

SCIENCE BEAT

THE UNION HEALTH MINISTRY has approved a proposal for the setting up of the country's first National Centre for Diseases Informatics and Research in Bangalore. The Centre, to be housed in the Indian Council of Medical Research (ICMR) building, will document and research non-communicable diseases

IN TWO PAPERS to be published in *The American Journal of Human Genetics*, scientists from the Institute of Genomics and Integrative Biology, Delhi, the Centre for Cellular and Molecular Biology, Hyderabad and a few Indian universities have described the results of a genome-wide survey to understand the population history of the Siddis, Afro-Indians from western India. The researchers conclude that the admixture between the African ancestors of the Siddis and neighbouring South Asian groups occurred in the past eight generations.

LAST WEEK, the Indian Space Research Organisation (ISRO) released a study of 2,190 Himalayan glaciers undertaken by 15 institutes and organisations in India. There are 32,392 glaciers in the region, covering an area of 71,182 sq km, the study says, adding that the average loss in area of the glaciers is 3.75 per cent. Interestingly, while 75 per cent of the glaciers retreated, 8 per cent have advanced and 17 per cent have shown no changes.

Nine-lab consortium positive about micro-algae as source of bio-fuel

ADAM HALLIDAY

EARLIER this year, Indian scientists drove a full-load diesel-engine Chevrolet Tavera fuelled with bio-diesel; nothing extraordinary, except the bio-diesel was sourced from a micro-algae.

As plantations for bio-fuel increasingly nudge out plantations for food, a joint project by nine Council of Scientific and Industrial Research (CSIR) laboratories may be heading towards a solution that could check carbon emissions while sustaining food supplies.

The micro-algae, or sea-weed, grows naturally in India's west coast and the bio-fuel extraction process is similar to that using Jatropa. Scientists working on the



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project recently tested a bio-diesel mix (20 per cent bio-fuel, 80 per cent petroleum) produced from micro-algae and found it road-worthy.

"The lipid-bearing mats could be simply skimmed off and the extracted oil converted into high-quality bio-diesel following a process similar to the one developed and patented earlier for Jatropa bio-diesel," said Professor Pushpito K Ghosh, director of the Bhavnagar-based Centre for Salt and Marine Chemicals Research Institute (CSMCRI), one of the nine labs.

When the labs secured Rs 13.27 crore in funds last year, they admitted that there was little Indian knowledge or data about micro-algae's possibility of being liquid-fuel sources. The next big step would be to see whether the micro-algae can be cultivated in quantities large enough to meet bio-fuel demands, either inland or in the sea itself.

Meanwhile, other marine micro-algal strains, especially those with high lipid productivity, are being investigated under the project. The nine-laboratory consortium includes CSMCRI, Andhra University's department of Marine Living Resources, Calcutta University, Indian Institute of Chemical Technology (IICT) in Hyderabad, IIT-Kharagpur, National Chemical Laboratory in Pune, National Institute of Oceanography in Goa, National Institute of Ocean Technology in Chennai and National Institute of Interdisciplinary Science and Technology in Thiruvananthapuram.

THE DANGERS of light at night

LAURA BEIL

JUST as the ear has two purposes—hearing and telling you which way is up—so does the eye. It receives the input necessary for vision, but the retina also houses a network of sensors that detect the rise and fall of daylight. With light, the body sets its internal clock to a 24-hour cycle regulating an estimated 10 per cent of our genes.

