These events raise several disturbing questions.

Should we wait for internal squabbles amongst the beneficiaries of corrupt practices, as it happened in the Nagpur University, to clean up our centres of higher education?

These malpractices must be accumulating in most, if not all, universities for many years before growing to such proportions. Several academicians remain indifferent to this, perhaps, because their personal immediate interests are not affected and the institution's future does not seem to matter to them. Presumably, they hope to retire peacefully with all the possible personal benefits and an amiable, non-controversial, saintly image. But at what cost to the nation? What are the quantitative estimates of the *cost of this silence*? We forget that it is our children who will have to study in these corrupt institutions.

Can a system which has commercialized education without instituting mechanisms to ensure fair competition, eliminate corrupt administration and deliver the intended quality products? Have our more serious academicians the will, or are they in a position to fight this mediocrity? Can they reverse the tide of entry of the fake and uneducated 'degree' holders in educational institutions, right from the primary schools? Assuming that half of the universities in the country are free from the Nagpur syndrome – possibly an overestimate – it will take at most one generation for the corrupt lot to replace the few good unyielding teachers and administrators. Can anyone honestly deny this writing on the wall?

The most important question, however, concerns the future of the good students who are studying in these universities and the unemployed degree holders seeking jobs. Can they ever hold their heads high in any respectable gathering? Who will console these sensitive youngsters and undo the injustice that they are bound to invite life-long in their careers? Some of us may directly or indirectly, consciously or unmindfully contribute to this damage too, and kill the spirits of our future Ramans, Boses and Sahas along with the dreams of enlightenment of a whole nation. Do we realize the extent of damage we are causing to the nation because of our silence? Indeed, it is not silence anymore, but the death-knell of the whole gamut of education, enlightenment, and institutions of learning, higher and lower alike – if only we have the heart and the courage to listen!

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Green chemistry

The Economic Times of 20 August 1999 carried on its centre page an interview with one of the senior scientists of Greenpeace International. The interview highlights the degradation of the environment caused by polluting chemical industries in India. The size of the industry is immaterial in this context. According to Greenpeace, 'relying on end-of-the-pipe pollution control technologies like common effluent treatment plants, landfills, and incinerators' can only lead to ecological disaster. The solution lies only in changing the processes adopted to produce the chemicals. Development of new eco-friendly processes may be more cost-effective in the long run than treatment of effluents and disposal of toxic wastes.

Modern advances in homogeneous and heterogeneous catalysis have helped in developing alternative strategies for gently persuading reactions to proceed in the required direction, obviating the necessity for employing brutal methods. But it takes a lot of dedicated effort to apply such new ideas to industrially important reactions. The push for this has to come from research-oriented chemists who have access to the relevant information, and who have the ability to innovate. However, this has not happened so far in our country to any great extent.

Why is it that the record of our R&D in this respect is so dismal? Industry, of course, is primarily responsible for creating the mess we are in at present, with their pitiable allocation for R&D. However, our science establishments are not free of blame either. They have so far shown scant interest in the subject. The reason for this seems to lie in the obsession of our scientists with doing 'fashionable' research. Consequently, all funding is diverted towards this objective. The scientist is encouraged to import the most expensive reagents, dump them on 'new' substrates, and get a paper! No matter if this paper is ignored in the outside world, or if it is grouped along with a dozen others which report the use of this particular reagent or method. Impact factors are placed on a pedestal and worshipped; such glorification was never dreamt of by their creator! Unfortunately, both the practitioner and the assessor have forgotten that these impact factors are designed just to promote fashionable research. I find it extremely difficult to justify public funding of the umpteenth synthesis (but the first in Asia, excluding Japan!!) of a natural product; whatever happened to our admiration of art in organic synthesis? To come back to the point, surely we can deploy at least part of our resources in trying to avoid the use of iron, tin or aluminium chloride in the age-old chemical transformations. Why don't we ever hear of National Symposia to discuss such problems and to monitor progress in the greening of our industry?

How many of our research establishments subscribe to the RSC journal *Green Chemistry*? And yet we all know that this is one of the most challenging tasks for our scientists – to replace the polluting technologies with more eco-friendly ones. Shouldn't we be allocating more funds towards developing products and processes which are less damaging to the environment?

