# In this issue

## Geochemical clue to a disease

Does the heart have a 'sense of geography'? Does it, in other words, respond to changes in the physical geography of the environment? That it does so and adapts is well known. Thermal stress and reduced atmospheric pressure at high altitude evoke changes in the heart's output and efficiency of pumping respectively. In the article beginning on **page 908**, M. S. Valiathan goes from such aspects of physical geography to the internal milieu of the heart's cells: the chemical elements that are effectors in heart function. In Valiathan's attractive analogy, the theme song of chemical cardiology belongs to the elements, whose music becomes imperfect when a regular player is replaced by an impostor. Taking this further, we understand the role of harmful elements in our geographical environment from our knowledge of the role of the physiological elements, even as we may recognize an impostor in a symphony better for having known the regular players. Valiathan considers pairs of physiological and nonphysiological ions, such as sodium and lithium, potassium and rubidium, and calcium and strontium, in which the latter can replace the former in a particular reaction but cannot sustain 'normal' physiology.

Valiathan and colleagues at the Sree Chitra Tirunal Institute for Medical Sciences and Technology in Trivandrum, and researchers at the Central Tuber Crops Research Institute in Trivandrum and the Bhabha Atomic Research Centre in Bombay have data that point to a substitution of magnesium by cerium in heart tissues of patients with endomyocardial fibrosis. There was a geochemical clue in that the region which has the highest incidence of the disease in India, viz. the coastal belt of Kerala, has cerium-rich soil. In an interesting experiment, it was shown that a local tuber plant could accumulate cerium under conditions of magnesium deficiency. Confirmation of this in an animal model may lead to dietary supplementation of magnesium in the control of the disease.

## Quantum potty?

That quantum mechanics introduced ideas that lead to unexpected and peculiar results or predictions in microscopic physics is well known. Quantum mechanics has made inventive use of language in describing its consequences. There is, for instance, the 'quantum pot that refuses to boil' when it is 'watched'. The quantum pot is really a system undergoing some quantum transition, the 'boiling'. 'Watching' a quantum system means making some measurement on it. The 'watched pot effect', in simple terms, is the inhibition of the evolution of a quantum system by repeated measurements on it. While this appears to make little sense in the familiar world of macroscopic objects, the idea is a striking consequence of the basic concepts of quantum mechanics: the quantum-mechanical description of an electron in terms of its wave function, which gives an array of 'probability waves' or 'superposition of states', 'collapses' into a description of a single, 'real' electron when we 'observe' it. In the case of the watched pot, the observation, or measurement, must occur at a frequency whose time interval is much shorter than a critical time of evolution of the system. Because these times are very short indeed it is difficult to demonstrate the effect experimentally. Partha Ghose and Dipankar Home draw attention (**page 897**) to a recent experiment that would seem to have done just that. The experimenters used an atomic transition in beryllium ions for which the critical time was known. By making repeated measurements of the survival probability of the ions in the initial state, they showed that, at a certain frequency of measurement, the survival probability reached unity, i.e. the transition did not take place. Ghose and Home also discuss other examples of the phenomenon.

B. Misra and E.C.G. Sudarshan, in 1977, first used the phrase 'Zeno's paradox in quantum theory' to describe the phenomenon. Zeno of Elea was a fifth-century-BC Greek philosopher who laid the foundation of paradoxes of infinity. One version of Zeno's paradox has a man conceiving a one-mile walk as a series of steps, each covering half the distance as the previous: he must first walk one-half mile, then one-fourth mile, then one-eighth, and so on *ad infinitum*. Such an infinite series is by definition a series that cannot be exhausted, hence the man can never reach the end of his mile. (Misra and Sudarshan recalled the arrow paradox of Zeno in their paper.) In the case of the watched quantum pot, an infinite number of observations, or continuous observation, is a limiting case of repeated, frequent observations.

## Excellence in science

How can distinction, or excellence, be attained in science? That is the question Sir Hans Krebs, after whom the citric acid cycle of metabolic reactions in living cells is named, asked himself. In his reminiscences (reprinted here, see **page 944**) fifteen years after he won a Nobel prize, Krebs is emphatic that he owed his own success to an outstanding teacher. That teacher was Otto Warburg, who was himself a Nobel laureate. Krebs makes his point by tracing his 'scientific genealogy' back to the eighteenth-century French school of chemists. Each of the great men of science in the genealogy had a great teacher, who also often collected a team of distinguished scientists around him. While technical skills can be learned from many teachers, and are a prerequisite for successful research, it is the proper use of skills and the attitudes that allow this that are critical and can be conveyed by a distinguished teacher. Krebs makes a plea for creating and nurturing scientific excellence in the universities. Even twenty-three years after these reflections, their importance must not be lost upon us; indeed, as far as India is concerned, the same sentiments, and action, are the need of the hour.

## Ancient plants...

The study of the origin and evolution of life on earth now draws from geology, palaeontology, classical divisions of biology, and even biochemistry and molecular biology, and numerical taxonomy. Data from different fields are carefully pieced together to obtain a coherent and consistent picture. The Birbal Sahni Institute of Palaeobotany in Lucknow (see **page 903**) is involved in such a multidisciplinary effort. Two significant findings of BISP are the signatures of anaerobic bacteria in > 2.6-billion-year-old sediments of the Dharwar Craton and metazoans in > 800-million-year-old sediments of the Vindhyan Supergroup. The article on BISP also discusses work on ancient floras, palaeoecology, palynology of petroliferous basins, plant economy in prehistoric human settlements, and geochronology.

### ...and ancient rocks

Robert C. Newton, reviewing a book on the granulites of South India (see **page 942**), remarks: '... descriptions and insights outline the essential attributes of a three-billion-year-old protocontinent. The evolution of the earth's early crust is perhaps nowhere else as compactly, though comprehensively, revealed as in southern India'. C. S. Pichamuthu, who died recently (see **page 943**) and whom the book commemorates, made an immense contribution to knowledge of South Indian geology.