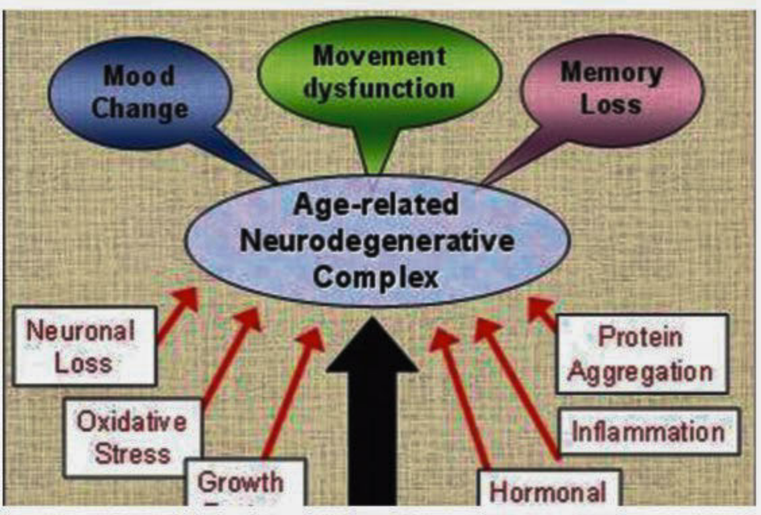
The Daily Star

SCIENCE & LIFE

DHAKA TUESDAY OCTOBER 19, 2010, E-MAIL: science&life@thedailystar.net

Science of getting old



Aging actually is the result of lifelong accumulation of various forms of damages at molecular and cellular levels

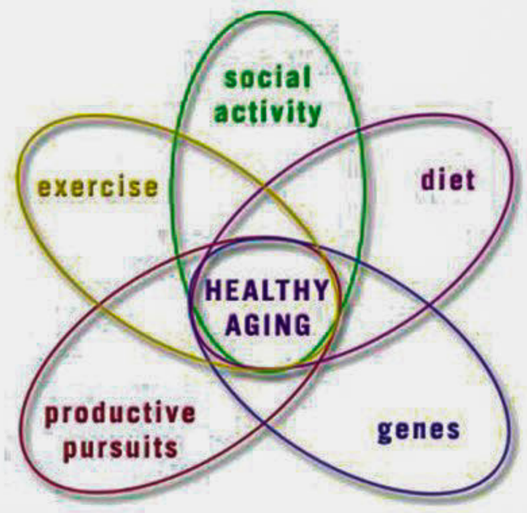
MD. RIAJUL HOSSAIN

TODAY, in this twenty-first century, life expectancy has become higher in the world, especially in the west. Indeed, in the previous century, people lived in constant association with death. It was very unlikely for twenty-five percent of the newborn to see their first birthday and again another quarter of the children died before their fifth birthday due to infection. But, the improved sanitation, living conditions and medical care over the past one hundred years have reduced death rates and life expectancy has been increased to the old age. The principal reason of death, today, is the aging process itself with the varieties of illnesses it gives rise to such as cancer, diabetes, heart diseases, Alzheimer's and Parkinson's diseases.

The cells and multicellular organisms face numerous challenges to survive. In the process, cells get damaged all the time and thereby a repairing system is also on to heal the damaged conditions. However, this repairing system, although very efficient, may also leave few damaged conditions, those are called misrepaired conditions. The damage may occur in many forms such as DNA get altered, proteins get damaged and the free oxygen radicals released as the mitochondria degenerate and breakdown. The somatic cells, the cells other than the germ line cells (cells that give rise to sperm and eggs) of the body, function in maintenance and repair and are not immortal like germ line cells. Indeed, some organisms like freshwater hydra and jellyfish found not to age.

Aging actually is the result of lifelong accumulation of various forms of damages at molecular and cellular levels. Certain genes are found to be involved in aging process. In 1980, Tom Johnson and Michael Klass have found a gene named age-1 in a nematode that increased the lifespan of the organism up to forty percent. On November 27, 2008, Science Daily reported that Harvard scientists Philipp Oberdoerffer and David Sinclair found sirtuin genes to play role in anti-aging. These genes repair damaged DNA and regulates gene expression by preventing the integrity of chromatin but they perform only one of these two tasks at once. Scientists now think this may be the actual cause of aging. Dietary restriction, in other studies, has been found to increase lifespan in mice but it is less likely to work in humans because the metabolism varies greatly between these two organisms.

