Editorial

K L Sebastian, Chief Editor

Email: kls@ipc.iisc.ernet.in

Quantum computing is a very promising area of research. It is based on the use of dynamics of quantum bits (qubits) to perform calculations. Qubits, unlike ordinary bits can exist not only in two states, denoted as $|0\rangle$ and $|1\rangle$, but also in any superposition of these two and hence offer much more computing power than traditional computing based on bits, which have just two possible states. Though the idea is attractive, actual building a quantum computer is extremely difficult. The difficulty is that quantum systems interact with surroundings, lose their quantumness, and become classical, in a process that is referred to as decoherence. This means that to have a quantum computer, one has to keep the system well isolated to prevent decoherence or use procedures that correct for it. This seemed so difficult that one always thought that quantum computing for useful purposes was still a long way off, at least twenty years in future.

However, in 2007 two things happened. The first was a demonstration of the retention of coherence in the photosynthetic machinery of purple bacteria (see Fleming *et al*, Vol.316, p.1462, 2007), suggesting that quantum effects can still be retained in the wet and hot environments of a biological cell. The other was the claim of a company called D-wave that it had built a quantum computer which was demonstrated with much publicity. The first was received with much excitement while the second was not, mostly because of the way the announcement was made – the company had not trodden the traditional path of scientific research, which is to publish the basic idea in refereed journals and then proceed to build a quantum computer based on them. Hence most workers in the area tended to disbelieve the claims. However, recently *Nature* reported a changed scenario, which appears very exciting. The company has sold a 512-qubit quantum computer to Google in May 2013! An earlier version with

128 qubits was sold to Lockheed Martin for ten million dollars in 2011. Further, there have been very interesting reports on use of the computer, one of which is its application to the protein folding problem (see A Aspuru-Guzik *et al*, *Scientific Reports*, Vol.2, p.571, 2012). While these are very important, there are skeptics who question even the quantum nature of the computing done by these machines (see John A Smolin and Graeme Smith in arXiv:1305.4904v1). However, it is clear that quantum computing is not so far ahead in the future, as one is used to thinking!

This issue of *Resonance* covers the life and work of Sadhan Basu, the eminent physical chemist who spent most of his life working at the University of Calcutta. He was a brilliant scientist who had done interesting work in polymer chemistry, chemical kinetics, spectroscopy and theoretical chemistry. He was the first to do quantum chemical calculations in the country and deserves to be referred to as the first quantum chemist of India.

This issue also contains the concluding part of the Series on Natural Products by N R Krishnaswamy and C N Sundaresan and the first part of a Series on Circadian Rhythms by Koustubh M Vaze and Vijay Kumar Sharma. Vijay Natarajan gives us an overview of visual representation of data. In the first part of a two-part article, Shailesh Shirali writes on combinatorial and algebraic proofs, giving beautiful examples of both.