

## UNDERSTANDING CLIMATE CYCLE

# Oceanic bacteria to help

**U**NDERSTANDING the flow and processing of carbon in the world's oceans, which cover 70 percent of Earth's surface, is central to understanding global climate cycles, with many questions remaining unanswered. Between 200 and 1,000 meters below the ocean surface exists a "twilight zone" where insufficient sunlight penetrates for microorganisms to perform photosynthesis. Despite this, it is known that microbes resident at these depths capture carbon dioxide that they then use to form cellular structures and carry out necessary metabolic reactions so that they can survive and reproduce.

Details are now emerging about a microbial metabolic pathway that helps solve the mystery of how certain bacteria do this in the dark ocean. These research results, which are enabling a better understanding of what happens to the carbon that is fixed in the oceans every year, were published by a team of researchers, including those from the U.S. Department of Energy (DOE) Joint Genome Institute (JGI), in the Sept. 2, 2011 edition of Science.

Carbon fixation in the dark ocean has so far been attributed primarily to the Archaea, single-



Bigelow's Dashiell Masland working with a Tecan Freedom EVO robotic liquid handler

celled organisms that often live in extreme environmental conditions. In this region of the ocean, the bacteria living there were thought to rely on organic compounds for both energy and carbon. According to DOE JGI collaborator Ramunas Stepanauskas, Director of the Bigelow Laboratory Single Cell Genomics Center and

senior author of the Sciencepaper, "Previous oceanographic models suggested that Archaea do not adequately account for the amount of carbon that is being fixed in the dark ocean. Our study discovered specific types of Bacteria rather than Archaea, and their likely energy sources that may be responsible for this major, unac-

counted component of the dark ocean carbon cycle."

To overcome the challenge that had hindered studies of deep ocean microbes, which have not yet been cultivated in the laboratory, researchers employed innovative single-cell genomics techniques, where DOE JGI's Tanja Woyke and Alexander Sczyrba,

Bigelow Laboratory's Ramunas Stepanauskas and their teams are among the pioneers. Study co-author Woyke explained, "After we sequenced the genomes of single cells that were isolated by our colleagues at Bigelow, it was possible to verify the predominant bacterial lineages capable of trapping carbon in this deep underwater region.

"This study represents a pristine example for the use of single cell genome sequencing to decipher the metabolic capabilities of uncultured natural microbial consortia, providing a powerful complement to metagenomics."