All individuals actually age and die, but the process varies. Cells respond to damages, sometimes by killing itself, the process of this self induced death of cells is called apoptosis. In aged cells, the frequency of apoptosis becomes higher and whereas the apoptosis is good at young age, it becomes the opposite at the old age when too many killing of cells by apoptosis accelerates the aging process. Recently, Thomas Kirkwood, professor of medicine and director of the Institute for Aging and Health at Newcastle University of England have made an exciting discovery. They found that after the amount of damage passes a threshold, the cell comes to a state of senescence where they can still perform useful functions in the body but lack the capability to divide. "But if we are to unpick the locks and so restore some division capacity to aged cells, we need to understand very thoroughly just how cell senescence works"- Thomas Kirkwood states. So, by restoring the division capacity of the cells locked at senescence and by preventing unnecessary apoptosis without the risk of causing cancer, may well increase lifespan and delay aging. Although some anti aging drugs are in development and a drug named resveratrol has been found to increase lifespan in mouse, the solution to the aging of human may not be that easy. Indeed, healthy or successful aging could be a good target for human. Productive pursuits, exercise, diet, genes and social activity together may help in healthy aging. "I believe we can and will develop treatments targeted at easing our final years" says Professor Thomas Kirkwood.



Productive pursuits, exercise, diet, genes and social activity together may help in healthy aging

The writer is a Lecturer in Biotechnology, BRAC University.

DEADLY MUD

HUNGARY'S RED SLUDGE

Can it be neutralised?

The bauxite residue holding pond (orange, middle), near Kolontar, Hungary (left), burst on Oct. 4, 2010

The red, metal-laden sludge that escaped a containment pond in Hungary last week could be made less toxic with the help of carbon sequestration, says an Indiana University Bloomington geologist who has a patent pending on the technique.

The bauxite residue now covers 40 square kilometers south of the Danube River, and has caused the deaths of eight Hungarians and injured at least 150. The residue also has caused the extinction of life in a local river and as yet unknown environmental damage elsewhere. While human deaths in the wake of the disaster may have been strictly a result of the containment failure, injuries have mostly been attributed to the chemical properties of the sludge, whose high pH (between 11 and 13) can quickly damage and kill living cells. Bauxite residue is between 10,000 and 1,000,000 times more basic than pure water, which has a pH around 7.

"We propose one way to reduce the pH of bauxite residue is to mix it with another kind of industrial waste -- oilfield brine, which is a by-product of oil and gas production -- and then carbon dioxide," said IU Bloomington geologist Chen Zhu, who submitted a U.S. Department of Energy patent application in 2007 describing the technique.

The water-based brine provides the medium for carbon dioxide to dissolve. Once dissolved, the carbon dioxide can chemically react with water to form carbonic acid. The carbonic acid counteracts some of the red mud's alkalinity, and what's left -- the negatively charged carbonate -- can serve as a partner for positively charged metal ions, such as iron, calcium and magnesium. Some of these salts spontaneously precipitate out of solution, which is a good thing, since the metals in these salts will longer will be free to interact with, say, living matter.

Bauxite residue, sometimes called "red sludge" or the more euphemistic "red mud," is the waste created by industries that produce aluminum. At present, the residues simply accrue in containment ponds. Worldwide, there are in excess of 200 million tons in these ponds.

"Companies don't voluntarily spend money to neutralize waste unless someone tells them to do it, sadly," Zhu said. "Our technique could be quite expensive. When you have a disaster like the one we're seeing in Hungary, though, I think perhaps companies and governments may think twice about what 'too expensive' means."

Source: Science Daily

ILLUSION OF TAIL

It's not a comet

Check out the X, marking the spot of an asteroid collision in this new Hubble Space Telescope photo.

"When I saw the Hubble image I knew it was something special," said researcher Jessica Agarwal, a European Space Agency astronomer in the Netherlands.

Astronomers suspect a rock maybe 10-16 feet (3-5 meters) wide slammed into a larger asteroid at speeds of about 11,200 mph (18,000 kph) with a detonation as powerful as a small atomic bomb.

Such collisions are not uncommon, though they're rarely seen in real time. In fact, past collisions have spawned families of smaller asteroids that astronomers can identify. And sometimes the fragments reach Earth.

