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CORRESPONDENCE

Fancy and facts in science and art

Science is often defined as the search for truth. In a true sense, art can also be considered as the search for truth. This leads us to the often-debated fundamental question – What is truth ('*Satyam*')? '*Sat*' in the Sanskrit word '*Satyam*' means 'that which exists forever'. This eternal fact was aptly presented by our predecessors as – '*Ekam sat vipra bahudhavadanti*' (Truth is one; scholars present it in many ways).

It is, therefore, not uncommon to feel the intermingling of the scientific quest for precision with artistic values of aesthetics. History does provide many inspiring examples. I was impressed by a statement from Charles Lindberg, whose exploits with aircrafts are legendary: 'Science, freedom, beauty, adventure: What more could you ask of life? Aviation combined all the elements I loved. There was science in each curve of an airfoil, in each angle between strut and wire, in the gap of a spark plug or the colour of the exhaust flame. There was freedom in the unlimited horizon, on the open fields where one landed. A pilot was surrounded by beauty of earth and sky. He brushed treetops with the birds, leapt valleys and rivers, explored the cloud canyons he had gazed at as a child. Adventure lay in each puff of wind'.

Barbara McClintock, undoubtedly one of this century's outstanding scientists, is a shining example whose work has embodied the elements of beauty and adventure. She dared to think differently and firmly placed her work and vision on genetic instability, duly earning a Nobel prize in 1983, though it is almost 34 years late! Aren't the anthocyanin colour patterns on the maize kernels, which incited the interest of McClintock, aesthetically appealing and beautiful in their own right?!

Probably, every scientist who takes pride in his/her work consciously realizes the innate artistic beauty of the subjects. I was, therefore, not so surprised to read the following statement by Chandrashekaran[1] in an article on biological research: 'What under the sun can possibly surpass the beauty of the feedback physiological principles involved in the capture of a moth by an insectivorous bat in the pitch darkness of a new moonlight?'

Doesn't art involve scientific elements? What better example can there be but the graphic work of M. C. Escher? Although he declared himself as 'absolutely innocent of training or knowledge in the exact sciences', Escher's drawings in the early part of this century gave expression to abstract concepts of infinity from finity, symmetry, self-similarity, precision and periodicity, stimulating the interest of mathematicians and crystallographers[2]. Aren't all these elements reflected in a good measure in the biological world as 'pattern formation', whether it is the colour patterns in the butterfly wings, anthocyanin patterns on a maize kernel, spatial periodicity of plant organs or the exine architecture of pollen?! So much so, Nijhout[3], a pioneer researcher on wing colour patterns, remarks: 'Few things in nature match the beauty and variety of the patterns on the wings of the butterflies and moths.'

Although there are several unifying principles in science and art, an important point to consider, in this context, is the degree and freedom of 'creativity'. I do find (as many must have) a basic difference in the 'creative potential' of science and art. Although science does give every scientist unlimited opportunities (at least theoretically) for demonstrating his own ego, talent, imagination and industry as in arts, the creative potential and the freedom of imagination of a poet or a writer are indeed far greater than that of a scientist. A poet could thus grant imaginative boons to a '*rakshasa*' (Hiranyakaship) that he could neither be killed by man nor by an animal, neither by a living nor by a dead weapon, neither in the day nor at night, neither on the earth nor in the sky and neither in the house nor outside. Having set all these variables, he comes out with a wonderful answer by creating a marvel of imagination – '*Narasimha*' (the Lion God) and the rest is an awe-inspiring mythological story. It is, therefore, said: '*Apaare kavyasamsare kavireva prajapathihi; ethamsmyi rochite viswam tathedham parivartate*', broadly meaning that poet is a 'brahma' of the vast literary family; as he wishes, so he creates.

The imagination and the infinite expressions from a finite means thus depend on the talent of an artist, whether in music, painting, poetry or even in film-making, where a Spielberg can recreate dinosaurs (aided by computer technology, of course), give 'life ' to these and instantly appeal to a worldwide audience.

