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EDITORIAL

What Sustains?

The universe, since its inception, is dynamic and has been evolving. The solar system and the earth came into being some billions of years ago as a consequence of such dynamic processes, and a series of stochastic events on this planet led to assemblage of some molecular entities that the humans define as "living" because of their certain unique properties. The planet Earth and the living beings present on it evolved together in a mutually interacting manner. One of the consequences of such interactive evolution was the origin of the human species on this planet more than 2 lakh years ago. *Homo sapiens*, because of certain unique features of its body and brain organization, rather quickly began to modify and control the surroundings for its own benefit. This tussle between the nature's stochastic dynamism and the human designer dominance has raised the question of sustainability.

Sustainability is a common point of discussion but the context varies in relation to the specific issue. From the human societal point of view, the remarkably rapid changes in technology and the consequent impact on human lives raise issues about sustainability of not only the process of advancement but also of the highly technology dependent society itself. Enormous debate on the issue of sustainable development has taken place, and continues to be held. Typically, we tend to define "development" in terms of technological and material advancements, although philosophers and social scientists may not fully agree to this definition. In a wider biological perspective, sustainability of the dynamicity of bio-diversity and thus the process of evolution itself has become an issue since the designer anthropogenic dominance has the potential to overpower natural selection.

Most debates on sustainability of development seem to start with the presumption that things were all very well in the past but the contemporary technological and material "developments" are disturbing the societal homeostasis, as a consequence of which not only the tempo and mode of the progressive development may not be sustained in future but there may actually be a "retrograde development" or even collapse of human civilization. Future only would tell how far such views are sustainable, yet the debate goes on.

The 101st session of Indian Science Congress Association, held at Jammu in January 2014, included a panel discussion on "Role of Science, Technology and Innovation in Ensuring Sustainable Inclusive Development" which was chaired by Prof. Krishan Lal, the then President of INSA. His report on this panel discussion, included in this issue (*p.* 193), emphasizes the roles of different Science Academies across the globe in discussing the factors that affect sustainable development and advising the policy bodies of different countries on steps needed to ensure sustainable development.

Prof. R Gadagkar, the current President of INSA, who also was a panelist in the above discussion, in his opinion piece (*p.* 181 in this issue) has raised some very pertinent questions about the nature of debate on sustainability and has drawn attention to the need to learn from evolutionary biology and anthropology in the context of sustainable development.

The success of human dominance in contemporary living world is evident in the enormous growth of human populations. However, the population growth too contributes substantially to the question of sustaining food security for the increasing

mass of human species. This has triggered intensive research on increasing the food resources. While genetic engineering and biotechnology have become the more popular contemporary approaches for augmenting the quality and quantity of food, other avenues are also being considered. One of them is improving the bio-fertilizers that may be environment friendly as well as effective in substantially increasing the agricultural yields. This issue of the *Proceedings* carries a special section, edited by Dr. D J Bagyaraj (*p*. 415), on "Microorganisms in Sustainable Agriculture". These series of articles derive from a brain-storming session held earlier at the Indian National Science Academy.

Another major concern, especially in the context of sustaibalility of India's progress, is the quality of education and learning being provided at different levels, starting from the primary to university levels. No matter how we define the issue of "sustainability", it is clear that a well-informed society alone can think of appropriate measures that can help sustain the anthropocentric civilization that the human species has created. The quality of education and learning experiences that become available to the increasing numbers of youth in the society decides how well-informed the society becomes. These vital issues about the quality and quantity of education have been very widely debated, including by the Indian National Science Academy, and the undisputed outcome of such debates has been that the state of education in the country is alarmingly poor. Numerous suggestions have been made over the decades to improve the quality and quantity of education- some have been implemented but a large majority, unfortunately, await attention and execution. Therefore, there is a strong need for continued sensitization about the state of education and what can be done about it. In this issue, Alok Bhattacharya (*p.* 185) briefly discusses some simple steps that the University Grants Commission, the main regulatory authority for higher education in the country, may take to catalyze and sustain excellence in Indian Universities.

We commonly believe that "old is gold" and that the current tempo of development is not moving in "right" direction and thus may not be sustainable. Palaeontology and histories of different human societies and cultures, however, tell us that there have been cycles of development and collapse of dominant biological forms and of human societies in the past as well. Therefore, the question of sustainability is not a new one. However, if we learn from histories of human societies and the evolutionary changes, we may better sustain the progressive development than otherwise.

The fundamental laws of thermodynamics imply that to sustain an organized state, entropy needs to be reduced through input of energy. Human society is an organized state and thus energy inputs are essential for its sustenance. Discussions on issues that impinge on sustainability of any aspect of our civilization do provide at least some energy inputs through sensitization and thus are important and welcome. While it remains to be seen if the so-called "progressive development" is sustained or not, discussions on "sustainability" would sustain!

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