more clear: 'I consider this a great privilege and honour for a variety of reasons although *I sometimes fear that repetition of a practice makes it rather stale*'[8] (emphasis added). Next year at the 45th session in Madras, Nehru repeated almost the same words[9].

The examples quoted above clearly demonstrate that Nehru was a sensible and honest person. Evidently, he would not have deprived a scientist or a member of the managing committee of the privilege, if he had not been invited.

Another important point to be mentioned about Nehru is that he took care to be punctual. Only once, that is, on 2 January 1953 on the occasion of 40th Session he was late. About it he said: 'I must apologize for my unpunctuality. But the fault was not mine really. I sat for three hours at the Delhi aerodrome waiting for the fog to lift and the fog was reminiscent of, well, the worst type of London fog.'[10] I wonder if today's politicians are conscious of the impropriety of coming late or ever apologize for it.

From Raman's and Nehru's statements one point is quite clear, that is, it was not the Prime Minister who was responsible for this misdeed. The fault seemed to be on the side of the Managing Committees.

From a historical point of view, we should verify whether such invitations have had a positive, negative or no effect on the achievements of scientific community. If there are more positive than negative results, the tradition should be continued.

So far as the issue of the so-called VIPs is concerned, a discussion can be started on: Whether the Organizing Committee should have VIPs and who should decide who is one? Why are politicians needed at the time of inauguration? Why cannot the inauguration be carried out by the President of either the ISCA or INSA, or IASc or by any world-famous scientist?

To discuss this issue, there cannot be a better platform than *Current Science*, which has a tradition and in the past often published detailed information such as the Presidential Address, etc[11]. Let me refer to the editor of *Current Science*, who about seventy years ago, wrote[12], 'No excuse is needed for making this issue of *Current Science* a special Science Congress Number.' In fact a Supplement on the 20th Indian Science Congress 1933 (Patna) was brought out.

I hope the present editors, who are well informed about the Indian political and scientific scenario may consider to start discussion on the above questions.

1. Unnikrishnan, M. K., *Curr. Sci.*, 2003, **84**, 484.
2. Fermor, L. L., *Curr. Sci.*, 1933, **1**, 196–205.
3. Chaudhuri, J. C., *Indian Fellows of the Royal Society and Others*, Academic Publishers, Calcutta, 1992, p. 60.
4. Singh, B. (ed.), *Jawaharlal Nehru on Science Congress – Speeches Delivered at the Annual Sessions of the Indian Science Congress*, Nehru Memorial Museum and Library, New Delhi, 1986, Foreword.
5. Singh, B. (ed.), *Jawaharlal Nehru on Science Congress – Speeches Delivered at the Annual Sessions of the Indian Science Congress*, Nehru Memorial Museum and Library, New Delhi, 1986, pp. 4–39.
6. Srinivasan, V. T., *Bhavan's J.*, 1970, **17**, 65–68.
7. Ref. 4, Singh, B., 1986,pp. 27–32.
8. *ibid*, pp. 54–59.
9. *ibid*, pp. 60–67.
10. *ibid*, pp. 33–39.
11. See *Curr. Sci.*, 1933, **1**, 196–205; *Curr. Sci.*, 1934, **2**, 255–264; *Curr. Sci.*, 1936, **4**, 495–516.
12. *Curr. Sci.*, 1933, **1**, 193.

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Cost of developing and commercializing transgenic crops

Subsequent to the *Current Science* issue[1] with a special section on transgenic crops, *The Economist* of 28 March carried several articles on biotechnology. A significant statement therein says: 'Developing a marketable transgenic strain is almost as costly as developing a new drug, and this kind of control of the market helps to make investing in transgenics worthwhile'[2]. The cost of developing a modern medicine is currently estimated to be upwards of US $800 million[3]. This also partly answers the question raised by the guest editors in the editorial – 'How is it that while in the laboratories a large number of transgenics have been developed, very few are in the field?'

