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Mystery of Shell Effect

Clues from Polonium

Marie Skłodowska-Curie who won two Nobel Prizes, for Physics and for Chemistry, christened an element that she and her husband delineated, Polonium. She named it after her motherland, Poland.

Unlike Uranium or Thorium nuclei, the nucleus of Polonium is quite stable against fission. Just as, when the outer electron shell of an element is fully filled, it becomes chemically more stable, so also Polonium's neutron number of 126 makes the nucleus stable. The experimental prodding to understand the role of the 'shell effect' in nuclear fission, however, led to ambivalent results.

In a General Article in this issue, Tilak Kumar Ghosh recounts attempts at the Variable Energy Cyclotron Centre, Kolkata, the Inter University Accelerator Centre, New Delhi and the Bhabha Atomic Research Centre, Mumbai to understand the role of shell effect in the fission of Polonium.

How does the shell effect decide the fate of the nuclear fission process? Read on from **page 1961**.

Soils under Soaring Temperature

What will happen to agricultural productivity when temperatures increase over the ambient? Any change in soil temperatures will change the dynamics of carbon sequestration, microbial and enzyme activities and, hence, soil fertility and, consequently, productivity.

As part of climate preparedness, ICAR scientists based in Nagaland, Meghalaya and Mizoram examined the issue. They evaluated the effect of elevated temperature on soils from forests, grasslands, orchards, rice fields, etc. in terms of nutrient transformation, carbon dynamics, microbial biomass and enzymatic activities in the acid soils of Nagaland. The scientists took into consideration two types of soils, Alfisols and Entisols, found in the region.

How would the soils under different land use fare when temperatures increase by three degrees centigrade over the maximum temperature? What if the increase is higher? What type of agriculture would be more affected? How should we adapt our food production strategies to climate warming? Turn to **page 2044** for a Research Article that tackles the problems experimentally.

Controlling Mobile Robots

Using EEG signals

Stephen Hawking used a motorised wheel chair to move around. But imagine a situation where you cannot use your hands – because of a stroke or for some other reason. Since you are a scientist, you will think of a way to use the EEG signals from your brain to move the wheel chair as you wish.

In these days of feature extraction from EEG signals, this is not a fantasy. When you imagine the movement of your feet or hands, there is an event related desynchronisation in the EEG that can be automatically detected and used to move a wheel chair in the way you imagined. But that's complicated, requires complicated headgear with many electrodes and complex processing.

It is simpler to track a positive spike which happens at about 300 milliseconds after you make your wish. Yumlembam Rahul and Rupam Kumar Sharma from the Assam Don Bosco University thought that it would not be too difficult to extract this signal, P300, with cheap EEG headgear used for gaming.

They went on to design and execute the control and processing systems needed to extract the relevant signal from the cacophony of other EEG signals and to use that for moving the robotic wheel chair. But they were disappointed. The performance was not up to the mark.

Then they tried a totally different strategy. When you blink consciously, the signal in the EEG is much stronger than that from involuntary blinks. So they trained the system to recognise blinks. They taught the system to recognise four blinks, three blinks, two blinks and non-intentional blinks and used four blinks to move the wheel chair forward, three and two to turn left and right. While the wheel chair is in motion, you blink twice to apply breaks. And the system worked!

Read about the small steps taken to convert a big fantasy into reality in a Research Article on **page 1993** in this issue.

Sanctity of Banaras Sanctuary

Turtles under threat

The Banaras Turtle Sanctuary came up as part of the Ganga Action Plan in 1989 when the soft shelled turtle, *Nilssonia gangetica*, was introduced and later protected under the Wildlife (Protection) Act 1972. The freshwater turtle consumes human carcasses surrendered to the holy river, thus cleaning the waters.

But now, under the National Waterway project, the river will undergo a sudden increase in cargo transport. How will it affect the sanctuary for the soft shelled turtles?

Scientists from IISER Bhopal, the Wild Life Institute of India and IIT Kanpur assessed the geomorphological impact of human intervention on the flow of the river and the potential ecological impact of the movement of large cargo vessels in the river.

By examining images from the 1965 Corona satellite and Landsat images from 1980 to 2018, the scientists point out the widening of parts of the river after the construction of two bridges. Though the flow of the river is relatively stable, geomorphological changes due to anthropogenic influences are evident. But the introduction of large cargo vessels in the river will have an impact on the nature of waves generated and, hence, impact the banks. The resuspension of river sediments caused by the disturbance will also change the ecological niche.

The authors of the Research Article on this issue call for further research to reduce the potential threat to not only the turtles in the sanctuary, but also to dolphins and other aquatic fauna in the Ganga. Read on from **page 2063** in this issue.

K. P. Madhu
Science Writing Consultant
scienceandmediaworkshops@gmail.com