, which pulsates once every hundred milliseconds or less. Researchers at the Australian Museum in Sydney theorize that this light response may allow the animals to communicate while remaining safe inside their hard shells.

DID YOU KNOW?

Which is biggest frog on Earth?

World's largest frog

There are close to 4,000 known species of frogs, including toads. They range in size from less than half an inch to nearly a foot long and come in a rainbow of colors and patterns.

The biggest frog is the appropriately named Goliath frog (Conraua goliath) of Cameroon. They reach nearly 30cm (a foot) and weigh as much as 3,3 kilograms (7 lb). The smallest frog is the Gold frog (Psyllophryne Didactyla) of Brazil. They grow to only 9,8 mm (3/8 inch).