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Biological mitigation of atmospheric CO_2 levels

Massive international efforts have been launched to mitigate the unprecedented rise in the atmospheric carbon dioxide (CO_2) concentration resulting in global climate changes. The rise in CO_2 concentration is known to contribute to the 'greenhouse effect', which has a direct impact on photosynthetic productivity. Global photosynthesis accounts for about 100 Gt of carbon per annum, of which 60% is by terrestrial systems and the rest 40% by phytoplankton. Tree species alone can contribute to 75% of the terrestrial net primary productivity. Photosynthesis plays a significant role in the global carbon balance and its published responses to increasing CO_2 have been contradictory. Data on productivity and acclimatory responses to elevated CO_2 among C_3 (plants that fix CO_2 first into C-3 compounds like phosphoglyceric acid), C_4 (plants that fix CO_2 first into C-4 compounds like phosphoenol pyruvic acid) and crassulacean acid metabolic (CAM) photosynthetic groups are inconclusive. However, plant photosynthesis is always rate-limited by the atmospheric CO_2 concentration and thus there is a need to improve the affinity of plants to increasing CO_2 concentration with different photosynthetic assimilatory mechanisms through biotechnological approaches. Attipalli R. Reddy *et al.* (**page 46**) focus on improving terrestrial photosynthesis as a major strategy for biological mitigation of atmospheric CO_2 levels, which merits attention from scientists and policy makers. This article is a part of the ongoing series on 'Photosynthesis and Global Issues'.

Echolocating bats

Morphologically similar but otherwise distinct cryptic lineages have over the past years been able to unravel enormous amount of unknown diversity among various organisms. Existence of such diversity has shown the importance of using different types of markers for species identification, rather than rely on morphological markers alone as is predominantly done. Among echolocating bats, echolocation call frequency of highest intensity is widely used for species identification and fittingly enough, this same trait has also been able to differentiate between dissimilar groups of organisms which are morphologically identical. Such distinct acoustic groups are commonly called phonic types and more often than not different phonic types have been found to belong to distinct genetic lineages. In many cases such lineages are distinct enough to demand species rank.

Among echolocating bats found in India, it is speculated that enormous cryptic diversity exists, though hardly any study been reported. The discovery of a new phonic type of the rufous horseshoe bat by Chattopadhyay *et al.* (**page 114**) in southern India throws some light in this regard. Their findings also highlight the significance of non-morphological markers in taxonomic and biodiversity studies. This finding should also encourage other researchers to initiate detail surveys in other chiropteran species in India using behavioural markers in addition to morphological markers. It remains a question if these phonic types are distinct enough to demand revision of the established taxonomy and study of these phonic types using suitable molecular markers can definitely help answer this question.

SQUID-based measurement of biomagnetic fields

M. P. Janawadkar *et al.* (**page 36**) report on setting up the first facility in India for the measurement of extremely weak biomagnetic fields associated with the physiological activities of human heart and human brain using Superconducting Quantum Interference Devices (SQUID). Cellular physiology is known to generate a distribution of electric potential on the skin surface, which is routinely monitored by clinicians as electrocardiography (ECG) and electroencephalography (EEG) signals; the measurement of the corresponding magnetic fields (100 femto-Tesla to 100 pico-Tesla) is a challenging task as these are a million times weaker than the earth's magnetic field. A special building, which uses non-magnetic stainless steel as reinforcement in concrete, has been erected at IGCAR to reduce the effect of transient magnetic disturbances. The facilities erected inside comprise a Magnetically Shielded Room housing a liquid helium cryostat supporting four SQUID channels and a RF Shielded Room housing the electronic instrumentation. The article reports successful measurement of several biomagnetic fields such as magnetocardiogram, α-rhythm and auditory evoked magnetic field from the human brain. Magnetic measurement techniques are noncontact, much less sensitive to the conductivity variation of the intervening tissues compared to ECG/EEG and offer superior source localization accuracies. The authors unveil their plans to augment the number of SQUID channels to enable simultaneous measurements at multiple locations and to set up a helmet-shaped cryostat for whole head coverage; such strategies are vital for the reconstruction of sources responsible for the measured magnetic field distribution. Establishment of such systems in a hospital setting in India is likely to pave way for developing clinical applications in probing cardiac dysfunctions and focal epilepsy with a view to provide enhanced diagnostic aid.