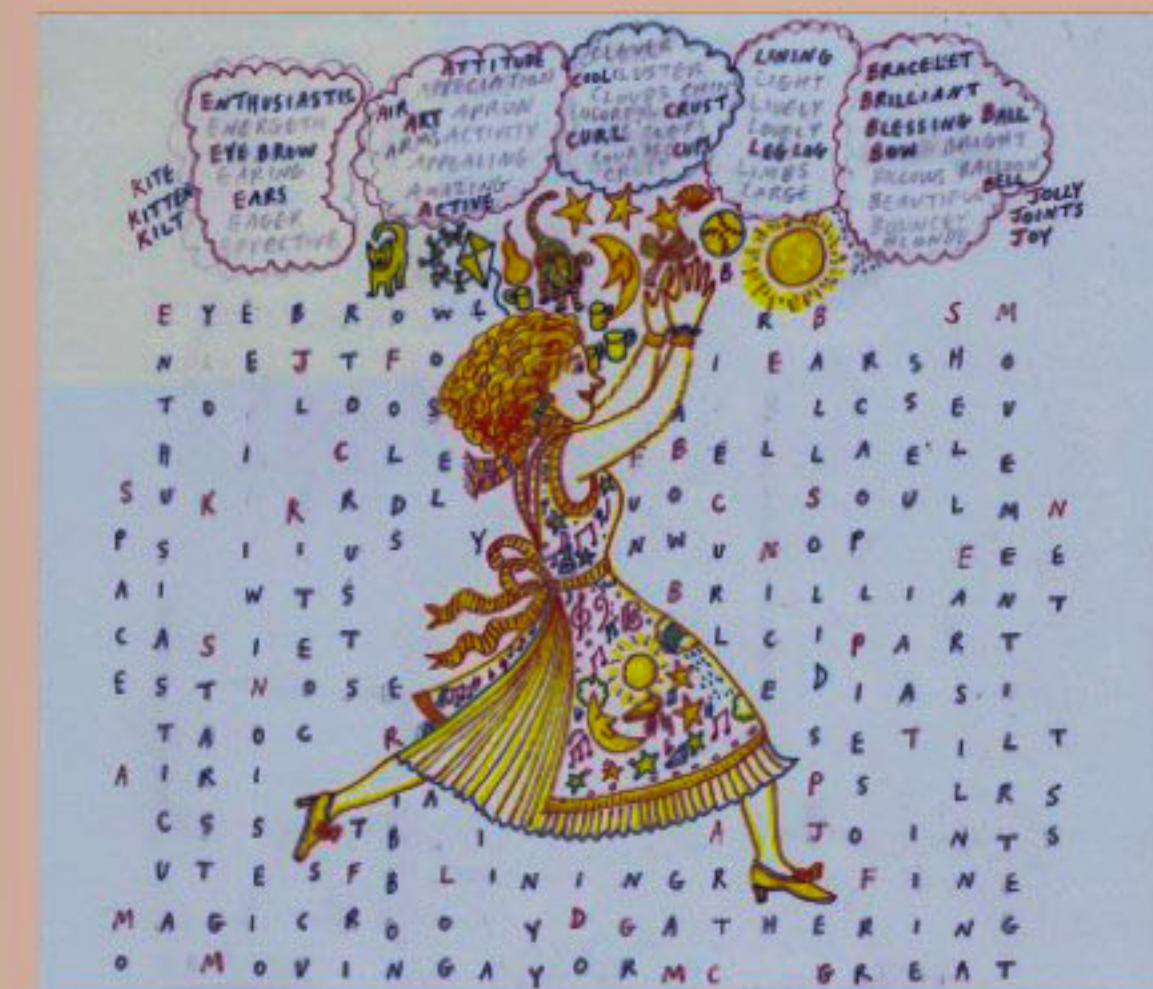
Stepanauskas attributed the success of the project to the combined efforts of the DOE JGI, the Bigelow Laboratory, the Monterey Bay Aquarium Research Institute, the University of Vienna, and MIT. "This is the first application of a single-cell genomic approach to the deep ocean, one of the largest and least known biomes on the planet," emphasized David Kirchner, Harrington Professor of Marine Biosciences at the University of Delaware. "The paper radically changes our view about how microbes gain energy and flourish in the oceans."

Source: Science Daily



### RECOVERY ART

#### Amnesiac aids in brain research



Lonni Sue Johnson created this artwork after suffering from amnesia

**A**FTER suffering devastating brain damage from a viral infection, artist Lonni Sue Johnson lost her memory. Now, after years of therapy, she is unveiling a new portfolio of "recovery art," while also teaching scientists a bit about the brain and creativity.

The new show at the Walters Art Museum in Baltimore follows Johnson's journey, including her artwork from before she got viral encephalitis in 2007 and as she recovered. The journey is providing scientists unique insights into the dire effects of amnesia and the complementary roles played by language and memory in her artistic expression.

"The illness destroyed the hippocampus a brain structure important for memory and spatial thinking on both sides of her brain," said cognitive scientist Barbara Landau at Johns Hopkins University, who has worked with Johnson. "Also sustaining damage were portions of the left temporal lobe that may be important for language and perception.

"We are not yet sure how much recovery there has been from the amnesia, if any," Landau added. "Ms. Johnson is still deeply amnesic about events that have happened in her life, and she has great difficulty remembering events that now occur during her daily life."

The intensive art therapy, which was led by her mother, Margaret Kennard Johnson, led to a new portfolio that is both similar and different from her pre-amnesia work. Her past work has graced the cover of The New Yorker magazine and appeared in the New York Times

"This art is distinctly different from the work she produced before the illness, yet some of the elements remain the same, and one can see a clear relationship between the old and new art," Landau said.

Johnson's old art was distinguished by intricate combinations of iconic visual elements for instance, a Christmas tree made up of holiday shoppers lined up in a zigzagging queue. This approach invited viewers to inspect her work closely to explore layers of meaning.

