Junior Nobel Prize for Indo-American Girl

THE Regeneron Science Talent Search, an annual competition for young talent in science, is also called the Junior Nobel Prize. Many of the winners in this competition have later captured the Nobel Prizes, Fields Medals, MacArthur Fellowships and numerous other accolades.

This year two Indo-American teenagers, Indrani Das and Arjun Ramani have respectively occupied the first and the third places in this prestigious competition and three others, Archana Verma, Prathik Naidu and Vrinda Madan have made into the top 10, while eight more have entered the list of 40 finalists.

Every year approximately 1,800 papers are received from high school seniors for the competition and the top 300 applicants are declared as semifinalists, each of whom is entitled to a prize of $1,000. Then in late January, 40 of them are chosen as the finalists, who are flown to Washington DC in March to take part in the interview for the top 10 spots. Every finalist is ensured of a prize of at least 25,000 US dollars while the one securing the first position receives a cash award of $2,50,000. The second and the third position holders get $1,75,000 and $1,50,000 respectively. The sponsoring schools are also rewarded by the title sponsor – the Regeneron Company – depending upon the positions of their sponsored candidates.

Indrani Das, a 17 year Indo-American girl was adjudged first for her research on treating brain injuries and diseases. Her project found a way of increasing the survival rate of neurons affected by injury or degenerative diseases in the brain.

The second prize has gone to 18 year old American boy Aaron Yeiser of Schwenksville, Pennsylvania for his development of a new mathematical method for solving partial differential equations on complicated geometrics.

Arjun Ramani, an 18 year old Indo-American boy from West Lafayette, Indiana has been nominated for the third prize for blending the mathematical field of graph theory with computer programming to answer questions about networks.
The Humble Chalk Ready to get a Makeover

IN the era of tablets and ipads, the humble blackboard and white chalk may appear to be a thing of past, but it is not so. Millions of school going kids still look up to the blackboard for their daily lessons. Now Indian scientists are deploying high technology to improve the quality of the writing chalk.

Writing slates have been in use in India at least as early as the 11th century. Al-Biruni, a scholar of the Islamic medieval era, had referred to the use of writing slates in his book, *Tarikh Al Hind* (History of India). He wrote that, “Indians use black tablets for the children in schools, and write upon them along the long side, not the broadside, writing with a white material from the left to the right.”

The practice of writing on blackboard using white chalk continues to date as an important teaching aid in educational institutions despite the advent of computers and other modern tools of information technology. The expectation is that it shall continue well into the future.

According to an estimate, about 20,000 tonnes of chalk are consumed in the country every year, considering that there are about one crore teachers and each of them could be using about two kilogramme of chalk per year.

The main issue with writing chalk is that it is typically manufactured by small-scale industries, with no formal production specifications. Poor quality is a major problem.

A group of Indian scientists have sought to rectify the situation. They have fine tuned the production process and have come up with a model chalk stick – it is dust-free, does not break easily, and has high bulk density and smooth finish. Writings made with the chalk are also easy to read and can be wiped off nicely without leaving much of a trace when they are not needed anymore.

The improved version of chalk was produced after a detailed analysis of various steps involved using latest scientific concepts and techniques. For instance, a thorough study was done before deciding on material to be used as binder which is needed to give necessary strength to the chalk sticks. The scientists tried out a large number of materials including urea, starch, guar gum, sodium silicate, and plaster of paris before zeroing in on the sodium salt of carboxymethyl cellulose.

The team of researchers consisted of Dr. Rajendra S. Thakur and Jignesh J. Shukla of the CSIR-Central Salt and Marine Chemicals Research Institute (CSIR-CSMCRI) at Bhavnagar; Girish R. Desale of CSIR-National Chemical Laboratory (CSIR-NCL) in Pune and Pushpito K. Ghosh of the Institute of Chemical Technology, Mumbai. They have published a report on their work in the latest issue of *Current Science*.

(Contributed by Sunderarajan Padmanabhan, *India Science Wire*)

Monitor Noise Pollution with a Smartphone

INDIAN researchers have developed a new way to monitor noise pollution using smartphones. Called “community sensing”, the process involves a community of phone users to monitor noise levels.

The noise pollution brain monitoring system is based on an application running on smartphones of participating individuals. It can detect noise levels and transmit the information to a server and share it on a Google map in the form of images. Due to the participation of the public in the process of sensing, mapping of noise can be done on real time basis.

Presently, special sound meters with sensitive microphones are used to monitor noise pollution. These sensors are deployed at selected locations. However, these cannot be used on a wide scale as it would require huge investments and lot of manpower. The new system developed by engineers at Thapar University, Patiala, is low-cost and is also easy to implement at a city-wide level.

