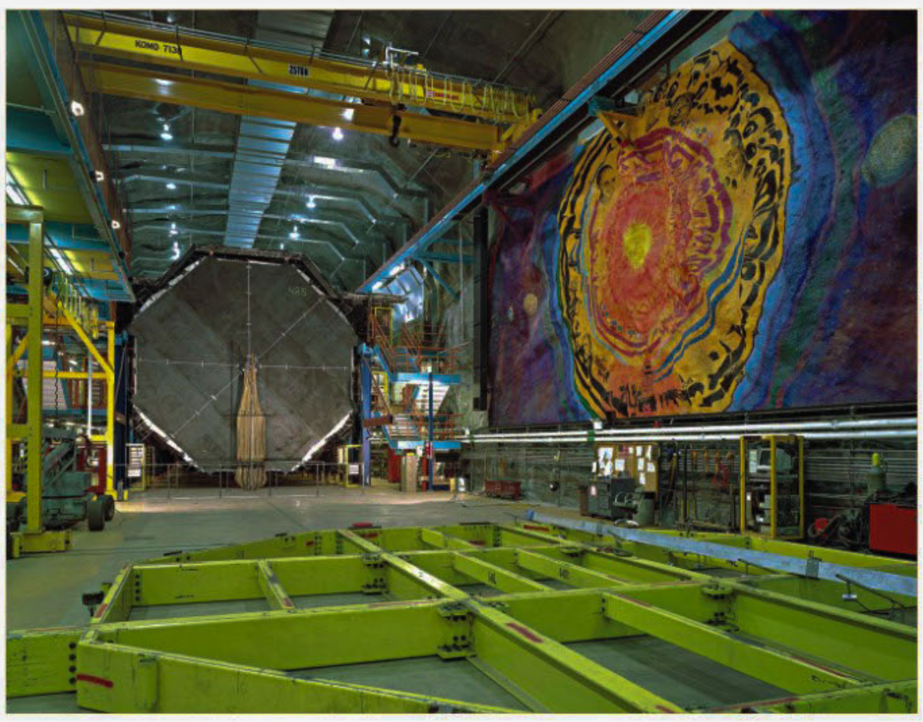
Exotic particle changes flavour

SCIENTISTS have observed the rare phenomenon of one type of exotic particle transforming into another, which could reveal secrets about the evolution of the universe.

The particles are two types of chargeless, nearly massless species called neutrinos, which come in three flavors: muon, electron and tau. In past experiments, physicists have measured the change of muon neutrinos to tau neutrinos and electron neutrinos to muon or tau neutrinos, but no one has definitively seen muon neutrinos turn into electron neutrinos.

Now, two separate experiments one in Japan and one in Minnesota have both found evidence for this transformation as well..



The MINOS neutrino experiment is located in a cavern half a mile deep in the Soudan Underground Laboratory, Minnesota. A mural of famous scientists is painted onto the rock wall.

Detecting neutrinos

Scientists of the Main Injector Neutrino Oscillation Search (MINOS) experiment at the Department of Energy's Fermi National Accelerator Laboratory announced their findings today (June 24). The results are consistent with, and significantly constrain, a measurement reported 10 days ago by the Japanese Tokai-to-Kamioka (T2K) experiment, which announced an indication of this type of transformation. [Strange Quarks and Muons, Oh My! Nature's Tiniest Particles]

The MINOS study sent a beam of muon neutrinos 450 miles (735 kilometers) through the Earth, from the Main Injector accelerator at Fermilab in Batavia, Ill., to a 5,000-ton neutrino detector, located half a mile underground in the Soudan Underground Laboratory in northern Minnesota.

The neutrinos' trip from Fermilab to Soudan takes about four hundredths of a second, giving the neutrinos enough time to change their identities.

MINOS recorded a total of 62 electron neutrino-like events, which is a likely indication that there were 62 electron neutrinos present at Soudan. If muon neutrinos didn't transform into electron neutrinos, MINOS should have seen only 49 events. The T2K experiment showed 71 such electron-neutrino events, though the two experiments use different methods and analysis techniques to look for this rare transformation.

