alone can solve the energy crisis of the world. He had published a scholarly book which seeks to relate the old relics at Stonehenge in England to practices related to astronomy in the ancient civilization. He gave well-argued lectures on the dangers of the future growth of population.

In 1957, Fred Hoyle published his first science-fiction novel, called *The Black Cloud*. This book was a great success and many readers felt that in Hoyle they had a reincarnation of H. G. Wells! But the difference here was that an internationally renowned scientist had attempted writing science fiction. The black cloud in the novel is formed of thinly-packed molecules with a brain which could think. The cloud needs energy for its survival and obtains it from stars. When it comes near the sun to 'charge' its energy reservoir, a havoc is created on the earth and the novel describes how, with the help of scientists, all the nations club together and face the calamity. The administrators, the politicians, and the eccentric scientists are all depicted very well. The fictional cloud of the novel turned out to have a realistic aspect too; when a few years later, through millimetre astronomy, clouds with molecules were detected by astronomers. (It is not yet known if there are any clouds with brains!) Indeed Hoyle once confessed that he was driven to write this novel when his scientific paper proposing the existence of giant molecular clouds was turned down by scientific referees on the grounds that such clouds could not exist in the interstellar space.

Hoyle has written quite a few science-fiction novels. Some of them were written in collaboration with his son Geoffrey. The children's play. 'Rockets in Ursa Major' described above, was subsequently written up as a novel by the father and son. *A for Andromeda* and its sequel *The Andromeda Breakthrough* were novels that grew out of very successful television serials (and brought the then relatively unknown actress Julie Christie before the British audiences). In 1969, Hoyle was given the Kalinga award by UNESCO, for popularizing science.

In 1958, Hoyle became the Plumian Professor of Astronomy and Experimental Philosophy in the University of Cambridge. This Chair was earlier occupied by Arthur Eddington and Harold Jeffreys, both stalwarts in their respective fields. He felt, however, that the accelerated mode of astronomy research with growing collaborations between theorists and observers and with the increasing role of the electronic computer, needed a research institute in order to keep Cambridge at the apex of astronomical development. He therefore worked hard for and ultimately succeeded in establishing in 1966, the Institute of Theoretical Astronomy (IOTA). IOTA indeed proved to be a great success and was later expanded to include observational astronomy as well. In 1972, he was knighted by the Queen. It was largely due to his stewardship as the Chairman of the Anglo-Australian Telescope (AAT) Board, that the Anglo-Australian Telescope was successfully commissioned.

But, though very well-known and distinguished, and creator of institutions, Hoyle was never a part of the establishment. Because, to be established, one requires a conformist attitude. Hoyle, by nature had the stubbornness proverbially associated with his native county of Yorkshire. So, even though he worked on different committees, he kept aloof from the establishment.

In 1972, following a policy disagreement, he resigned directorship of IOTA, as well as the Plumian Chair and his natural love for hiking in the hills, prompted him to live in a small village in the Lake District. Living like a recluse and without any formal day-to-day connection with any institution, he still kept his research going.

In the mid-1970s, Hoyle created another controversy by challenging the generally believed ideas of terrestrial origin of life and its Darwinian evolution. With his former student Chandra Wickramasinghe he proposed a theory of extraterrestrial origin of life. This theory requires that bacteria and viruses enter the earth's atmosphere on cometary tails and may have seeded life on the earth four billion years ago. Although severely attacked by biologists and astronomers, their theory is now gaining more support. Ironically, he passed away while an Indian balloon experiment testing this hypothesis of panspermia had been successfully completed and its results are being analysed.

In spite of all this controversy, even his critics admit his unique creativity, originality and extraordinary perception. It would not be an exaggeration to call this extraordinary personality, the Galileo of modern times.

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T. S. Sadasivan – A tribute

Toppur Seethapathy Sadasivan was born in an affluent family in Madras on 22 May 1913. After graduating in Botany from the Madras Presidency College in 1934, he went to the Lucknow University for his Masters under the renowned Palaeobotanist, Birbal Sahni. He then enrolled for D.Sc. in mycology under S. N. Das Gupta in the same university. Subsequently he went to England to join the Rothamstead Research Station, Harpenden to work for his Ph.D. under F. C. Bawden and S. D. Garrett specializing in plant virology and soil microbiology. He returned to India in 1940 after obtaining his Ph.D. from the University of London and rejoined the Lucknow University. In 1941 he took up the position of microbiologist at the Punjab Agricultural College, Lyallpur, now in Pakistan. In July 1944, he joined as Reader in the University of Madras and became the Head of the Botany Laboratory succeeding M. O. P. Iyengar.

