Withering of science in engineering education

This letter refers to the latest syllabi of the first year BE (Bachelor of Engineering) courses of Universities in Tamil Nadu. Unlike the previous pattern, the core (common) syllabus has been changed and the new syllabus varies from University to University. The new syllabus is less relevant for engineering education because most of the universities neglect basic sciences. In Bharathiar and Bharathidasan Universities, the four important basic science subjects, viz. applied physics, applied chemistry and their practical subjects have been reduced to physical science theory and laboratory. This shows the declining interest towards science in engineering education. Some universities (Madras, Madurai Kamaraj and other State Universities) are still having physics and chemistry along with practicals.

Science is very important for engineering education and engineering students must study basic sciences as separate papers. Most of the institutions like IIT, BITS Pilani, Roorke University, Anna University, etc. have engineering physics and engineering chemistry as separate papers.

The following points should be kept in mind while preparing the engineering curriculum: (i) The syllabus committee should consist of all subject experts including mathematics, physics and chemistry. Individual ideas should not be reflected in the syllabus; (ii) Science is important for maintaining and improving technology. Hence, all the engineering students should study basic sciences; (iii) Basic sciences with common syllabus will be helpful for the students, even for their future employment; (iv) AICTE must define certain criteria regarding the BE syllabus, in which the percentage of science subjects should be clearly mentioned; (v) The state board for higher education or technical education body should form a committee for formulating or revising the syllabus; and (vi) The proposed syllabus should be submitted to the AICTE, to be finalized.

The Government should form a committee to analyse the revised syllabus of all universities in Tamil Nadu. Steps must be taken to prevent neglect of science in engineering education. I appeal to the DTE (Directorate of Technical Education), HES (Higher Education Secretary) and AICTE authorities to bring a common syllabus for all universities. At least, the science subjects should be the same for all the universities. AICTE must improve the standard of the BE syllabi of all the southern universities. Will the AICTE look into this?

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India in 2020

I have been highly impressed by the exciting optimism expressed in the recent book *India 2020 – A Vision for the New Millenium.*

A news-item about the risk of 'tech colonialism' by C. N. R. Rao on the occasion of the dedication of 'PARAM-10,000' on 19 March 1999, urges me to pen down the reactions of an academic scientist who has struggled to contribute his mite in ordinary universities for the past 55 years. Originating from A. P. J. Abdul Kalam with Y. S. Rajan after astounding success in high profile national indicators like satellite or/and missile launch as well as after long deliberations in TIFAC, one should have full faith in their optimistic vision for 2020. However, having been an active worker in the university system (including UGC) with the added advantage of close association with the highest bodies (e.g. G. B. and laboratories) of CSIR, I would like to re-emphasize the conclusion of Kalam and Rajan, 'India will transform into a developed nation before 2020. A billion people are our resource for this national transformation'.

The second generation to which the authors belong (cf., p. 22 of the book) 'has put India strongly on the path of economic, agricultural and technological development'. However can this second generation to which I also belong have similar expectations from the coming generations, which in my personal opinion are even more brilliant basically. Hopefully, a few flourishing centres like IISc, JNCASR, TIFR, IACS, etc. continue to be our hope for the future but can these few institutions alone deliver the results on the massive scale envisaged by the authors. For the past few years, CSIR has been successful in the competitive growing era of specialization (including patents), but the general university system which is the source of original thinkers even for manning such organizations, is becoming an increasing source of worry to even persons like us who have been struggling hard not to lose faith in our younger generation. The authors of the book have also rightly emphasized (just in passing) the golden triangle of 'industry – R/D lab – academia' and there has been considerable debate on the topic in various forums including *Current Science*, but there are no visible signs for the same to be effective on the ground particularly in the latter two aspects.

Another closely related point emphasized at the dedication of PARAM-10,000 is that focussed attention on the

development of new (not merely borrowed) technologies could probably be achieved with greater success in areas in which the developed countries might have lower fascination due to non-availability of source-materials like titanium and rare earths, etc. Success stories in these directions would be a source of encouragement for more competitive fields.