The balance of matter

The new finding could have major implications for our understanding of the history of the universe. If muon neutrinos can transform into electron neutrinos, neutrinos could be the reason that the Big Bang produced more matter than antimatter, leading to the universe as it exists today. To solve this mystery, scientists want to calculate how often different flavors of neutrinos change into each other, and compare that with the rate of change among neutrinos' antimatter partners, antineutrinos.

If it turns out that the rules of transformation are different between neutrinos and antineutrinos, that asymmetry could help explain why matter vastly outnumbers antimatter in the universe.

MINOS will continue to collect data until February 2012. The T2K experiment was interrupted in March when the severe earthquake in Japan damaged its muon neutrino source. Scientists expect to resume operations of the experiment at the end of the year.

Source: Live Science

LIGHT OF JOY

Blue light to treat diabetes

ATTENTION, shoppers: The latest blue light special could help combat diabetes and some genetic diseases.

Scientists have harnessed a light-gathering protein usually found in the eye to turn on the production of a protein that controls blood sugar. Researchers in Switzerland and France rigged kidney cells to make the blood-sugar control protein when exposed to blue light and then implanted diabetic mice with tiny capsules containing the engineered cells. Shining a blue light directly on the mice's skin or through an implanted optical fiber brought blood sugar levels back to normal, the team reports in the June 24 Science.

The new technique could be used to spur the manufacture of proteins lacking in patients with rare genetic diseases such as phenylketonuria, in which an inability to make an enzyme can lead to brain damage. Modified versions of the system might also help scientists figure out which biochemical processes are going haywire in a wide variety of diseases, Boyden speculates.

Conceptually, the system is simple. Researchers start with human embryonic kidney cells engineered to make a protein called melanopsin and then insert a gene for whatever other protein they want to produce into the cells. Melanopsin is a light-harvesting protein normally found in the retina of the eye. It responds to blue light and sets off a biochemical chain reaction that sends nerve signals to the brain. Instead of sending nerve signals, the scientists harnessed a chain reaction already present in kidney cells to turn on the inserted gene.

In the new study, shining a blue light on the melanopsin-carrying kidney cells turns on production of a protein called glucagon-like peptide-1, or GLP-1. That protein, in turn, governs production of insulin and other proteins that help control blood sugar levels.

Source: Science News

A light-sensitive protein from the retina can be manipulated to help treat diabetes or other metabolic diseases

LEARNING FROM PAST

Asian experience

Countries need to learn from experience and adapt to new priorities for agricultural development

LESSONS from past agricultural development successes can inform policymaking and influence the choice of strategies to follow in a changing world, argue David J. Spielman and Rajul Pandya-Lorch.

Asia has seen the most dramatic success stories in agricultural development over the past 50 years, say the authors. In South Asia, new policies and investments known as the Green Revolution doubled cereal output and improved food security. And China's reintroduction of household farming in the late 1970s increased grain production and reduced rural poverty.

But innovations in producing, distributing and consuming food are just as important as gains in output, say Spielman and Pandya-Lorch. Farmers in South Asia have adopted tillage techniques that help replenish the soil's moisture and nutrients, for example, and in Burkina Faso farmers using traditional practices such as collecting manure and rainwater have increased their capacity to cultivate staple crops.

These successes were large-scale, long-term projects based on robust evidence and this is what sets them apart, note the authors. They prove that agriculture is crucial for development.

But lessons need to be learned to build on these successes in a world changing with advances in biotechnology and information, the threat of climate change and new demographic trends.

Countries need strategies to sustain successful projects by creating policies and encouraging investment. They must also learn from experience, adapting to changing priorities. And because success is often difficult to recognise, countries must support their strategies with strong evidence, documenting and sharing successes as well as failures so others can learn from them.

Source: SciDev.net

KNOWLEDGE BYTE

In search of the memory molecule

HAVE a tough time remembering where you put your keys, learning a new language or recalling names at a cocktail party? New research from the Lisman Laboratory at Brandeis University points to a molecule that is central to the process by which memories are stored in the brain.

A paper published in the June 22 issue of the Journal of Neurosciencedescribes the new findings.

