Catch them young

Medical research by and large falls into three categories. Educational, dealing with teaching and training of medical students with the aim of making them better doctors and thereby improve their services to the community. Clinical/epidemiological type, encompassing research in a variety of areas with emphasis on data collection and analysis, which is helpful in planning strategies in tackling and preventing illness in the community. It is encouraging to note that many medical colleges have taken to these two areas of research as can be gauged from the papers published or presented at conferences. The third type is laboratory-oriented experimental research which seems to be fast disappearing from the medical colleges! No doubt Balaram[1] laments that the situation in Indian biomedical research is grim. Is there anything we can do to get the young medical students interested in experimentation in biomedicine? I suggest the following measures.

1. Promote extra reading: Students may be encouraged to read about researches presented in a simple manner as in *Scientific American* or *New Scientist*. Articles of D. Balasubramanian that used to appear in scientific section of *The Hindu* are inspiring. Senior students might find V. S. Ramachandran's studies described in his book[2], *Phantoms in the Brain* fascinating. I was so thrilled to read Balaram's editorial[3] on discovery of artemisinin that I continue to recommend it to all students and their teachers as well.

2. Conduct journal clubs: Encourage students to read a journal and present an article they have read. In order to get a response from the interested, the meetings of the club should be held at a convenient time. No attendance should be taken and anyone should be able to walk in or out. This is much easier in institutions where students are encouraged to acquire laptops. Initially the students may need guidance in scanning journals and selecting the articles. I started with 20 students of which only 5 stayed on till the end. But my cup of joy was full when one of them was selected for KVPY!

3. Train mentors: It is sad that KVPY is no longer available for medical students due to very few applications from medical colleges. Students are not interested in research because their teachers never did any research! Often students interested in KVPY ran from pillar to post to find a suitable mentor. How can we improve the situation? Opportunities must be provided to train interested medical teachers to gain hands-on experience in research institutes situated in several parts of India. They must be encouraged to keep in touch with scientists in these institutes so that they would be able to obtain help and guidance.

4. Acquire instruments: This has been an important obstacle for research in all medical colleges – public or private. The MCI must insist on the presence of at least minimal equipment in the institutes, prior to recognition. I am a witness to equipment lying unused due to lack of minimal repair and also the lack of will on the part of the staff to open and see what is wrong. Sadly, this is due to lock and key culture of the heads of departments still prevalent in many medical colleges.

5. Cultivate friendships across the departments and institutes: My interest in research was aroused by watching a biochemist friend force-feeding rats with artificial diets! A pharmacologist donated all his leftover research chemicals, including adrenergic receptor blockers! Engineers helped me by designing equipment to measure conductance of frog skin or contraction of its aorta! I appeal to all medical college teachers to break the barriers and extend a hand of friendship to others.

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Loktak, the largest floating lake of the world, needs restoration

Manipur, a northeastern state of India, lies in the Indo-Burma biodiversity hotspot. The only floating lake in the world and also the largest freshwater lake in NE India, the Loktak Lake, is located in the state. The lake is rich in floral and faunal biodiversity constituting over 233 species of macrophytes and 425 species of animals, including invertebrate species, fishes, amphibians, reptiles, birds, mammals and other aquatic biota[1–6].

The most important feature of the lake is the presence of floating islands known locally as *phumdis*, a floating heterogeneous mass consisting of soil, vegetation and organic matter at different stages of decomposition. The Keibul Lamjao National Park is situated on the largest *phumdi* on this lake and is home to the Sangai, the endemic and endangered Manipuri-brow antlered deer (*Cervus eldi eldi*).

The lake has also been reported[7] to be a breeding ground for several migratory fishes from the Chindwin Irrawady river of Myanmar. In addition, a large number of aquatic plants serve as food for the biota present in this lake ecosystem. Also a large number of fishermen cohabit the *phumdis* and the lake is their only means of sustenance as they depend solely on fishery and cultivation of floating plants[1,8].

Recent reports[1,2] have highlighted major threats that are affecting the very life of this fragile lake ecosystem; the most important among them being the rapidly spreading *phumdis* and aquatic weeds, which are threatening to cover almost

70% of the lake. This has led to a decline in the number of rooted floating plants species such as *Nelumbo nucifera*, *Trapa natans*, *Euryale ferox*, *Nymphaea* sp., and *Nymphoides indica* (to name a few), which were abundant in the area. This habitat, which served as home to important birds such as *Hydrophasianus chirurgus* and *Metopidius indicus* is now devoid of them. Over 16 indigenous species of fish and 20 economically important species of aquatic plants are reported to have been disappeared so far.

The water-holding and possible phytosequestering or remediation capacities of the floating mass are reported to have been lost to a large extent. The root cause of these issues has been the construction of the Ithai barrage that has led to the damming of the lake and degradation of catchment areas[1,2]. Most of the reports are restricted to enumeration of biota and description of the species richness of the lake. Wetzel[9] has rightly commented on the concentration of research towards higher organisms and described the importance of biotic components, especially microbes as the fastest means as a metabolizing system.

Figure 1. An aerial view of the Loktak showing spreading *phumdis*.

Lovely[10] and Banning *et al.*[11] have highlighted the importance of analysis of microbial genes involved in bioremediation as their presence has been positively correlated with degradation of contaminants. Therefore, identification of microbial biota, using modern molecular biology tools, stands crucial for the Loktak remediation programme.

Analysis of 16S rRNA gene, a highly conserved sequence found in all microorganisms, has been the most intensely used approach for quick identification of the micro flora of the lake. The information thus obtained could be meaningfully utilized for restoration and remediation biology. Besides, the study of 16S rRNA gene could help characterize microorganisms associated with other biotic communities[12]. In some instances, subsurface microbes (aerobes) which can oxidize organic contaminants to carbon dioxide have been utilized for remediation of the environment[13].

Microorganisms, because of their diverse enzymatic activities, are capable of mediating bioremediation through sequestration in associating with the roots of plants. Hence, there is an urgent need to study the microbial diversity of this unique and fragile ecosystem. Bioremediation mediated by microorganisms is simpler, cheaper and more environment-friendly than other approaches[10].

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Biowaste utilization for improving health and productivity of acid soils in North East India

Nutrient requirement in agriculture has been rising and is likely to increase further to boost the agricultural productivity in order to keep pace with growing food demand in the country, especially in the context of climate change[1]. Chemical fertilizers have been indiscriminately used to meet the growing nutrient demand over the past half a century which, of course, boosted the agricultural productivity, but not without its deleterious impact on soil health and sustainability of crop production. Further, economic and environmental concerns associated with the excessive use of chemical fertilizers make it imperative to search for an alternative which can reduce the over-dependence on chemical fertilizers and increase soil health and crop productivity as well. This is particularly important for North East region (NER) of India where inadequate availability of nutrients and soil health-related constraints induced by extreme forms of soil acidity are the major impediments to crop production and food security[2]. As NER has abundant availability of biowaste, such as crop residues, weed biomass, forest litter, animal dung, etc. and use of chemical fertilizers is traditionally minimal, efficient utilization of biowaste could be an important strategy to meet the growing nutrient requirement and improve soil