Source: Live Science

The Hubble Space Telscope captures aftermath of asteroid collision in this series of photos taken between January and May 2010

SHAKEN BEDROCK

Shifty physical constants

A number traditionally believed to be the same universe-wide, and which characterizes the strength of electricity and magnetism, actually varies from place to place, according to a new study.

Astronomers involved in the research predict it will generate controversy because it could force a rethinking of the foundations of physics. It might among other things imply that the universe is infinitely large, they add.

The research team, led by John Webb of the University of New South Wales, Australia, studied quasars, very distant galaxies witnessing violent processes at their cores due to giant black holes that lie there.

This furious activity generates bright light that travels through the cosmos. Part of this light is absorbed by various atoms in clouds in space. The absorption leaves distinctive signatures on the light's colors, offering astronomers a further opportunity to study natural processes billions of light-years away. A light-year is the distance light travels in a year.

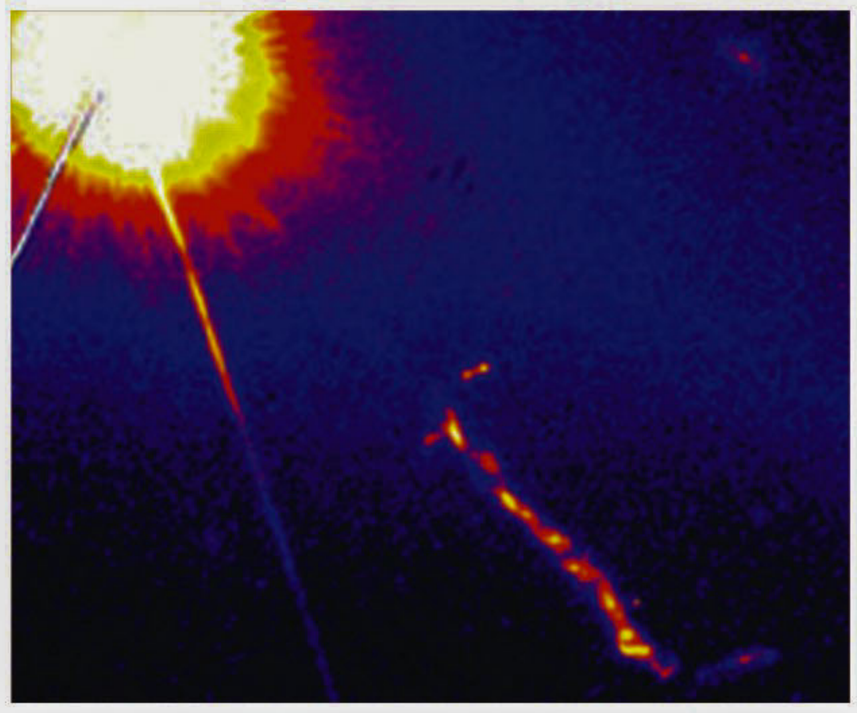
Webb and colleagues used these processes to estimate a number known as the fine-structure constant, which characterizes the strength of the so-called electromagnetic force. This force determines the strength of electric and magnetic fields, which are so closely intertwined that they are treated as a single force. Light, indeed, is simply an oscillation of interwoven electric and magnetic fields.

Webb said his results imply that the fine-structure constant might have different values depending on which direction we are looking in the sky, thus being not so "constant" after all.

"The precision of astrophysical measurements of the fine structure constant, or alpha, dramatically increased about a decade ago," Webb said, when he and a colleague introduced a new method for measuring the figure. "Since then evidence started mounting, suggesting this crucial physical quantity might not be the same everywhere."

Variation by place in the "constant" appears to be much more than variation by time, if there is any, added the researchers.

They claim that the implications of these results are so resounding that they will probably cause controversy in the scientific community.



A quasar designated 3C273 as observed by the Hubble Space Telescope

Using two major observatories, the Keck Telescope in Hawaii and the European Southern Observatory's Very Large Telescope in Chile, Webb and his team observed the light from quasars, the most luminous objects in the known universe. Although quasars are incredibly far away, we can detect them due to the sheer quantity of light that they emit. The light is thought to come from material that heats up as it plunges into the central, "supermassive" black holes.

Because the light that reaches us from these objects actually left them billions of years ago, the images we receive offer a record of the way they would have looked back then.

"The interaction of the light from the quasars with the gas clouds provides an impressive opportunity to investigate the physical conditions when the Universe was just a fraction of its current age," said PhD student Julian King, also of the university, who played a major role in the research. It's "exciting that we have the technology to be able to measure the laws of physics in the early Universe so precisely," he added.