Source: Live Science



### HOPE OR CHIMERA!



### BIO SAFETY AND BIOSECURITY

#### Treating baldness



Scientists get to the root of baldness

**Y**ALE researchers have discovered the source of signals that trigger hair growth, an insight that may lead to new treatments for baldness. The researchers identified stem cells within the skin's fatty layer and showed that molecular signals from these cells were necessary to spur hair growth in mice, according to research published in the Sept. 2 issue of the journal Cell.

"If we can get these fat cells in the skin to talk to the dormant stem cells at the base of hair follicles, we might be able to get hair to grow again," said Valerie Horsley, assistant professor of molecular, cellular and developmental biology and senior author of the paper.

Men with male pattern baldness still have stem cells in follicle roots but these stem cells lose the ability to jump-start hair regeneration. Scientists have known that these follicle stem cells need signals from within the skin to grow hair, but the source of those signals has been unclear.

Horsley's team observed that when hair dies, the layer of fat in the scalp that comprises most of the skin's thickness shrinks. When hair growth begins, the fat layer expands in a process called adipogenesis. Researchers found that a type of stem cell involved in creation of new fat cells -- adipose precursor cells -- was required for hair regeneration in mice. They also found these cells produce molecules called PDGF (platelet derived growth factors), which are necessary to produce hair growth.

Source: Science Daily

## Threats from biological agents

MUHAMMED AFTAB UDDIN and RUHUL KUDDUS

**A** different type of seminar titled "Biosafety and Biosecurity: What do we know, what do we need, and what can we do?" was held at ICDDR,B's Sasakawa Auditorium on August 22, 2011. The main purpose of the seminar was to launch a national professional organization on national biosafety and biosecurity issues. The professional organization would, in the near future, help the government promulgate laws and create institutions with regulatory authorities. Our part of the globe is generally familiar with regulatory organizations created and imposed by the government. This exceptional seminar reflected the development of a sensible private sector and a group of non-government organizations in the country.

Biosafety and biosecurity had gained significance since the advent of the biotechnology era some fifty years ago. Biosafety defines the containment conditions under which infectious agents can be safely manipulated. The objective of containment is to confine biohazards and to reduce the potential exposure of the laboratory worker, persons outside of the laboratory, and the environment to potentially infectious agents. Biological agents may accidentally escape to the environment and the agents can be manipulated and even weaponized by domestic and international terrorists. National biosafety regulations are thus necessary for international cooperation and trade.

Biosecurity is a poorly defined concept within biosafety. The main goal of biosafety is to protect individual laboratory workers from exposure to the hazardous microorganisms. In contrast, the main goal of biosecurity, according to the Sunshine Project (a biodefense research organization) is to "protect dangerous biological materials from inadvertent or deliberate release to the community (humans, animals, plants) or environment." Thus scientist and technologists would be interested mainly in biosafety issues but, admirably, here the Bangladeshi professionals have also included biosecurity in the discussion. In fact, the professionals are volunteering in building the infrastructure of their young nation.

Agriculture research had been strong in Bangladesh for a while now. Obviously the nation would like to protect its investment in agricultural research. If our business and industrial leaders had already not done so, they will in time



Working with harmful microorganisms requires extensive biosafety measures

import genetically modified (GM) organisms in this country and propagate the organisms here. There are many scores of diagnostic laboratories where hazardous microbes are handled and in some cases propagated in high concentrations. The national forensic laboratory also needs to dispose significant amount of leftover human tissues. Dr. Jesmin, Associate Professor at the Department of Genetic Engineering and Biotechnology of the University of Dhaka indicated that there is no implementable local or national guideline at present for disposal of hazardous laboratory waste. Bangladesh is also the home of ICDDR,B; a highly reputed international biomedical research organization. All these concerns require our nation to have a sound set of laws and appropriate institutions that would enforce the laws.

Dr. M. Aftab Uddin is a Professor and the chairperson and Dr. R. Kuddus is a US Fulbright Scholar and a visiting Professor at the Department of Genetic Engineering and Biotechnology, University of Dhaka.

