In this issue

Mapping agricultural research in India

Arunachalam and his colleagues, who have earlier mapped and analysed the Indian research contributions to agricultural sciences (1990–1994), life sciences and medical sciences, must be complimented for having chosen to revisit the Indian agricultural research 1998 in view of its importance (**page 896**). In India, 16% of the world population has to be sustained on 2.4% of the global land area. Not surprisingly, agriculture is the major determinant of the destiny of over 700 million Indians. Hence, its progress holds the key to the nation's economic and political future. In India, agricultural research is perhaps performed in the largest number (1280) of institutions and (531) locations, and is published (11,855 publications) in large number of (854) journals.

Bibliographic information on all agriculture research papers having an address in India in the byline and published in the year 1998 was downloaded by the authors from *CAB Abstracts*. They are classified until 21 major areas and 244 sub-specialities. Firstly, the mapping and analysis of the Indian agricultural research 1998 shows no significant qualitative and quantitative improvement over those of 1990–1994. Secondly, areas which have shown recognizable increase, are aquatic sciences and sociology. Thirdly, we have not been active in areas of post-harvest and food processing technology; they are likely to be increasingly important in the light of the prediction that India will have to import 40 million tonnes of food grain by 2030. Incidentally, India may prove that the prediction goes wrong, as there is an opportunity to raise productivity because of the gap between potential and actual yields. Fourthly, India is slow in biotechnology, a rather important area, where others are doing well. Even the few papers published in biotechnology have originated from general universities. Therefore, there is a need for effective interactions between agricultural scientists and their counterparts in general universities.

The paper has also identified the institutions that are active, the areas, which have attracted active research and journals, in which publications are made. Haryana Agriculture University, Punjab Agriculture University, Indian Agricultural Research Institute, New Delhi and University of Agricultural Sciences, Bangalore must be complimented for publishing more than 250 scientific papers. Of 119 articles, not even a single publication of the Gujarat Agricultural University was published in an indexed journal. Surprisingly, the performance of mega institutions like those at Pantnagar (Uttar Pradesh) and Rajendranagar (Andhra Pradesh) is poor.

Rightly, the authors have emphasized 'the need to strengthen both research and public policy in order to improve the productivity, profitability, stability and sustainability of the major farming systems'. Woefully, India is investing only 0.5% of its agricultural GDP on its research. Until such time the agricultural research is financially strengthened and suitable public policy is implemented to support small and marginal farmers as well as ensure the grain availability at affordable prices by the ultra-poor, we will continue to have the co-existence of 'grain mountains and hungry millions'. Agriculture research must include laboratory research and restructured extension work 'to make agricultural production environment-safe, economically viable and socially sustainable'. Agriculture is increasingly becoming knowledge-intensive; much of life sciences and agricultural research is fast becoming proprietary science and India must gear up publicly-funded agricultural research.

There are also lessons to learn from this article. Firstly, agricultural scientists must note that over 77% of their publications appear in non-SCI journals. This is certainly not desirable and is higher than that for mathematics (55%), medicine (48%), life sciences (43%) and new biology (11%). Secondly, almost all the Indian journals in agriculture and allied sciences have hardly any impact factor. Like mathematics, agriculture is a low-impact journal field. But the argument that research in agriculture is mainly of local relevance, may not hold water any longer. For instance, rice and wheat are crops of international importance, and if our researches in these crops are to be visible, they must be published in indexed journals. The same is true of our cattles and carps.

In India, education and research in agriculture is supported by the Indian Council of Agricultural Research, New Delhi. Agricultural research institutions are wholly supported by the Council; of course, the council also extends support largely to agricultural universities and colleges, and marginally to general universities. The council may note that 69% of agriculture research publications have originated from academic institutions. Therefore, it should increase the funding to academic institutions. It may also note that recognizably large number of publications on agriculture research have originated from general universities; to name a few, Banaras Hindu University, Jawaharlal Nehru University and University of Delhi. Therefore, they should keep an open door policy and encourage more effective interactions between the ICAR institutions and agriculture universities on one hand and general universities on the other, especially in emerging areas like biotechnology for effective utilization of the limited resources.

The authors have recognized a few internal and external threats to our agriculture progress. The external ones include the unequal trade bar-inherent in the WTO agreement of 1994, and potential changes in temperature, precipitation, sea level and so on. We may have to encounter the internals through education and social motivation. We need to restructure our research strategy to the one of anticipatory and participatory. Understandably, this analysis has led the authors to pose a series of questions, which should provoke agriculture scientists and policy makers to meet the challenges and opportunities ahead of us, as the Indian agriculture is at cross roads. One can realize the anguish of Arunachalam, a world renowned scientometric analyst and fellow of the Institute of Information Scientists, UK, when he concludes 'are men like Swaminathan merely crying in the wilderness?'

