

CORRESPONDENCE

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 issue¹, 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*, Arunachalam¹ 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 PhD 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 study² 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.

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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

commentary¹ 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-

tary¹, I could compute a mean probability of a normal monsoon rainfall in India as 66%. Hence, I can state that in 2003, rainfall is going to be normal with 66% probability. Isn't this type of quantitative probability limit needed for forecasts?

(2) 66% is just 2 units short of 68.2%, the $\pm 1S$ limited-area of a normal distribution to which the computed data in table 4 can be approximated. Hence, it is simple to state that all the mean rainfalls for India for coming monsoons for many decades, at least, would be normally (68.2%) be normal (LPA $\pm 10\%$), provided that significant climate changes do not happen by human-made agencies. If queried about long-term performance of rains, an experienced old farmer would say 'rains were always good to us but very rarely winds fail to bring rains', in a sense, what was inferred from the normal distribution.

(3) I doubt the usefulness of this all-India average (LPA $\pm 10\%$) which is

vague considering the large climatic and rainfall variations within India (rainfalls varying from <20 cm in Rajasthan to >400 cm in northeast India, per season) for any precise use in any specific area, say Rajasthan or Konkan and Goa. This is not to deny some correlations between mean rainfalls for different regions within themselves and with LPA due to monsoon's quasi-hemispherical nature. For example, if an electrical engineer enquires about the possibility of good storage in a reservoir in the coming season along the west coast, my reply would be 'normal rainfalls and normal filling up of reservoirs can be expected since IMD has forecasted normal rainfalls all over India, but what is precisely going to happen along west coast nobody can say'.

(4) Even if normal mean rainfall is predicted for a season for a specific region, say in Konkan and Goa, the final crops' production depends on how much

it rains in June (during transplanting) or in July and August (when maturing takes place) or in August/September (when flowering and graining take place). Hence, what is needed are forecasts for homogeneous climatic regions for June, July, August and September separately. This can come, possibly, from computer-based numerical models only.

Nevertheless, IMD's model serves the purpose of gross estimates of all India rainfall averages and related quantities.

1. Gowariker, V., *Curr. Sci.*, 2002, **83**, 936-988.

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NEWS

Canadian Academy Fellowship for C. N. R. Rao

C. N. R. Rao, Linus Pauling Research Professor at the Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore, has been elected Foreign Fellow of the Royal Society of Canada. The

Royal Society of Canada is the prestigious academy of science which represents the scientific elite of Canada. It occasionally elects scientists of eminence from other countries as foreign fellows

based on their contributions to science. This is the first instance an Indian scientist has been elected as a foreign fellow. C. N. R. Rao is already a member of all the major academies of the world.

MEETING REPORTS

Nutrition is the key to health and nation's development*

So say eminent nutrition scientists at the IX Asian Congress of Nutrition. The Nutrition Foundation of India (NFI) and the Nutrition Society of India (NSI) jointly sponsored the Congress. The octogenarian doyen of Nutrition Science, C. Gopalan, president of NFI was the

president of the congress and the brain and brawn behind it. The theme of the congress was 'Nutrition goals for Asia - Vision 2020'.

According to a recent WHO report, under-nutrition ranks first and together with micronutrient deficiencies (iron, zinc and vitamin A deficiencies) it contributes to over 24% of the burden of disease in terms of Disability Associated Life Years (DALY) lost in the high mortality developing countries of Africa and

South Asia. South Asia has over 50% of the malnourished women and children in the world. The holding of the conference in India at this juncture is therefore very appropriate. India hosted the first Asian Congress of Nutrition at Hyderabad in 1971.

Almost 1400 delegates from 49 countries including 1025 delegates from 25 Asian countries participated in the conference. The sessions were well attended throughout.

*Report on the IX Asian Congress of Nutrition, 23-27 February 2003 at New Delhi.