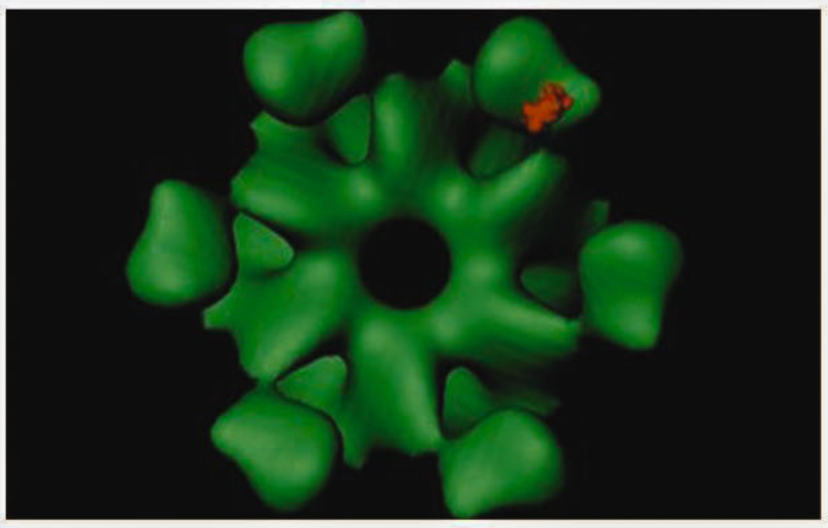
The brain is composed of neurons that communicate with each other through structures called synapses, the contact point between neurons. Synapses convey electrical signals from the "sender" neuron to the "receiver" neuron. Importantly, a synapse can vary in strength; a strong synapse has a large effect on its target cell, a weak synapse has little effect.

New research by John Lisman, professor of biology and the Zalman Abraham Kekst chair in neuroscience, helps explain how memories are stored at synapses. His work builds on previous studies showing that changes in the strength of these synapses are critical in the process of learning and memory.

"It is now quite clear that memory is encoded not by the change in the number of cells in the brain, but rather by changes in the strength of synapses," Lisman says. "You can actually now see that when learning occurs, some synapses become stronger and others become weaker."

But what is it that controls the strength of a synapse?

Lisman and others have previously shown that a particular molecule called Ca/calmodulin-dependent protein kinase II (CaMKII) is required for synapses to change their strength. Lisman's team is now showing that synaptic strength is controlled by the complex of CaMKII with another molecule called the NMDAR-type glutamate receptor (NMDAR). His lab has discovered that the amount of this molecular complex (called the CaMKII/NMDAR complex) actually determines how strong a synapse is, and, most likely, how well a memory is stored.



The CaMKII molecule can bind to the NMDA receptor, forming a complex. The number of such complexes at the synapse may increase the amount of memory that can be stored

"We're claiming that if you looked at a weak synapse you'd find a small number of these complexes, maybe one," says Lisman. "But at a strong synapse you might find many of these complexes."

A key finding in their experiment used a procedure that reduced the amount of this complex. When the complex was reduced, the synapse became weaker. This weakening was persistent, indicating that the memory stored at that synapse was erased.

The experiments were done using small slices of rat hippocampus, the part of the brain crucial for memory storage.

Lisman assembled a large team to undertake this complex research. A key collaborator was Magdalena Sanhueza, who once worked with Dr. Lisman at Brandeis, and her student, German Fernandez-Villalobos, both now of the University of Chile, Department of Biology and Ulli Bayer of the University of Colorado Denver School of Medicine, Department of Pharmacology, who developed CN19, a particular form that could actually enter neurons.

Others involved include Nikolai Otmakhov and Peng Zhang from Brandeis and Gyulnara Kasumova, who worked in the Lisman laboratory for several years as an undergraduate. An additional group contributing to the work was that of Johannes Hell, Professor of Pharmacology at the UC Davis School of Medicine. He and his student, Ivar S. Stein, used immunoprecipitation methods to actually show that the CN19 had dissolved the CaMKII/NMDAR complex.

