Editorial

N Mukunda, Chief Editor

Thomas Kuhn, and with him Karl Popper, are two of the most frequently mentioned names in contemporary discussions of the philosophy of science. Popper was prominently featured in our issue of November 1996; this month we likewise provide our readers with some information on Kuhn. Initially trained as a graduate student in theoretical physics, Kuhn went on to a deep study of the nature of science itself, analysing the key steps that ultimately lead to the greatest advances. Thus were the words and phrases — "paradigm", "normal science", "revolutionary science", "paradigm shift" – so common today in this context brought into the jargon. There is a feeling that Kuhn's ideas were somewhat excessively influenced by the case of physics; if so, this is understandable. Other factors which are relevant but which were assigned less weight than they deserve by Kuhn are mentioned in Sujatha Byravan's *Article–in–a–box*. As with Popper so here too M G Narasimhan provides an independent look at Kuhn – a second opinion – emphasizing his role as a historian and not just a philosopher of science. Many professional physicists will recall the very extensive recorded conversations Kuhn had in the early sixties with the makers of the quantum theory, including Heisenberg and Dirac, collected in the Archive for History of Quantum Physics deposited at the Niels Bohr Institute in Copenhagen.

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Turning to other items, I would like to point out some cross-connections among articles in different areas. S Ranganathan's "A Tale of Two Topologies" and the Woodward–Hoffmann rules of organic chemistry brings out the importance of the Möbius strip. At our request Vishwambhar Pati contributed

a companion piece from the mathematical angle, telling us what orientability is all about. The key lesson is that you cannot pour wine into a Klein bottle. And while R Srinivasan's series continues to explore the question "How cold can you get?"

Thomas Samuel Kuhn

Historian and Philosopher of Science

When Gil Scott Heron sang *"The revolution will not be televised"*, he seemed to have political revolutions in mind. But the words might very well characterise the invisible scientific revolutions that Thomas Kuhn wrote about. Science text books, Kuhn said, systematically mislead readers by presenting scientific progress as a linear process of accretion that may be compared to the addition of bricks one-by-one to a wall. That, however, might not be the way science actually develops. What text books fail to reveal, and many scientists still fail to appreciate, is the existence and nature of revolutions in the scientific enterprise. This was the subject of Thomas Kuhn's tome, *The structure of scientific revolutions*, for which he is best remembered.

Thomas Kuhn died on June 20, 1996, at the age of 73. But his controversial work, first published in 1962 and now available in 25 languages, can still provoke heated debates among scientists and philosophers alike.

Kuhn first conceived of *Structure* as a graduate student in theoretical physics. A fortuitous opportunity to teach the history of science to non-scientists at Harvard caused him to re-examine his concepts of scientific progress. This effort completely undermined what he had come to believe during his training as a scientist. In *Structure*, published fifteen years later, Kuhn employed the history and development of the physical sciences to present his polemic.

Kuhn's leitmotif, the notion of *paradigm*, is the framework of concepts within which scientists work and interpret their observations. For the most part, scientists carry out what Kuhn calls 'normal' science, working within the paradigm using the tools and concepts that it provides. This is largely puzzle-solving, aiming little at producing "major novelties, conceptual or phenomenal." So, then, how does science progress? Observations of anomalies that do not conform to the paradigm challenge it, and then evolve ultimately into a crisis that needs to be resolved. An example of this is the work of Barbara McClintock, who challenged the dominant paradigm that 'genes are stable entities' when she proposed the presence of transposons (*Resonance*, October,1996). According to Kuhn, scientists enmeshed in a paradigm may employ the same vocabulary