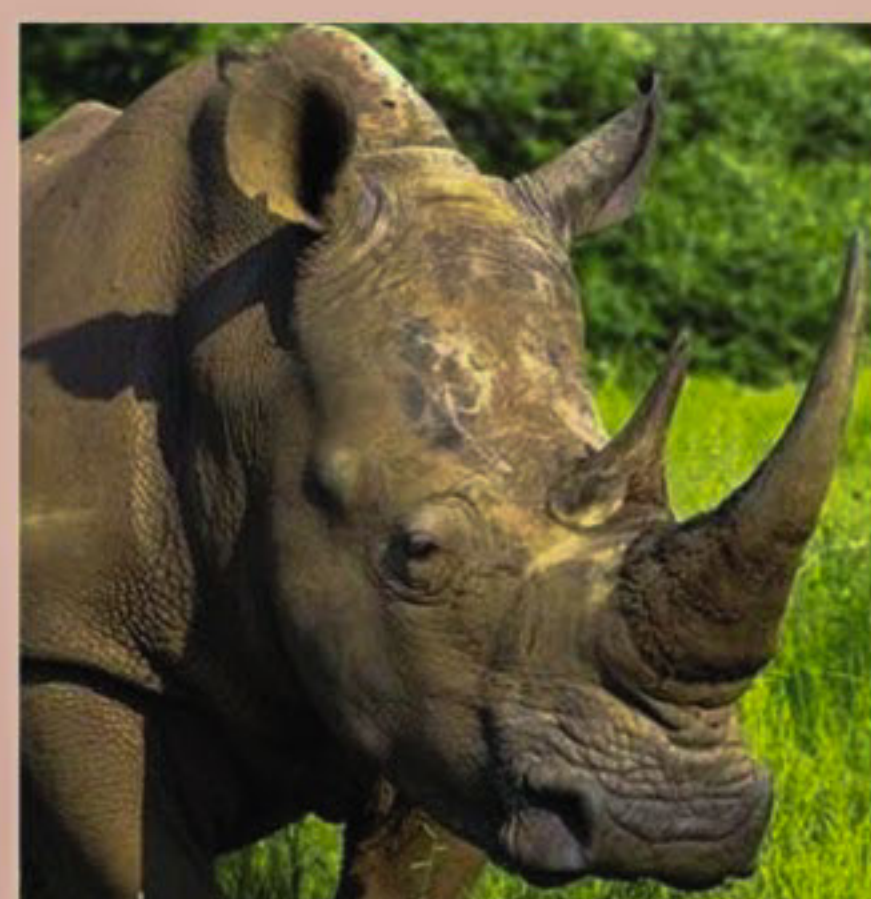


### LIFE FROM FOSSIL!



### DID YOU KNOW?

#### Stem cell to save rhino



Source: BBC

In a novel marriage of conservation and modern biology, scientists have created stem cells from two endangered species, which could help ensure their survival.

The northern white rhino is one of the most endangered animals on Earth, while the drill - a west African monkey - is threatened by habitat loss and hunting.

The scientists report in Nature Methods that their stem cells could be made to turn into different types of body cell.

If they could turn into eggs and sperm, "test-tube babies" could be created.

Such applications are a long way off, but research team chief Jeanne Loring said she had been encouraged by the results on the rhino cells, which they had not really expected to be successful.

#### What is software entropy?



than build on the existing programme.

The tendency, over time, for software to become difficult and costly to maintain is known as software entropy. A software system that undergoes continuous change, like new functionality added to its original design, will eventually become more complex, losing its original design structure, and may even become disorganized as it grows. In theory, it may be better to redesign the software in order to support the changes rather



### TOXIC NANO

#### Risks of nanotech

**D**EVELOPING countries forging ahead with nanotechnology need regulation and research into local risk patterns, say Alok Dhawan and Vyom Sharma.