The actual costs may be marginally lower in the public sector institutions in India than the estimates based on privately funded research laboratories in US. Nevertheless, it is obvious that the cost of developing and commercializing a genetically engineered, transgenic crop cultivar/hybrid would be substantial. The overall cost has five major components – (i) transfer of the desired gene into the crop species with adequate expression levels, (ii) development of crop cultivar/hybrid combining other desirable agronomic and quality parameters, (iii) nutritional, toxicological and other bio-safety evaluation in laboratory and field experiments to meet the requirements of the regulatory process, (iv) agronomic evaluation in field experiments, and (v) seed production and distribution. The last two are similar to crop cultivars developed using conventional plant breeding methods. Elsewhere[4] it is stated that 'the time span and expense of rigorous field studies that conform to regulations often far exceed the resources available to researchers, particularly academic scientists funded by research grants'. The statement is made in the context of relatively well-supported academic scientists in US. It would be extremely difficult for Indian scientists working in public institutions on project-based funding to generate data to meet regulatory requirements.

Very few research laboratories presently engaged in developing transgenics have the required infrastructure, or the managerial experience to efficiently generate the required bio-safety data.

Considering the need of transgenic technologies for enhancing productivity and sustainability of Indian agriculture highlighted in the special issue[1], and need for bio-safety assessment, it is essential to bring down the delivery cost of such seeds to the farmers. Apart from the R&D cost, additional support would be necessary for bio-safety evaluation of locally developed transgenics in public-funded institutions. Otherwise the benefits of the new stocks will not reach the farmers. The experience generated in the private companies who have already participated in bio-safety evaluation can be an asset.

1. *Curr. Sci.*, 2003, **84**, Special section: transgenic crops.
2. *The Economist*, 27 March 2003, p. 15.
3. Miller, H. I., *Nat. Rev. Drug Discovery*, 2002, **1**, 1007–1008.
4. Strauss, S. H., *Science*, 2003, **300**, 61.

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Mathematics research in India

In a recent article in *Current Science*, Arunachalam[1] has clearly described the standard and the role of research in mathematics in India. He cited that the best institutions in India are unable to attract bright students for research. These institutions feel themselves lucky if bright motivated students are enrolled with them. No doubt many do apply for admission but those who qualify for final entry into these institutions are meagre.

Does this mean that in India, a seat and land of many intellectuals in the field of mathematics like Ramanujam and a land who founded the number zero, intellectuals are no more seen or born? Further, in some institutes they are finding it difficult to locate candidates for Ph D programs in basic sciences. All these situations give us a caution signal that unless we (a) create congenial atmosphere to encourage study of sciences from the basic secondary level, (b) create job opportunities in scientific study places, laboratories and universities, (c) improve the level of teaching science including mathematics at graduate level, (d) motivate young minds to study and understand science, we may reach a point of no return.

Study of mathematics has to be stressed from the elementary level. This requires active participation of talented teachers in the subject. The teacher should have enjoyed the subject during his/her studies and only such persons can give a real feeling of the subject to the younger generation. There is an increasing need for modelling, simulating and optimizing technological, physical, medical and economic processes.

In fact, recently a study[2] program entitled 'Tech0-mathematics' at the university of Kaiserslautern (Germany) as well as the program 'Modeling of complex realities' at the ICTP and SISSA, Trieste (Italy) have been promoted to provide education for students from all over the world in this growing area at the interface of math, computer sciences and applied sciences.

It is also important to teach mathematical modelling as a subject of study at senior levels using appropriate realistic problems. In this way the subject is made attractive to young students and this paves a way in improving research also in this area.

1. Arunachalam, S., *Curr. Sci.*, 2002, **83**, 353–354.
2. Goetz, T. and Neunzert, H., Private commun., April 2003.

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IMD's model for forecasting monsoon in India

India Meteorological Department's long range mean rainfall forecast failed in 2002. The crops suffered serious damage by July 2002. Even though rainfall improved considerably from August onwards, this could not save the crops since they were already damaged and replanting was not possible. The departure from normal rainfall in the country as a whole was as much as –30%. This brought a lot of criticism against the forecast-model. Reacting to these, V. Gowariker (one of the modelers) wrote in *Current Science*[1], 'no forecast model developed for the prediction of the Indian monsoon at any time, at any place and by anybody else has come anywhere near the accuracy of the IMD model!'. Tables presented in the commentary[1] justify the statement to a good degree. In this context, I present a few points or comments.

(1) IMD's yearly forecasts usually state that the rainfall is 'likely to be normal' (e.g. 2001 forecast). They do not specify the probability of 'probable (or likely) normality', say 60% or 85%. From table 4 in Gowariker's commen-