The ability of a scientist in playing the role of a 'creator' has increased manifold in the recent years in the biological field after the advent of genetic engineering. For instance, let us consider the recent manipulations of floral colour patterns through molecular techniques, termed 'molecular flower breeding'[4]. In nature, we do not find brick-red petunias or blue roses for the simple reason that these plants lack appropriate enzymes that catalyse certain chemical reactions in the anthocyanin biosynthesis to produce respective colour pigments. Researchers have been recently successful in introducing and expressing the gene coding for the enzyme dihydroquercetin reductase from maize into petunia, thus producing a novel brick red petunia variety 'This is

a fairly successful, commercially beneficial and environmentally harmless (apparently) application of plant genetic engineering. In contrast, several restrictions do exist in carrying out similar exercises in the animal world. The point I make is that a scientist cannot and perhaps should not have a free hand in his 'creations' as much as an artist has, and his pursuits are most often, if not always, limited by nature and other regulations imposed by man himself. Except for this variable degree of 'freedom', there may not be any fundamental difference between scientific and artistic quests for truth. The underlying similarities between science and art have been presented in a brilliant portrayal of Newton and Michelangelo by Prof. Chandrasekhar[5].

Finally, it is tempting to quote Leonardo da Vinci (cited by Dobzhansky[6]), the multifaceted personality par excellence: 'Even though the genius of man might make various inventions, attaining the same end by various means, it will not invent anything more beautiful or more economical or more direct than nature, for in nature's inventions nothing is wanting and nothing is superfluous.'

1. Chandrashekaran, M. K., *Curr. Sci*, 1991, **61**, 309–311.
2. Schattschneider, D., *Sci. Am.*, 1994, **271**, 48–53
3. Nijhout, H. F., *Sci. Am*, 1981, **245**, 104–115.
4. Mol, J., Stuitje, A, Gerats, A, van der Krool, A. and Jorgenssen, R, *Trends Biotech*, 1989, **7**, 148–153.
5. Chandrasekhar, S, *Curr. Sci.*, 1994, **67**, 497–499.
6. Dobzhansky, T., *Cold Spring Harbor Symp Quant. Biol*, 1959, **24**, 15–30.

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Distortion of Indian degrees

It is rather common to find that authors of research papers who are of Indian origin but now settled abroad mention their Indian degrees in a distorted form in their biographies. Here are some examples from recent IEEE publications:

1. '... received the B Eng from the Indian Institute of Science, Bangalore, in 1964 ...'
2. '... received the B S E E degree from the Indian Institute of Science in 1976 ...'
3. '... received the B S E E degree in Electrical Engineering from Bangalore University, India, in 1969 ..'
4. '... received the B S degree in electronics from the Bangalore University in 1981 ...'
5. '... received the B Eng (Electronics and Telecommunication Engineering) degree from the Bengal Engineering College, University of Calcutta in 1980 ...'
6. '... received the B S degree from Agra University, India in 1969 and M S degree from Aligarh University, India ...'
7. '... received a B S (Honours) degree in Physics from the University of Delhi, St. Stephens's College, in 1956 ...'
8. '... received the B S in Electrical Engineering from the University of Madras, India ...'

The names and references have been suppressed for obvious reasons. All the degrees mentioned above are distorted versions, as one may easily verify. IISc neither offers a B Eng nor a B S E E; neither does Bangalore University award a B S E E or B S in Electrical Engineering or a B S degree in Electronics. Calcutta University awards a B E and not a B Eng degree. None of the three Universities at Agra, Delhi or Madras offers a B S degree. Also, Aligarh University does not award an M S degree.

Why do these authors, who are some of our very best products, distort their Indian degrees? Is it their wish to conform to the US/Canadian degree? If so, why? If conformity is important, why is it that scientists of European origin do not have to resort to such distortions? Or, is it a reflection of an inferiority complex? Are B Sc, M Sc and B E inferior nomenclatures as compared to B S, M S and B S E E?

It is my impression that Indian degrees are well understood and well respected throughout the world. Such disrespect for Indian degrees, as shown by some authors, is, in my opinion, totally uncalled for, and almost amounts to falsification. What would happen to the individual concerned if one of our institutions writes to his/her employer that he/she was never awarded the stated degree?

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