T. J. Pandian

A novel method for detecting patterns in DNA sequences

Information Technology and Biotechnology/Molecular Biology have been two of the most high-profile fields (in scientific as well as corporate circles) in the past few years. It is therefore quite natural that Bioinformatics, a product of their union has become the latest buzzword. As to whether this fourteen-letter mantra indeed revolutionizes our lives remains to be seen. What is most certain, however, is that only a joint exploration of the genome information by computer scientists and molecular biologists can reveal the subtle and diverse patterns hidden in DNA sequence. One illustration of such an approach is the article on **page 1090** of this issue by Prashant Goswami and Sowmya Raghavan, introducing an ingenious approach for describing a pattern at the interface between non-coding and coding regions in DNA.

As is well known, DNA molecule is a long chain composed of the bases A, T, G and C. The length of DNA (genomes) ranges from a few thousand bases in viruses to billions of them in mammals. Almost all the life processes in the living cells are due to proteins – and it is the exact sequence of DNA, which codes for the exact sequence of proteins. However, DNA also has a large component of non-coding regions, which have other functions (to help correct positioning of the coding region, to regulate the rate of protein synthesis, etc.). Though the cell machinery can easily and faultlessly tell apart the coding and non-coding regions, it is not easy for us to do so. We need to be able to do so, however; with the rapid progress and increasing interest in sequencing genomes, the number of DNA sequences available in various databases is growing explosively, and understanding the functional significance of such sequences has become the most important challenge for the contemporary researcher. Being able to identify the boundary between coding and non-coding regions is one of the important requirements in this undertaking. As a first step towards this objective, one should examine if there is any detectable pattern at the junction (interface) between coding and non-coding regions. This is what is reported in the article.

Prashant Goswami and Sowmya Raghavan have examined a large number of known genes from a diverse set of organisms and widely different base compositions. They have looked at the known broad interface between the non-coding and coding region, i.e. 200 bases before and 200 bases after the start of the coding region. What they have done next is to compute the cumulative frequencies of the 16 dinucleotides up to every position. The really novel and ingenious part is the next step, where they have looked at the gradient – rate of change of this function (cumulative frequencies). When they plot this gradient as a function of location (position) separately for each of the 16 dinucleotides, a very characteristic vertical line is seen exactly at the boundary for some of the dinucleotides! In fact, just a look at these 16 graphs is more than enough proof of their suggestion that the gradient of the dinucleotide frequencies is a good indicator for characterizing the boundary between non-coding and coding regions.

Of course, the authors have done much more than just relying on such a striking visual representation. A detailed statistical investigation carried out and reported by them in the article demonstrates the robustness of the signature identified by them. They have done well in explicitly making a distinction between identifying a pattern and being able to use it as a diagnostic tool. As they have said, at this stage, this approach is not useful for locating a boundary in a given sequence. On the other hand, the approach developed by them seems quite interesting and promising, and can be easily generalized, as pointed out by them. See **page 1090** and especially the diagrams to fully appreciate the other interesting findings emerging from this analysis.

N. V. Joshi

Billion-year-old rain-pits on sandstones of Madhya Pradesh

There is currently a spurt among earth scientists to study the formative period of the earth's evolution, particularly its first billion years. The origin of oceans, evolution of the atmosphere, beginnings of life, emergence of continental land masses above the ocean surface are some of the important events that took place during this span. Massive outgassing of water vapour, along with other gases, from the early or proto-earth led to precipitation of torrential rains leading to the formation of oceans. Another major step in the earth's evolution was the onset of chemical differentiation processes that generated the first or early-formed crusts. But these crusts had only brief existence as they were recycled back into the earth's interior and it took quite a few hundred million years for such crusts to remain stable, be exposed to weathering and erosion by rains. The latter process liberated voluminous amounts of sediments that were carried down to the oceans to form shallow or deep-sea deposits. Tidal action on the shallow water sediments or the tidal flats, accompanied by gentle wave action often produced ripple marks on the sediments, while rains falling on such tidal flats, exposed above water surface, left pits or minute 'craters'. These features, ripple marks and rain imprints, get erased usually, except under a rare combination of favourable depositional process that rapidly covers them with a layer of fresh deposits. In this issue (**page 1116**), a discovery of billion-year-old well-preserved rain imprints on ripple-marked sandstones is reported from eastern Madhya Pradesh by Chirananda De of the Geological Survey of India, Calcutta. From the orientation of these rain pits and other associated features, the author has been able to draw inferences about the nature of the early rainfall, the atmosphere of the times, depositional environment and manner of deposition in the tide-dominated marine environment. The geomorphologic conversion of Madhya Pradesh region, existing as a coastal plain during the Proterozoic period, ultimately to an inland territory of low hill ranges, flats and wide valleys of the present day, is another deduction made from these ripple-marked sandstones.

A. V. Sankaran