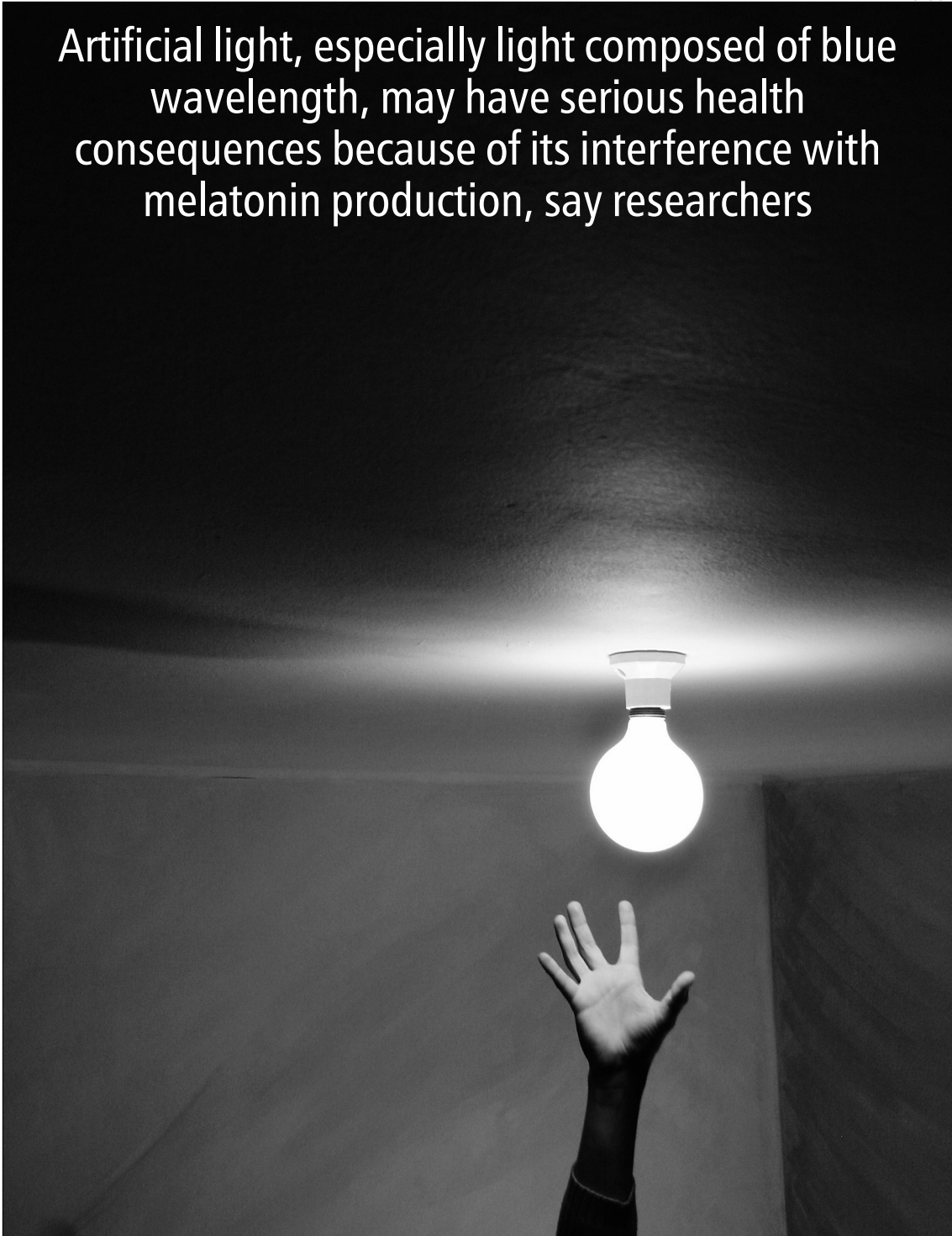
The workhorse of this system is the light-sensitive hormone melatonin, which is produced by the body every evening and during the night. Melatonin promotes sleep and alerts a variety of biological processes to the approximate hour of the day.

Light hitting the retina suppresses the production of melatonin—and there lies the rub. In this modern world, our eyes are flooded with light well after dusk, contrary to our evolutionary programming. Scientists are just beginning to understand the potential health consequences. The disruption of circadian cycles may not just be shortchanging our sleep, they have found, but also contributing to a host of diseases.

"Light works as if it's a drug, except it's not a drug at all," said George Brainard, a neurologist at Thomas Jefferson University in Philadelphia and one of the first researchers to study light's effects on the body's hormones and circadian rhythms.

