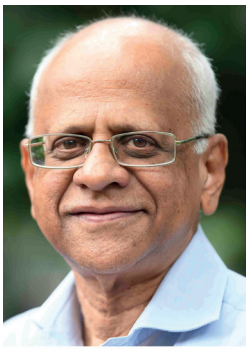
International Edition: DOI: 10.1002/anie.201813798
German Edition: DOI: 10.1002/ange.201813798

Science And Society—What Do They Owe Each Other?**

*Gautam R. Desiraju**



G. R. Desiraju
Professor
Indian Institute of Science
Past President
International Union
of Crystallography

Science is objective and scientists are viewed as being impersonal, dispassionate, in their ivory towers, and far from the madding crowd. It is felt they are not concerned with societal values and politics, and indeed that they should not even be concerned with these matters if their science is to be pure and untainted. Society, on the other hand, is complicated, dynamic, subjective; it is full of ifs and buts and it has to do with real life! So, is science not real life then? And what of the social sciences which by their very name have to do both with science and with society? Do they have any overlap with the hard sciences?

Privilege and Responsibility

One of the most controversial scientists of the 20th century, J. D. Bernal said famously that "science is an integral part both of material and economic life and of ideas which guide and inspire it".[1] His unabashed admiration of Soviet-style communism when it was its most repressive, went up to open support of the fake scientist Lysenko, and therefore Bernal's statements raise disturbing questions as to whether science and scientists should be influenced by the societal and political pressures that swirl around them.

Science is very much an ego-driven profession

As the political pendulum swings, a different emphasis is given in any country, at different times, to science, the doing of it, and the expectations that the political masters and the general public have from the activities of scientists. Does all this change the science itself? Science is supposed to be universal but the way of life is different in each culture. How does one reconcile this dichotomy?

Far from being in their ivory towers or at the other end, the handmaidens of politicians, scientists, as custodians of higher values such as truth, justice, and respect for human diversity and culture, need to lead from the front and guide the general public in various aspects of life itself. The world is peopled by winners and losers, and scientists are broadly in the group of what might be called winners. They are educated, therefore privileged, they are given opportunities denied to most, they are generally financially advantaged, and they have the scope to rise in their professions. The vast majority of people in any society are, relatively speaking, underprivileged, disadvantaged, lacking in opportunity and without too much scope for improvement. With privilege, however, comes a responsibility and scientists owe it to society to provide guidance, leadership, and above all, moral stature, so that they become role models. But there is a caveat—society in turn needs to provide a framework within which scientists are able to operate as moral and ethical beacons. What happens if either scientists or the society in which they operate fail to live up to these expectations?

Extreme examples of situations where society failed in its duty towards scientists are displayed by Nazi Germany and the Stalinist Soviet Union. Michael Polanyi, who saw the persecution of scientists in both these regimes, was one of the first who proclaimed that scientists should necessarily subject themselves to the values of truth and justice. He viewed science as a positive influence driven by passion. He was aware of the fact that scientists are all too human, very often biased, and sometimes even dishonest. Polanyi asked for a major role from society at large to correct and redirect the negative aspects in the personality of scientists towards a more positive direction that would benefit all.

Scientific Narcissism

Situations where scientists let society down are seen in excessive displays of ego leading to scientific narcissism. Ego

[*] Prof. Dr. G. R. Desiraju
Indian Institute of Science
Bangalore (India)
E-mail: gautam.desiraju@gmail.com

[**] This Editorial is extracted from the text of a lecture delivered in the University of Bologna on 12 October 2018, on the occasion of being awarded the ISA Medal for Science of the University.

The ORCID identification number(s) for the author(s) of this article can be found under:
https://doi.org/10.1002/anie.201813798.

is a must in any creative activity, and when it finds its healthy outlets, it leads to higher levels of competitiveness and excellence. Science is very much an ego-driven profession. The fact that we give so much emphasis to citations, which are, in the end, a manifestation of the voluntary giving up of one's ego to another scientist, is proof enough that ego is very important in science.

But what happens when ego crosses its natural healthy bounds and develops into a need for power and control, which leads then to narcissism which then influences the scientific behaviour of others? This is a far more serious concern.[1] In today's world there is a greater tendency for status to be perceived as a function of social attention a person receives and, such status leads others to change their conduct and attitudes even within their own ecospaces, so that their basic behaviour is itself compromised.

Social Attention

Let's consider the matter of social attention. There is sadly today, an increasing tendency to view visibility rather than excellence as a yardstick of scientific worth. The same work published in a high-impact journal is often viewed as being better. Scientists sometimes over-publicise their work in social media. An administrative position is often seen as a sign of influence, power, prestige, and money. Do the best scientists become directors, rectors, and vice-chancellors? Awards and prizes in any country are perceived as a sign of success. What happens when a person who feels (s)he deserves recognition, does not get it? Except scientists at the very top, the rest of us are surely affected by this malaise. Maybe even they are. Everyone is human and humans do not remain passive when they receive recognition.

It is an established fact that early recognition does make a person more active, quicker, sharper, seemingly more energetic and alert. But early recognition can easily move one into the sphere of a very negative type of narcissism.[2] Since a person who receives early recognition becomes more alert and active, it follows that a person who receives less recognition, for whatever reason, becomes dull, withdrawn, maybe cynical and bitter, and in the end, even incompetent. So an initial group of scientists gradually gets further demarcated into the haves and the have nots. The haves become dominant and the have nots become the subordinate group. This is a well-established feature of all social structures and while there is nothing specific to scientists here, none of it is desirable.