Individual scientists too appear to have shirked their responsibility. How many of us have even thought of replacing organic solvents with water or super-critical carbon dioxide? Again the reason for this neglect is that research in such areas is not glamorous enough, and so is less likely to result in flashy awards to the individual! Let me emphasize at this point that no 'academic' scientist should consider it beneath his/her dignity to get deeply involved with such issues. After all, it was Barry Trost who coined the term 'atom economy' in synthesis. And it is Noyori who has come up with a novel way of oxidizing cyclohexanone to adipic acid using only aqueous hydrogen peroxide (the existing process using nitric acid results in the emission of the oxides of nitrogen – the cause of ozone depletion, smog and acid rain). Noyori's process employs a biphasic system with two catalysts – tungsten oxide along with a phase transfer catalyst (Bolm, C., Beckmann, O. and Dabard, O. A. G., *Angew. Chem.*, 1999, **38**, 907).

And yet, the future is not altogether bleak. Several leaders of the chemical industry are fully aware of the urgent need to take remedial action, including change of reagents, solvents and even of the whole process if alternatives are available. There has also been some significant progress in replacing traditional polluting technologies with new non-polluting ones in the Indian industry. One such example is the replacement of hydrogen fluoride by a zeolite in the synthesis of linear alkyl benzenes. However, such instances are too few; the whole movement will gain momentum only if the academicians and science establishments undergo a change of attitude.

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The multitude of 'omics' and 'omes': Evolution of scientific terms in molecular biology in the new millennium

The era of large-scale molecular biology has started. Information generated by the application of automation in molecular biology has been extensive and intensive. The complete sequences of 22 genomes[1] are now available; many others are close to being completed.

The term genomics meant to cover all facets of genetic studies and even a new journal called *Genomics*[2] was initiated recently. In close succession, a term called 'functional genomics' emerged (see for example Rastan and Beeley[3]). Next came the term transcriptome[4] that denotes the messenger RNA transcripts from a genome. The proteome is the expressed protein complement of a genome and proteomics is functional genomics *at* the protein level[5].

The excitement over embarking upon genome-scale investigations is in the log phase. The emerging metabolic genotypes and the accompanying proteomics has stimulated some authors to investigate the genotype–phenotype relationship using the methods of systems science leading to a new field called phenomics[6]. Similarly, the *cis* acting transcriptional regulators in genome can be termed catrome. These are functional sites (as shown by experiments[7,8]) and therefore the term catrome has similar basis as transcriptome and proteome that represent real molecules. Similarly, the *trans* acting factors in a cell may be called tafome. The terms for the analyses of the relationships between the *cis* acting sites and gene expression at the genome level may evolve as catromics. Similarly, the analyses of the relationships between *trans* acting factors and gene expression may evolve as tafomics.

Binomial terms are also evolving at a great speed. After several genomes have been completely sequenced, 'comparative genomics' has emerged. Similarly, 'structural genomics' although referred to earlier[9] in the context of gene identification through computational analysis, has emerged again at the protein level[10] now, and may grow to cover other topics as well. Comparative genomics and structural genomics and related work carried out *in silico* can be grouped as 'genome-informatics'. Genome-informatics which comprises analysis at the genome level, is an offshoot of bio-informatics.

Thus, at the beginning of this era, we are exposed to a shower of several new terms. This development is very attractive but also young. Some terms represent relatively straightforward issues but others are somewhat less clearly defined. The term genomics meant to cover all facets of genetic studies but most of the papers published by the journal *Genomics* focus on gene mapping.

Generally, after a genome is sequenced, most of the encoded proteins are predicted computationally either using the first generation set of programs such as BLAST and FASTA, or the second generation set of programs such as GeneMark[11], GeneScan[12,13] and TB-parse[14]. The expression status of these protein products may be known after a detailed analysis of the different proteomes through the analyses of 2D gels, advanced imaging software and staining techniques[15]. Present work on proteomes indicates that the term represents expressed molecules. It is ambiguous whether many of the computationally predicted proteins, whose expression status in a given organism is not known, can be included in the proteome.

Similarly, comparative genomics could be interpreted to address the issues related to the analysis of information in the genetic material. These include synteny (order of genes on the chromosomes of different species), absence or presence of genes[16], strand compositional asymmetry[17], comparative hybridizations by whole-genome DNA microarray[18] and so on. A recently published work, however, deals with proteins[19], and so it can be debated whether 'comparative proteomics' could have been used instead of comparative genomics.

Our perception of functional genomics is graphically displayed in Figure 1. Although computational comparative genomics was referred to as functional genomics by pharmaceutical companies, a bioinformaticist from the National Centre for Biotechnology and Information has re-described the term[9] in line with the scheme in Figure 1. Functional genomics integrates the information and emerging concepts from genome-informatics, experimental comparative