Any sort of light can suppress melatonin, but recent experiments have raised novel questions about one type in particular: the blue wavelengths produced by many kinds of energy-efficient light bulbs and electronic gadgets. Brainard and other researchers have found that light composed of blue wavelengths slows the release of melatonin with particular effectiveness.

Until recently, though, few studies had directly examined how blue-emitting electronics might affect the brain. So scientists at the University of Basel in Switzerland tried a simple experiment: They asked 13 men to sit



Artificial light, especially light composed of blue wavelength, may have serious health consequences because of its interference with melatonin production, say researchers

before a computer each evening for two weeks before going to bed. During one week, for five hours every night, the volunteers sat before an old-style fluorescent monitor emitting light composed of several colours from the visible spectrum, though very little blue.

Another week, the men sat at screens backlit by light-emitting diodes, or LEDs. This screen was twice as blue.

"To our surprise, we saw huge differences," said Christian Cajochen, who heads the Center for Chronobiology at the University

of Basel. Melatonin levels in volunteers watching the LED screens took longer to rise at night, compared with when the participants were watching the fluorescent screens, and the deficit persisted throughout the evening.

The subjects also scored

higher on tests of memory and cognition after exposure to blue light, Cajochen and his team reported in the May issue of *The Journal of Applied Physiology*. While men were able to recall pairs of words flashed across the fluorescent screen about half the time, some scores rose to almost 70 per cent when they stared at the LED monitors.

The finding adds to a series of others suggesting, though certainly not proving, that exposure to blue light may keep us more awake and alert, partly by suppressing production of melatonin.

What do these findings mean to everyday life? Some experts believe that any kind of light too late into the evening could have broad health effects, independent of any effect on sleep. For example, a report published last year in the journal *PNAS* found that mice exposed to light at night gained more weight than those housed in normal light, even though both groups consumed the same number of calories.

Light at night has been examined as a contributor to breast cancer for two decades. While there is still no consensus, enough laboratory and epidemiological studies have supported the idea that in 2007, the World Health Organization declared shift work a probable carcinogen.

Researchers like Brainard hope the science may lead to a new generation of lights and screens designed with wavelengths that adjust according to the hour of the day.

Among those interested are officials at NASA, who have approached the neurologist about designing light on the International Space Station in a way that promotes alertness during waking hours and encourages sleep during times of rest.

"I think we're on the verge of a lighting revolution," said Brainard. If the hormone-sparing lights can be made to work during spaceflight, he said, "people will use it here on the ground."

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From waste to oil

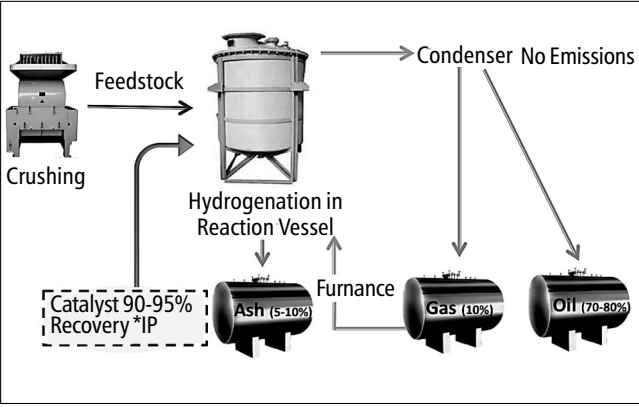
PK Clean Technologies has won several awards for its method of converting plastic waste into oil and gas

GARIMA MISHRA

AMONG the six winners of this year's Business Plan Competition conducted by Rice University, Texas, was PK Clean Technologies, which bagged the third position for an environment-friendly technology it uses to recover energy from waste products. PK Clean also won MIT's Clean Energy Prize under the non-renewable category. The company has combined and tweaked the technology which was originally invented by the late Australian Percy Kean with unique inputs that aim to optimise the mass energy balance.

