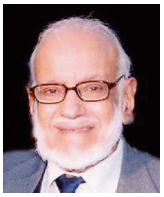
"Scientific Temper", What it is!



Mambillikalathil Govind Kumar Menon

Mambillikalathil Govind Kumar Menon (Padma Shri, Padma Bhushan, Padma Vibhushan), FRS (born on 28 August 1928), also known as M. G. K. Menon, is a physicist and policy maker from India. He has had a prominent role in the development of science and technology in India during the past four decades. One of his most important contributions was nurturing the Tata Institute of Fundamental Research, Mumbai, which his mentor Homi J. Bhabha founded in 1945.

He undertook experiments with cosmic rays to explore the properties of fundamental particles. He was actively involved in setting up balloon flight experiments, as well as deep underground experiments with cosmic ray neutrinos in the mines at Kolar Gold Fields. He is currently the President of the prestigious Indian Statistical Institute and the Vikram Sarabhai Fellow of the Indian Space Research Organization. In the past, he has been the President of the National Academy of Sciences, India, Director of the Tata Institute of Fundamental Research, Mumbai (1966–1975), Chairman of Board of Governors, Indian Institute of Technology, Bombay and Chairman of Board of Governors of the Indian Institute of Information Technology, Allahabad. He has won the Abdus Salam Award, and is a member of the Pontifical Academy of Sciences. He is one of the most prominent scientists from the state of Kerala. He was elected as a Fellow of the Royal Society in May 1970. The asteroid 7564 Gokumenon was named in his honor in late 2008.

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In the process of evolution, man developed four highly significant abilities: tool making and the general intelligent manipulation of objects; speech, and the development of sophisticated vocabulary; the capacity for social development which permitted an increased ability to cooperate within the family or the tribe; and most importantly, the ability to reason logically has its origins in the evolution of the human brain; and through the ages, man has used this significantly to become the most dominant and powerful species on earth.

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About ten thousand years ago, man developed the ability to cultivate, on a controlled basis, plant species suitable for food; this was the beginning of agriculture. This relieved humankind from its nomadic existence in search of food as was available in nature. It resulted in human settlements and stronger cooperative relations; and a sense of security from want. It thereby gave man very much more time to think and reason, and to satisfy his sense of curiosity about the surroundings and the natural phenomena that he observed. He applied a great deal of the information so gathered, and this he analyzed in an empirical manner, to various practical activities that he was engaged on agriculture, weaving, pottery, handling and shaping material, tool making, etc. and developed ways of living not too different from what obtains today.

THE ORIGIN OF SCIENCE

While a large part of his observations and analysis related to aspects of his daily needs and their fulfillment, there also arose, in parallel, thinking of a philosophical character on the basic aspects of nature unrelated to human needs. Apart from metaphysics and philosophy, this basic work was initially in the areas of mathematics and astronomy and then moved into the disciplines of physics and chemistry. In these developments lay the origins of science man's ability to reason logically, having the leisure to think and satisfy his curiosity, and cooperative relationships within the community which led to fruitful interaction.

At each point of time, there has been a limit to scientific understanding. Many aspects of human thought and

experience remained outside scientific explanation. These were looked at from other angles based on intuition and deep philosophical thought; they were often manifested in music, literature and other art forms to name some of the other great creative abilities of humankind. There were, of course, many in society who approached these question that lay outside scientific understanding at that point of time, in terms of myths, superstitions, miracles and other types of obscurantism. Miracle workers, witchcraft practitioners, godmen and charlatans appeared in society because they could derive power and material benefits in their manner of functioning. When overwhelmed by force of nature, in facing completely unknown situations and at moments of deep emotion, particularly sorrow, it has generally not been possible for man to reason logically.

In the early stages of human development, there were pseudo sciences like cabbalistic number lore, geomancy, alchemy and so on. Several of them demanded observations and experimentation, and gave rise in time to meaningful science. Thus chemistry is an off-spring of alchemy.

Society has always had within it a mix of the following: those working toward fulfillment of human needs and aspirations through increased scientific understanding of nature, or even through empirical applications without a true scientific understanding; those engaged in deep philosophical thought concerning the many things outside the ken of scientific reasoning; and finally those concerned with obscurantist approaches. The extent of this mix has varied from society to society and from time to time. Indeed, one can say that a mix of rational objective thinking, of intuitive, philosophical and impressionistic thinking and of irrational obscurantist thinking exists within each human being. But the mix varies from society to society, from individual to individual and their backgrounds of education etc. and also with time.

