

Editorial

Amitabh Joshi, Associate Editor

India's most important export today is its brain power, whether it be in information technology or in other areas of knowledge. In many ways, this is only fitting – India was a major centre of learning in ancient and medieval times, attracting scholars from all over Asia and even beyond. However, in order to be able to produce a large pool of technically proficient people in present times, a country must possess a sophisticated infrastructure that directly or indirectly plays a role in nurturing future scientists and technologists. That we in India possess such an infrastructure is due to the foresight and efforts of many dedicated Indians over the past hundred years or more. These visionaries spent their time, energy and often money, on projects that helped ensure that our country kept up with the world in terms of economic development, public health, education and industrialization.

In this issue, we remember Sir M Visvesvaraya, an innovative and creative engineer whose active working life spanned almost 60 years. A civil engineer by training, Visvesvaraya is best known for his work on river projects aimed at using dams for power generation, irrigation and flood control.

The evolutionary success of humans has largely been due to our ability to face the challenges put forth by an environment that is often hostile. Visvesvaraya's work, whether

in taming rivers, or in solving the problem of fuel for the Bhadravathi Iron & Steel Works, shows a self confidence that seemingly insurmountable problems can be solved by the application of some creative thought. It is this self confidence and creativity that has been responsible for all the great successes of human endeavour. As Allama Iqbal has so well said

*"guftand jahaan-i-ma aaya be tu mi saazad
guftam ki nami saazad, guftand ki barham zan"*

(God asked me if I did find, his world to my liking and taste

I said – no! Then he replied – create your own and lay this waste).

Visvesvaraya's genius lay in his ability to understand a particular problem in all its aspects, visualize an optimal solution to it, and then plan and implement the solution meticulously. His projects are famous for not having overshot the proposed budget or time limit. In many instances he developed novel and creative ways of dealing with practical problems arising in the various projects he undertook. It is also fascinating to note that Visvesvaraya was not merely an engineer. He was equally mindful of the economic aspects of his projects, and ensured that his ventures were economically viable and, to a great extent, self sustaining. Several such examples can be found in the articles by Shankara Rao



and, in Visvesvaraya's own words, in the excerpts from his *'Memoirs of My Working Life'* reproduced in our *Classics* section.

In addition to being a very innovative engineer specializing in river projects, Visvesvaraya was truly a visionary. He foresaw the need for all round economic and technological development in India and, in his own life, embodied the best possible work ethic. While in the service of Mysore state, Visvesvaraya was instrumental in setting up many industries and also the Bank of Mysore. Looking to the future, he also helped establish institutions for engineering and agriculture education. Karnataka today is recognized as one of the leading states in India in the areas of science and technology: much of the renowned scientific, industrial and technological infrastructure of Karnataka can be traced back to Visvesvaraya's efforts more than half a century ago.

Visvesvaraya was in essence very much Indian, rooted in his native culture, but yet forward looking and ever ready to embrace new ideas or come up with novel and innovative solutions to problems, as opposed to merely copying technology developed elsewhere. His life and works embody the sentiments expressed by the Kannada poet D V Gundappa, who writes in his *Mankuthimmana Kagga*:

ಹೊಸ ಚಿಗುರು ಪಳೆ ಬೇರು ಕೂಡಿರಲು ಮರಸೊಬಗು |
ಹೊಸಯುಕ್ತಿ ಪಳೆತತ್ವದೊಡಗೂಡೆ ಧರ್ಮ ||
ಋಷಿವಾಕ್ಯದೊಡನೆ ವಿಜ್ಞಾನ ಕಲೆ ಮೇಳವಿಸೆ |
ಜಸವು ಜನಜೀವನಕೆ ಮಂಕುತಿಮ್ಮ ||

(the coming together of old roots and new sprouts yields a beautiful tree
what is dharma but old principles merged with new approaches
when ancient wisdom merges with arts and sciences, truly life becomes beautiful)

Other articles in this issue run the gamut from butterfly behaviour to quantum computation. In an ongoing series on butterflies, Smetacek describes the diverse ways in which these insects avoid predators. In the second part of his article on quantum information science, Simon discusses mixed states, entanglement and quantum measures of information. Shylaja's article sheds light on the luminosity and mass of stars and explains how the relationship between these two attributes leads to a better understanding of the interiors of stars.

There is nowadays great interest worldwide in finding substitutes for fossil fuels, and ethanol has been recognized as a useful fossil fuel substitute. Lachke's article describes ways of producing ethanol from *D*-xylose, a sugar found in abundance in plants, being one of the constituents of hemicellulose. In the second part of his article on Markov Chain Monte Carlo, Chakraborty discusses the mathematics behind this method of simulation. Turning to chemistry, we have an article by Gadre on the Nobel Prize winning work of Svante Arrhenius on electrolytic decomposition. Finally, in our *Classroom* section, we have a piece on the twin prime problem.