Indic Thought

Indic thought might well be able to address issues pertaining to the societal roles of scientists and might as well be able to solve the problems of high-level, modern-day science. The idea of Indic thought was first expressed by the visionary Swami Vivekananda (1863–1902) who initiated an epoch-making revival and global expansion of Yoga, Vedanta, Hinduism and India in the late 19th century. The highlights of Indic thought are that it is free of ideological fundamentalism (Communism, Nazism, Aryan physics, Islamic science) and epistemological monovision.[3]

Vivekananda's statement of 1896, a full 20 years before the high noon of quantum mechanics, is noteworthy. He said, "Take anything before you, the most material thing—take one of the most material sciences, as chemistry or physics, astronomy or biology—study it, push the study forward and forward, and the gross forms will begin to melt and become finer and finer, until they come to a point where you are bound to make a tremendous leap from these material things into the immaterial."[3] The ancient Hindus recognized the five elements in ether, air, fire, water, and earth like the Greeks. But they went a step further and said that these elements themselves were composed of more subtle entities called "tanmatras" in Sanskrit. These subtle entities have to do with the five sensations. They are based on properties and not upon material composition or structure. Unlike the Greeks who went to ether last, the Hindus started with ether. Ether is what can be heard. Air can be heard and felt. Fire can be heard, felt, and seen. Water can be heard, felt, seen, and touched. And finally earth can be heard, felt, seen, touched, and smelt. One goes from the immaterial to the material. Property as a definer of matter rather than structure is a very modern concept, and has just come into my own subject, crystal engineering.[4]

Complex Systems

Invoking intuitive thinking and the oneness of that with form and the formless, one can argue that many great scientific discoveries are due to the inventive genius of creative thinkers, intuitive thinking being as relevant to science as it is to the arts. Consider, for example, Faraday's discoveries, Mendeleev's periodic table, Kekulé's postulation of the cyclic structure for benzene, or the way in which Crick and Watson unravelled the double-helix structure of DNA. Why did Kekulé ask us to dream? Why did Mendeleev confidently predict eka-aluminium and eka-silicon, today's gallium and germanium? Not how, but why.

Crystal Engineering

Turning briefly to the subject of crystal engineering, the central question here is given the molecular structure of an organic compound, what is its crystal structure, in other words the structure of an extended periodic low energy ensemble of molecules? The difficulty in answering this question is posed by the fact that each and every portion of a given molecule may interact with each and any portion of a neighbouring molecule in variable ways that are connected with the nature and positioning of each and every molecular fragment vis-à-vis one another.[5]

This essence of crystal engineering is encapsulated in the Pratityasamutpada (प्रतीत्यसमुत्पाद) school of Buddhist thought which says that "A substance does not exist in isolation." The famous Indian chemist Nagarjuna who lived in Western India around the 10th century CE, says "For the sprout does not exist in the seed which is its cause; it does not exist in each one of earth, water, fire, wind and so forth, which are agreed to be its conditions; it does not exist in the combinations of conditions, nor in the combination of causes and conditions, and it does not exist as separate from these, free from causes and conditions."[3,6,7] Having looked at organic crystals for well-on 40 years, and even having acquired some kind of reputation for so doing, and calling them holistic, I could not have put it so effectively!

Many great scientific discoveries are due to the inventive genius of creative thinkers

Quo Vadis?

The present is a period of high narcissism in science and we sometimes see the deleterious effects of an over-competitive society—greed, lust, and dishonesty. We need approaches that include roles traditionally given to religion, ethics and family values. Scientists need to shed their so-called neutrality, which is very often a cover or a shield. The enlightenment was not the age of reason. A society which promotes synchrony and synergy, say through religion, will reduce the negative expressions of ego and the disastrous consequences that flow therefrom. If a belief is provided by society that there is something larger than the individual, it will naturally flow that a scientist should live according to ethical rules. Plagiarism, pirated journals, ethical misconduct, conflicts of interest, and mutual exploitation are all consequences and not causes of the lawless climate that can be seen today in society. Some scientists seem to be feeding short-term expectations of politicians, possibly to secure funding, instead of working towards real knowledge and wealth for all. But in the end, both knowledge and wealth are acquired only through the pursuit of truth, which is defined in Hindu scriptures as that which confers maximal benefits to all people and things. This is smoothly achieved when then there is a seamless exchange of unspoken thought between science and society.

How to cite:
Angew. Chem. Int. Ed. **2019**, *58*, 3232–3234
Angew. Chem. **2019**, *131*, 3266–3268

[1] J. D. Bernal, *The Social Function of Science*, Stephen Austin and Sons, Hertford, **1938**
[2] B. Lemaitre, *FEBS J.* **2017**, *284*, 875.
[3] A. Neelakandan, *Swarajya*, 1 July 2017 issue. https://swarajyamag.com/magazine/future-of-science-needs-plurality-of-frameworks-and-that-is-exactly-what-indic-thought-provides.
[4] S. Saha, G. R. Desiraju, *Chem. Eur. J.* **2017**, *23*, 4936.
[5] G. R. Desiraju, *Angew. Chem. Int. Ed.* **2007**, *46*, 8342; *Angew. Chem.* **2007**, *119*, 8492.
[6] P. C. Ray, *A History of Hindu Chemistry from the Earliest Times to the Middle of the Sixteenth Century, A. D.* **1902**, Williams and Norgate, London, pp. liii–lv.
[7] E. Chinn, *Philosophy East and West*, *Vol. 51*, No. 1 (Jan., **2001**), pp. 54–72.