The concept was originally tested in various laboratories across Australia. Further development was conducted at a laboratory in Pune, where the firm has established a 10,000 sq ft pilot plant. "The plant has the potential to convert 20 tonne of plastic waste into 80 barrels of fuel each day," said Priyanka Bakaya, founder PK Clean Technologies, that was set up in the year 2009 in the US. The project is currently in the pilot testing phase in Pune and is expected to reach the commercialisation stage by 2013. The company's method of converting plastic waste into oil and gas is called catalytic depolymerisation. It takes two-to-four hours for the entire process and requires 8-10 people including engineers and operators.

This is how it works: Plastic waste is first crushed, then



Conversion of plastic waste into oil and gas (above); Priyanka Bakaya, founder PK Clean Technologies

mixed with catalysts in a reaction vessel. After applying heat to the reaction vessel, the product goes through a vapour column and condenser to get converted into oil (70-80 per cent) and gas (10-15 per cent). This hydrocarbon gas is reused to heat the system. The catalyst (90-95 per cent) is recycled, and a small amount of ash (5-10 per cent) is left which can be sold for industrial purposes. The key is the catalysts, which allow the reaction to happen at a lower temperature. "It costs us \$25-\$30/bbl to produce oil from waste, which is better than our closest competitor at \$52/bbl," Bakaya said.

PK Clean is essentially targeting two markets. "The customers we take the plastic waste from and customers we sell the oil product to. In the US, we are eyeing the metal recycling industries who are large producers of non-recyclable plastic waste and small refineries who would be interested in buying our renewable fuel. We hope to build a plant that will have the capacity to convert 100 tonne of waste per day. It would cost \$1 million," said Bakaya, an MIT Sloan and Stanford University graduate.



The then and now of the memory

BENEDICT CAREY

RESEARCHERS have long known that the brain links all kinds of new facts, related or not, when they are learned about the same time. Just as the taste of a cookie and tea can start a cascade of childhood memories, as in Proust, so a recalled bit of history homework can bring to mind a math problem from that same night.

For the first time, scientists have recorded traces in the brain of that kind of contextual memory. The recordings, taken from the brains of people awaiting surgery for epilepsy, suggest that new memories of even abstract facts—an Italian verb, for example—are encoded in a brain-cell firing sequence that also contains information about what else was happening during and just before the memory was formed. The new study suggests that memory is like a streaming video that is bookmarked, both consciously and subconsciously, by facts, scenes, characters and thoughts. Experts cautioned that the new report falls short of revealing how contextual memory and different cues interact; some words might throw the mind into a reverie, while others do not. But the report does provide a glimpse into how the brain places memories in space and time. "It's a demonstration of this very cool idea that you have remnants of previous thoughts still rattling around in your head, and you bind the representation of what's happening now to the fading embers of old thoughts," said Ken Norman, a neuroscientist at Princeton who did not participate in the study.

In the new study, appearing in the current issue of the journal *PNAS*, doctors from

the University of Pennsylvania and Vanderbilt University took recordings from tiny electrodes implanted in the brains of 69 people with severe epilepsy. The implants are standard procedure in the case allowing doctors to pinpoint the location of the flash floods of brain activity that cause seizures. The patients performed a simple memory task. They watched a series of nouns appear on a computer, one after another, and after a brief distraction recalled as many of the words as they could, in any order.

Repeated trials, with different lists of words, showed a predictable effect: The participants tended to remember the words in clusters, beginning with one and recalling those that were just before or after. This pattern, which scientists call the contiguity effect, is similar to what often happens in the card game concentration, in which players try to identify pairs in a grid of cards lying face-down.

Recording from the electrodes, the researchers looked for a neural firing pattern that had a very distinct signature—it updated continually, like a news ticker tape. They found a strong signal in the temporal lobe of the brain, an area extending roughly between the temple and the ear. When participants recalled a word—"cat," for example—the pattern in this region looked identical to when "cat" was originally seen on the computer screen. Moreover, the pattern was only slightly different when they recalled the words just before, and just after, "cat" on the list. "Here we have shown, that the word before 'cat'—let's say it's 'tree'—has influenced the encoding for 'cat,' just as 'cat' has influenced the encoding of the next word, let's say 'flower,'" said Michael J. Kahana, a neuroscientist at the University of Pennsylvania and an author of the paper.

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