Sadasivan's group launched studies on soil-borne diseases in crops such as cotton, pigeonpea and rice, aimed at

controlling the survival of their pathogens in soil and developed concepts such as competitive saprophytic ability, Rhizosphere effect, etc. C. V. Subramanian's excellent contributions on the taxonomy of Hyphomycetes and other groups resulted from Sadasivan's work on soil-borne pathogens. The University of London awarded Sadasivan the D.Sc. degree in 1955 for his contribution to mycology and plant pathology.

Sadasivan's group also pioneered studies on host–pathogen interaction at physiological and biochemical levels and was the first to demonstrate fusaric acid, a metabolite produced by *Fusarium* in wilting cotton plants. Excessive transpiration, loss of potassium and accumulation of calcium indicated destruction of membrane integrity by the vivotoxin of cotton wilt. Derangement of carbon and nitrogen metabolism, tissue respiration and role of toxins/enzymes of pathogens in the development of disease syndrome, the nature of interaction both in compatible and incompatible host–pathogen combinations of a number of fungal and virus diseases of plants were studied by his group. That a genotype–nycto-temperature interaction was critical for host compatibility and host range of rice blast pathogen, *Pyricularia oryzae*, was an important breakthrough of his group. These studies have been published in over 600 papers with a high citation index. In spite of his close association and involvement in the execution of research work by his students, Sadasivan never put his name as co-author when the work was published.

A review committee of the University Grants Commission ranked Sadasivan's department at Madras as number one along with Panchanan Maheswari's department of Botany at Delhi University. Sadasivan's Laboratory was upgraded as the Centre of Advanced Study in Botany along with that at the Delhi University in 1964.

Sadasivan strove to promote experimental botany as an interdisciplinary approach. His group had botanists, agricultural graduates, organic chemists, biochemists and biophysicists at a time when such interaction was rare elsewhere. He also forcefully advocated opening of biosciences departments in the newly created Universities rather than the conventional botany and zoology departments. The vigour of these departments thus set-up bear ample testimony to his vision and foresight.

Sadasivan organized several summer schools for revision of school curriculum and summer camps for university teachers. He also organized a UNESCO-sponsored training camp in physiological plant pathology for scientists from South-East Asia. He was the chairman of the biology study group of NCERT which brought out six graded texts in biology for 10 + and 15 + year school students. He firmly believed that improvement of science

education should start at the school level and donated a substantial portion of his estate in Kodaikanal to establish Gandhi Vidhyashram under the aegis of Bharathiya Vidya Bhavan. As Chairman of Vidhyashram, he devoted much of his time and energy for the past 15 years in shaping this residential school as an ideal centre for training young students.

Sadasivan served in many high-power committees of the Ministry of Education, Ministry of Science and Technology, CSIR and UGC constituted to chalk out policies for development. Creation of the scientist pool in CSIR, of Centres of Advanced Study and Departments of Special assistance by UGC, the Faculty Improvement Scheme, and the Teacher Training facility are some of his innovations.

In recognition of his immense service to the growth of botanical studies and Indian Science, he was awarded the Padma Bhushan in 1974. Sadasivan also received the Bhatnagar Award for Biology (1960), the Birbal Sahni Medal (1962), the Jubilee Medal of the Birbal Sahni Institute of Palaeobotany (1971), and the Sunderlal Hora Medal of the Indian National Science Academy (1973). He was the Birbal Sahni Professor at Birbal Sahni Institute of Palaeobotany, Lucknow from 1977 to 1980.

Sadasivan was elected a Fellow of the Indian Academy of Sciences in 1945 and served on its Council for nearly a quarter of a century and became its President in 1971 soon after the demise of its founder C. V. Raman. He was a Fellow of the Indian Botanical Society, the Indian National Science Academy (1955), the Indian Phytopathological Society (1974) and the Deutsche Akademie Naturforschung, Germany (1960). He was elected Vice-President of the International Botanical Congress for five consecutive terms and Vice-President of the first International Plant Pathology Congress in London in 1966. He was Editor of the *Journal of the Indian Botanical Society* (1950–66) and served on the editorial board of *Phytopathologische Zeitschrift*.

Sadasivan always gave more to others than he got from them. He made every one feel important and close to him. He displayed remarkable self-control, never raised his voice to hurt anyone. He mellowed the ebullient, emboldened the meek and supported the bright. His flock followed him with reverence and shared his glory.

He passed away in Chennai on 18 August 2001 leaving a gaping void in our midst. He is survived by his wife Radha and three daughters.

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