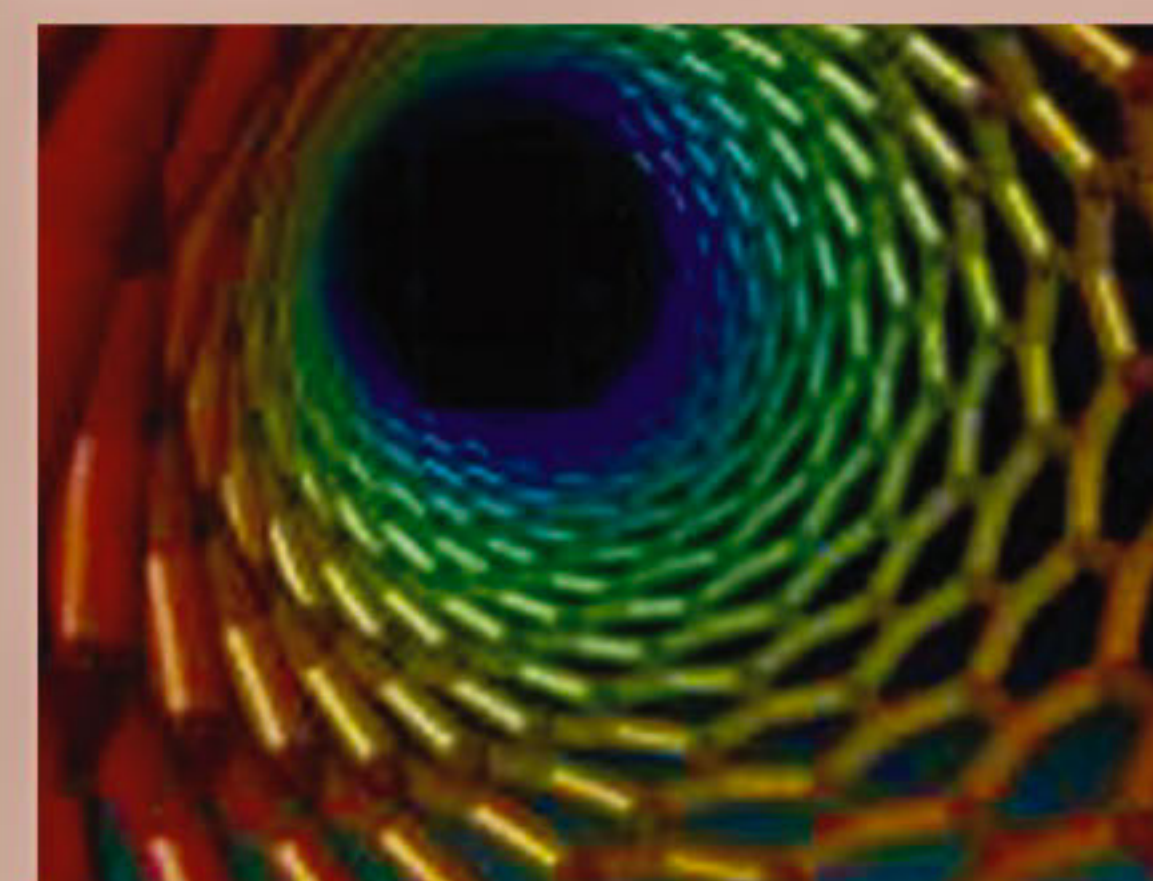
Nanotechnology, the science of manipulating tiny particles less than 100 nanometers in diameter, has found many applications in consumer products, biomedical devices, drug delivery agents and the industrial sector.

In the consumer sector alone, more than 30 countries are manufacturing some 1,300 nanotech-based products, including textiles, food packaging, cosmetics, luggage, children's toys, floor cleaners and wound dressings. The number of such products has increased five-fold in the last five years.

But this rapid growth has also raised concerns about the potential for adverse effects on human health and the environment. Although research on harm remains inconclusive, developing countries that embrace nanotechnology should not overlook possible risks and must regulate products that contain nanoparticles.

Their small size gives nanoparticles some unusual physical properties, as they have a larger ratio of surface area to volume than bigger particles. This can also make them biologically more active. For example, when gold, usually an inert material, is converted to a nano-form, it acts as a catalyst for chemical reactions owing to high surface reactivity.

Source: SciDev.net



Developing countries overlook the potential risks of nanoparticles and structures like carbon nanotubes