The purpose of this brief note is to encourage a continuing debate and effective steps to remedy the situation before it is too late for the 'vision-2020' to be a reality.

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The enigma of insect conservation

Increasing interest in the production of comprehensive mapping schemes involving the most conspicuous groups of insects is a step in the positive direction, since such efforts reflect the nature of the collecting sites as well as the distributional range of species. Though the world plant biomass is 99.9 times that of animals, the latter make up 99.8% of species and among these insects dominate all ecosystems. The significance of plant–insect mutualism cannot be overlooked since pollinating insects maintain plant biomass in as much as plant diversity contributes to pollinator success with resultant interactive increase in biotic richness[1]. Spatial scales in relation to insect conservation becomes relevant and enough evidence exists to show the diversity of scales used from 1, 10 or 100 m to km^2 ranges, the latter often giving a good picture of insects such as butterflies, dragonflies, crickets and grasshoppers. The extent of landscape interference through fragmentation mostly due to deforestation naturally leads to an assessment of available elements of landscapes such as microsites and biotopes within the available plantscape. This is important since the degree of heterogeneity in populations as well as intra- and inter-specific interactions are involved so that consideration of biotopes becomes important, since it covers the physical and biotic components wherein insects live. The need for conservation of small insects which abound in both species and population is equally vital. Within the mapping site specific plantscape and biotopes have to be considered more in view of the fact that many small insects have comparatively small home ranges.

For small-scale environments the term 'microscape' is used, so that the microscape to the plantscape or plant architecture becomes important in insect biodiversity studies, since at scales from metres to kilometres biotopes make up landscape elements so that heterogeneity tends to increasingly contribute to conservation efforts. From the conservation viewpoint therefore, insect habitats from micro- to macro-habitats have to be conserved. Many species which are biotope-sensitive suffer the consequences of anthropogenic factors which induce changes. I had worked in the Thenmalai area of the Western Ghats in the early sixties when the vegetation was lush. Subsequent comparison two or three decades later, particularly of the composition of species of gall thrips and mycophagous thrips, has indicated the virtual disappearance of several species, some of which were good examples of discontinuous distribution. In view of many species being endemic there should be an intensive effort to document all endemic species belonging to diverse insect groups in such areas. There also exists the high levels of genetic variation in natural populations with adaptive responses particularly in relation to sex-related polymorphism and diversity of patterns involved in such polymorphism is often great, calling for the need to keep in mind the existence of such diversities and also involve specialists who alone can predict the occurrence of such diversity[2]. Of equal relevance are species occurring alongside margins of their ranges with differing physical and biotic conditions and these populations are liable to dwindle due to environmental causes. Therefore, conservation of appropriate habitats would appear more meaningful in insect conservation rather than on the basis of species and as has been rightly asserted 'conservation decisions rest essentially on the interpretation of field data into biological reality'[3].

Conservation biology is essentially a 'crisis science' needing specialists to justify the need for conservation in terms of their usefulness. In view of the demarcation of well-defined biosphere reserves, a beginning could be made through integrated efforts to study the range of disturbance levels in these reserves to conserve groups of insect species. Further, the maintenance of biodiversity succession is also an important parameter in natural ecosystems, since insects and plants are more often the primary determinants of succession patterns. It would also be an useful exercise to become involved in long-term monitoring of insects in specific habitats such as in biosphere reserves with emphasis on individual species to know their responses to change, as well as other species in the community.

There is a need to protect water bodies such as lakes and wetlands which are being threatened by various factors and which are sources of insect reservoirs. A comparison of such disturbed water bodies in our own hill resorts all over the country becomes all the more relevant in view of increasing anthropogenic influence.

1. Lawton, J. H., *Annu. Rev. Entomol.*, 1983, **28**, 23–29.
2. Ananthakrishnan, T. N., *Reproductive Biology of Thrips*, Indira Publishers, Michigan, 1985.
3. Mound L. A. and Gaston, K. J., in *Perspectives of Insect Conservation*, Intercept Ltd., Andover, 1993, pp. 185–196.

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