In this issue

Barriers in protein folding

Some proteins require minutes to hours in order to fold to their functional forms while others can fold correctly on a time-scale of milliseconds or faster. Why are the kinetic barriers to folding high for some proteins and low for others? The determinants of the free energy barriers to folding are still poorly understood. The nature of the free energy surface which a protein molecule traverses during its folding reaction is also open to vigorous debate.

On page 457 of this issue, Santosh Kumar Jha and Jayant B. Udgaonkar make a critical assessment of the current status of knowledge on the energy barriers that slow down protein folding and unfolding reactions of proteins. The authors discuss the recent applications of high resolution residue-specific probes and time-resolved fluorescence methods to study the folding and unfolding of proteins, which have resulted in a significant wealth of data on the nature of free energy barriers during these reactions. In particular, the data indicate that the folding and unfolding reaction of proteins might not be characterized by the presence of a single dominant free energy barrier. Instead, many small barriers might be distributed on a complex free energy landscape separating the native and unfolded states. The authors also discuss the recent experimental observations of dry molten globule intermediates during the unfolding of proteins, which pose a significant challenge to the conventional two-state models of protein unfolding.

Coherent information in femtosecond shaped laser pulses

The optical C-band includes the widely used 1560 nm band. The existing telecom infrastructure (sources, receivers and channels) is optimized for this band, and optical fibre channels in use now are optimized for the purpose. If THz communication happens as a reality tomorrow, it has to use this band. To use femtosecond lasers in this band, accurate pulse characterization in this band is needed. The limitations of present pulse characterization have been computational complexity. The iterative nature of algorithms used at present makes the number of computation dependent on the nature of pulse and number of data points. The algorithm presented (page 476) is a Fourier domain inversion algorithm with a complexity dependent only on number of data points. This means that a high resolution data can be processed faster irrespective of nature of pulses. Higher resolution data means better frequency and time characterization. Accordingly, the technique has been used to characterize complex laser pulses in 1560 nm from IMRA Er-doped fibre laser (currently Er-doped lasers find application in optical communications). The effectiveness of the technique to measure even weak pulses has been established by this experiment. A mathematical analysis of the technique has been provided for additional insight into the technique. Analysis of the SNR offered by the technique has also been given and established experimentally. Characterization of complex pulses means the technique can be used for demodulating the pulses at receiver.

Ungulate species in Pathri Rao Watershed

Watersheds perform a wide variety of valuable services, including the supply and purification of fresh water, the provision of habitat that safeguards biological diversity and the sequestering of carbon that helps mitigate climatic change. The conservation of watersheds at regional scale has implications at global level and ungulates play an important role in vegetation dynamics which is important for overall utility and functioning of the watershed. Bilal Habib et al. (page 500) evaluate the suitability of Pathri Rao Watershed for four sympatric ungulate species sambhar, nilgai, chital and goral. Fine niche scale overlap analysis was used to model the co-existence of four sympatric ungulate species. The purpose of the study is to validate utility of micro-watershed Pathri Rao as a potential habitat for ungulate species using geo-statistical modelling. It is evident from the study, that advanced statistical techniques in combination with GIS can play an important role in developing habitat suitability analysis at micro-watershed scale which will govern wildlife conservation and management planning for watersheds and will emphasize their importance for overall water security and biodiversity conservation.