Source: Science Daily

CLIMATE CHANGE

The bomb ticks away

SHAMIM HUQ

SEA level is rising faster and faster. About 70% of the world's population live on coastal plains; 11 of the 15 biggest cities stand on a coastline or river estuary. As the seas rise, salt will invade the water table depriving inhabitants of drinking water. The Himalayan glaciers are the source of all the great Asian rivers, the Indus, Ganges, Mekong and Yangtze Kiang; 2 billion people depend on them for drinking water and to irrigate theirs crops, as in Bangladesh. Bangladesh is directly affected by the phenomena occurring in the Himalayas and at sea levels. This is one of the most populous and poorest countries in the world; it is already hit by global warming. The combined impact of increasingly dramatic floods and hurricanes could make a third of its land mass disappear. In 1988 and later the city of Dhaka was under water, there were boats on the roads. When populations are subjected to these devastating phenomena they eventually move away.

Around the North Pole the ice cap has lost 30% of its surface area in 30 years. Greenland is getting warmer rapidly and fresh water of the whole continent is flowing toward the sea increasing the sea level and saline water. Greenland's ice contain 20% of fresh water, if it melts sea level will rise by nearly 7 metres. As the fresh water of the Greenland's ice sheet gradually seeps into the salt water of the oceans low- lying lands around the globe are threatened. In the atmosphere, major wind streams are changing direction, rain cycles are altered; the geography of climates is modified.

Some experts claim that we have less than 10 years to change our patterns of consumption and reverse the trend before the damage is irreversible. Unless we act quickly, we risk losing the only home we may ever have.

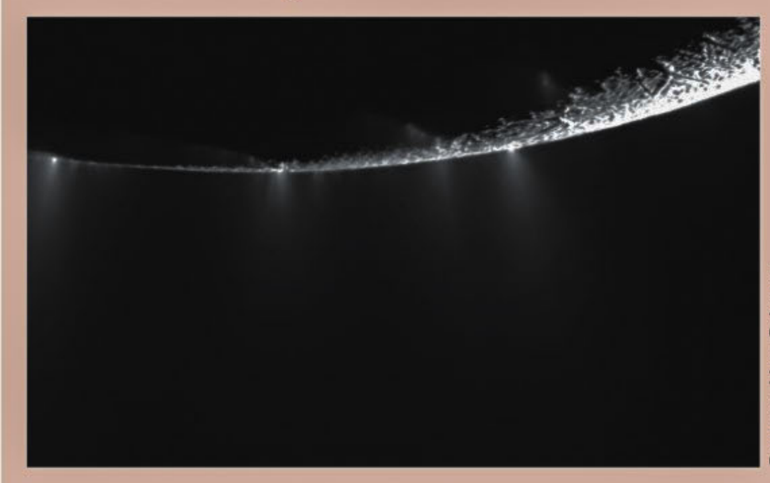
Now, both developed and developing nations should act in a concerted manner to make up the loss for our common survival.

The writer is a Chemistry graduate from USA.

An artist's view of Eath in the firmament

EXOTIC STREAK

Saturnian light



Source: Live Science

Go ahead, take a wild guess today. If somebody doesn't think "UFO" I'll be darned.

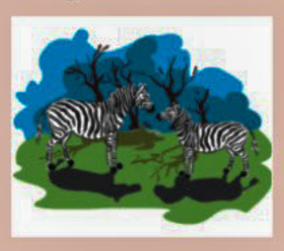
This object is far out, for sure, but not that far out. Can't give you any more hints.

The image shows plumes of water ice shooting out from many locations along "tiger stripe" features near the south pole of Saturn's moon Enceladus. The stripes are fissures that spray icy particles, water vapor and organic compounds, NASA explained in releasing this image this week.

The image reveals more than 30 jets of varying sizes more than 20 that hadn't been identified before.

DID YOU KNOW?

Why are Zebras striped?



Zoologists believe the stripes on a zebra could be one of several reasons. It could be basically for camouflage very much like the military fatigues. The bold wavy lines of a zebra blend in with the tall wavy grassy plains of Africa where these animals live. The bold stripe may even serve to break up the shape of the Zebra. If a zebra is standing still in such surroundings, a lion, its chief predator, may overlook it completely.

It doesn't matter that the zebra's stripes are black and white and the grass are dusty brown or green, because the lion is colour blind!