The new results can be explained if our Universe is exceptionally or even infinitely large, the researchers said. This would allow fundamental quantities and "constants" to have different values in different areas. In such a scenario, we would exist in just a tiny patch of the cosmos, with correspondingly small changes in the physical constants.

This view, the scientists said, raises questions as to why a whole range of these "constants" happen to be just rightin our areafor developing life, along with physics and chemistry as we know them.

Source: World Science

BUT IT BITES!

New species a little nipper

Scientists have found the first new carnivore species to be discovered in more than 20 years, a mongoose-like creature with a pointed snout and sharp teeth that lives in the swampy wetlands of Lac Alaotra, Madagascar's largest lake.

The new beastie was spotted swimming in the lake by researchers from the Natural History Museum in London, Nature Heritage, the Durrell Wildlife Conservation Trust and Conservation International as the biologists surveyed bamboo lemurs, another mammal found exclusively on Madagascar. Closer inspection suggested the animal was a vontsira, a mammal in the family Eupleridae, whose eight members are found only on the island. Euplerids tend to have slender bodies similar to cats or weasels and mostly eat meat, although some species eat fruit. Genetic analyses suggest the new vontsira is very closely related to the brown-tailed vontsira, Salanoia concolor, which lives in nearby rainforests.

Comparisons with museum specimens suggest that the teeth and distinct habitat of the marsh-dwelling vontsira warrant granting it specieshood, the team reports in the September Systematics and Biodiversity. The researchers are calling it Durrell's vontsira, after conservationist and writer Gerald Durrell.

Madagascar is believed to have split from mainland Africa more than 100 million years ago, creating a playground for evolution. The island is home to whole families of plants, primates and birds that are found nowhere else in the world. The team notes that the vontsira's swampy home recently lost a member: The Alaotra grebe, Tachybaptus rufolavatus, was declared extinct by the IUCN earlier this year.

Source: Science News

MUG SHOTA small creature called a Durrell's vontsira is the first new carnivore species discovered in more than 20 years

BOMBING FOR SAFETY

Destroying NEOs

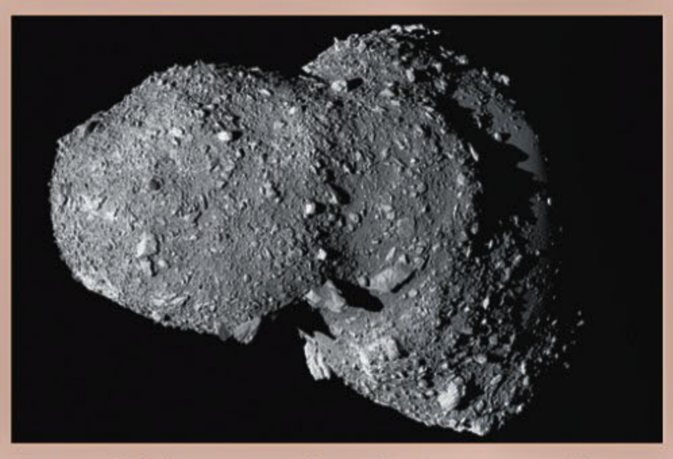
In the movies, a bomb is usually the most effective way of stopping an asteroid from wiping out life on Earth. But real scientists have had their doubts about bombing the potentially hazardous objects.

Now, however, some researchers are finding evidence that an explosion might not, as feared, make a bad situation worse by sending a huge cloud of harmful debris raining down on the planet.

And other scientists are suggesting that, despite previous assumptions, we wouldn't need an impossibly powerful bomb to destroy a threatening asteroid.

Considering the damage a large asteroid strike could do to humanity, bombing any so-called near-Earth objects, or NEOs, headed our way might be a viable last resort "if we have the international political will," said Robert Weaver of Los Alamos National Laboratory in New Mexico. In such a case, "my calculations show that we have the means."

Source: National Geographic



The asteroid Itokawa, as seen by the Hayabusa spacecraft in 2005

BUILT-IN SMILE

Bottlenose dolphin

Perhaps the most iconic and beloved of all cute sea creatures, the bottlenose dolphin has a smile built into its snout. These social animals live in pods, and are quite intelligence. Their brains make them not only great for show tricks at aquariums; they've also been trained to locate sea mines.

Source: Live Science