A major advantage with smartphones is that they come with a variety of sensors like accelerometer, gyroscope, magnetometer, light, microphone and position sensors (GPS). In addition, they have processing and communication capabilities and storage. All these features make smartphones the best candidates for monitoring environmental noise.

The system has been tested in Khanna-Mandigobindgarh, a rapidly growing semi-urban area in Punjab. Noise levels at different parts of the industrial cluster – residential, commercial and educational areas including “silence zones” – were monitored. The results were very promising.

The team that developed the system published its research findings in *Environment Monitoring and Assessment Journal*.

(Contributed by Umashankar Mishra, *India Science Wire*)
RESEARCHERS at Sastra University in Tamil Nadu have developed a sensor for measuring levels of a sugar-derived substance directly responsible for heart-related complications and vascular damage in diabetic population.

Methylglyoxal (MG) is a by-product of glucose metabolism and its levels are seen several-fold higher in people suffering from both Type 1 as well as Type 2 diabetes as compared to healthy humans. Over 20,000 times more reactive than glucose, this toxic substance is constantly removed in a healthy body. But this scavenging mechanism is impaired in diabetics and is believed to be associated with many complications such as atherosclerosis, vascular damage and kidney malfunction.

Even though the mechanism through which MG acts is not fully known, one recent study showed that MG reduces the amount of “good” HDL cholesterol, which removes the excess bad cholesterol from the body, and hence is potentially dangerous.

Till date, there has been very little effort to quantify the MG levels in the blood or food products we consume. There are many sophisticated lab techniques such as ELISA or gas chromatography that can do that job, but they are expensive, time-consuming and require trained manpower.

A team of engineers and biotechnologists at the Sastra University, however, has been trying to develop cheap but highly efficient electrochemical sensors for quantifying MG levels.

The scientists led by Dr. John Bosco Balaguru Rayappan, a professor at the School of Electrical and Electronics Engineering, and Dr. Srinivasan Vedantham of the School of Chemical and Biotechnology at Sastra University, have reported one such sensor for measuring MG levels in rice in the journal *Analytical Biochemistry*. They have also fabricated a similar sensor for measuring the MG content in the blood and have filed a patent application for this.

“Our idea is to develop a simple handheld device – very similar to the glucometer – for detecting MG levels in the blood as well as food articles we consume,” says Dr. Rayappan.

A project proposal to measure the MG levels in diabetic, pre-diabetic and those suffering from gestational diabetes was recently given in-principal approval by the Science, Engineering Research Board (SERB) of the Department of Science and Technology, says Dr. Rayappan.

Understanding complications linked to MG in diabetics is very important for India, which is said to be home to nearly 70 million diabetics according to the International Diabetes Foundation.

(Contributed by T V Jayan, India Science Wire)
Lifelong Pacemakers!

THERE is good news for people using pacemakers and other implantable medical devices. A new, bio-friendly capacitor now makes use of body fluids to power them, and has been found to enhance the life of implantable medical devices by several notches.

The research team from University of California, Los Angeles (UCLA) and the University of Connecticut – also consisting of Indian scientists – designed this energy storage system which works on charged ions from body fluids like blood, serum, urine, etc. and does not hamper the biological systems. Calling it the “Biological Supercapacitor,” the team published their design details in the journal Advanced Energy Materials.

Current pacemakers are small coin-sized devices that help regulate abnormal heart rhythms. These are surgically implanted into the body to give steady pulses to the heart. They run on traditional lithium film batteries which occupy half the size of the implant. Eventually, when the battery runs out (typically in 5-12 years), it requires another painful surgical procedure to replace them. In addition, these batteries depend on chemical reactions to supply power to the device. In the event of a leak, the toxic chemicals can pose a risk to the user’s life.

In contrast, the Bio Super Capacitor is just 1 micron thick, flexible in nature and can bend and twist according to the body movements. All these factors not only bring down the size but also improve the energy efficiency of the implant and make it durable too.

The Bio Super Capacitor is made out of graphene layered by modified human proteins which work as the electrodes. These grab charged ions from body fluids and work in conjunction with another microdevice called the energy harvester. The energy harvester converts heat from body movements to electricity (like a self-winding watch); this electricity feeds the bio-capacitor.

In a news release by UCLA, Maher El-Kady, a UCLA postdoctoral researcher and a co-author of the study said, “Combining energy harvesters with supercapacitors can provide endless power for lifelong implantable devices that may never need to be replaced.”

“The loss of capacity over time is very small, which makes these supercapacitors very promising power biomedical devices over the long term,” adds lead author Islam Mosa.

Contributed by Ms Susheela Srinivas, an Engineer, Entrepreneur and Writer. She contributes to publications in India and abroad.

Address: #189, I F Cross, 3rd Stage, 4th Block, Basaveshwaranagar, Bengaluru-560079; Email: sushsri@gmail.com