It is interesting to note that Gautama the Buddha had said the following:
"Believe nothing
Merely because you have been told it
Or because it is traditional'
Or because you yourself have imagined it
Do not believe what your teacher tells you, merely out of respect for that teacher
But whatever after due examination and analysis
you find to be conducive to the good
the benefit,
the welfare of all beings,
that doctrine believe and cling to,
and take it as your guide."

Over the past five hundred years, there have occurred two major developments of profound significance for human development. First, there was a Scientific Revolution which placed science on its present exponential growth, to attain an intellectual virtuosity that characterizes it today, and which has made it an indispensable feature of a new industrial civilization. Then there was the Industrial Revolution which resulted in a great transformation in the means of production. Over recent centuries, there has been a development in symbiotic relationship between science and technological aspects relating to production in agriculture and industry. And we see today is a powerful unified functioning of an integrated science and technology. This has led to economic and social changes of profound magnitude.

RENAISSANCE IN SCIENTIFIC ACTIVITY

Among Indian leaders, the one who understood most clearly the relationship between science and society was Jawaharlal Nehru who has remarked: "Science is not a matter of merely looking at test tubes and mixing this and that and producing things big or small. Science, ultimately, is a way of training the mind and the whole life functioning according to the ways and methods of science." This demands a continuing long-range program of developing, in all sections of society, what Jawaharlal Nehru referred to as the 'scientific temper'.

1958 SCIENTIFIC POLICY RESOLUTION

The Scientific Policy Resolution, which was adopted by the Government of India on 4th March, 1958, and which was primarily due to Jawaharlal Nehru, has, in it, several sentences which forcefully bring out certain fundamental concepts. In particular, it states: "It is only through the scientific approach and method, and the use of scientific knowledge that reasonable material and cultural amenities and services can be provided for every member of the community. . . . . ", and "science has provided new tools of thought and has extended man's mental horizon. It has thus influenced even the basic values of life and given to civilization a new vitality and a new dynamism."

The Scientific Policy Resolution states what Jawaharlal Nehru recognized that science was not something only for the professionals in science, or for an intellectual elite, but is of concern to and involves society as a whole. Let me amplify this point. Science is often regarded as a vast repository of knowledge, or of complicated instruments and equipment demanding specialized capabilities. These, no doubt, are a part of a great deal of science as practiced today. But primarily, science represents a spirit

of inquiry and is based on the process of logical reasoning. What is important is the scientific method which consists analyzing the observations and measurements; building a hypothesis or theory which would fit the measurements, which could involve generalizations resulting in prediction of other phenomena; experiments or calculations to look for these and to test the hypothesis or theory; building up self-consistent theoretical or experimental methods in their own right, and so on. There is no acceptance of authority. What is accepted finally is that which can be confirmed independently by anyone desirous of verifying the facts. The scientific method is applicable not just to the narrow confines of what many would define as science. The scientific method is of general applicability. It is the spread of this rational, objective, enquiring approach that Jawaharlal Nehru wanted to see in society, and which he very appropriately referred to as the scientific temper.

PROPAGATING SCIENTIFIC TEMPER

The development of scientific temper involves the following: The growth of a coherent scientific community which is concerned not only with the skilled use of the technique and instruments of science in its professional work, but also has a deep commitment to the rational and objective methods of enquiry and analyses that characterize science; in ensuring that the scientific method, and in the broader sense the process of logical reasoning, is used in decision making in the country in all facets of national endeavor, particularly in a manner which is visible: And inculcating the method and spirit of science in society as a whole. How can all of this be brought about? In my view, the most important single element is education. What is required is a new design for the educational system in which, instead of the present approach which largely involved a body of knowledge being handed over to a student to be memorized and retained, and to be brought out at appropriate occasions such as examination, we should relate the educational system to the environment around. All of us have had the great fortune of associating with children; and we immediately notice the insatiable desire on their part to know and to understand the world, to find connections between things and events, we are often asking questions that are inconvenient and are difficult to answer. Education as it exists today, instead of encouraging this curiosity and spirit of enquiry, kills it. I would like to emphasize that everything that we wish to normally teach children, namely language, mathematics, science, moral values, basic features of history, geography, etc., can all be taught through experiences that they can have in their immediate vicinity, and which would and should be of great interest and excitement to them.

And today we are in the midst of a new revolution in which electronics and computer are playing the principal role- this is called information technology revolution which is leading to the most significant economic and social change which humanity has seen.

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