Difficulties in doing science at school

Numerous articles and correspondences relating to educational reforms in India have appeared, the most recent one being 'Education reform in India' by Vedachalam[1]. But any education begins at the school level. The Government of India initiated the INSPIRE scheme to encourage young people to pursue science. CSIR also has its own Innovation Awards for school children. These schemes are certainly worthy of appreciation, but are inadequate mainly due to our mindset. I wish to narrate my views about the difficulties I faced in doing innovations at school in a generic, social perspective.

The first problem is our increasing materialistic approach. India is a country with a rich tradition of science embedded in its culture. However, nowadays many school students dream of pursuing economically lucrative careers such as engineering or medical sciences not for the sake of excellence in such fields, but for the money such professions offer. In small towns and cities, a number of coaching institutes have opened up to cater to such dreams. We hear that those with an MBA degree have been given 'packages' running into seven digits. Thus any child between 10 and 15 years of age is tempted to take the MBA route through engineering. Undue pressure is put on him to join a good institute, resulting in unnecessary stress.

Another major problem is that we look down upon a science-related career. There is a general perception that one pursues B Sc (Hons) only if he/she has not secured admission in an engineering or medical course. I know of a national laboratory which offers scholarships to the children of its employees selected to IITs but not IISc! When a student's paper is selected for publication in an international journal, which should ordinarily be seen as an achievement, he is advised to 'Concentrate on examination and science can always come later'. This is disheartening for a young student.

Therefore, I would like to suggest that those who retire from top scientific posts in the country should help increase awareness among the masses regarding a science-based career. The current procedure admits students on the basis of the merit lists of examinations like JEE, AIPMT and KVPY. However, there are several students who are not able to do well in examinations while being genuinely interested in science and possessing good scientific aptitude. Selection on the basis of a few multiple choice questions is definitely not the right way and that too for an institute which science students consider to be holy. Therefore, such examinations should serve only as an eligibility criteria and additional achievements such as innovative projects, publications and medals in international Olympiads should be given importance. Then, scientific achievement in the school will automatically be valued.

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Popularization of *Perilla* seed oil as a functional food source

Perilla frutescens L. (Lamiaceae), commonly known as 'bhanjira', is an underutilized crop of the Indian Himalaya with potential utility in agriculture. In India, the plant is grown in the Himalaya and cultivated in Assam by the local people, but there is no organized cultivation of the herb[1]. In Uttarakhand, the plants grow naturally and the local villagers generally collect the seeds for the preparation of 'food chatney'[2], making 'roti' and the seed oil for frying purposes. In some areas they are also cultivated on a small scale or as a garden herb.

Seeds of *Perilla* are a potential source of food that is rich in fats and protein of good quality, which can be used in both human and animal nutrition[3]. These are a good source of polyunsaturated fatty acids such as α-linolenic acid (ALA; omega-3) and α-linoleic acid (omega-6). The consumption of *Perilla* seed oil has also been reported to improve learning ability, retinal function, suppression of carcinogenesis, metastasis, thrombosis and allergies[4], and has shown potential beneficial efforts in decreasing the circulating levels of serum cholesterol and triglycerides without toxicity in a short-term animal experiment[5].

Omega-3 fatty acids are important for a number of bodily functions, including muscle activity, blood clotting, digestion, fertility, cell division and growth. Rich sources of omega-3 fatty acid are flaxseed, walnut, soybean oil, canola oil, olive oil and vegetable oil. In these the major class of omega-3 fatty acid is ALA. Several fish oils, such as mackerel, tuna, salmon, mullet, bluefish, sardines and herring, also contain omega-3 fatty acids, which are found beneficial in the case of Alzheimer disease, Zellweger syndrome, etc.[6]. Fish oils provide two nutrients – eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA)[7,8] – which can be converted from ALA. Fish liver oils, such as cod liver oil, are not the same as fish oils; these contain vitamins A and D as well as omega-3 (EPA, DHA). Above all, unlike fish oil, *Perilla* oil is considered safe because it has no mercury contamination risks[9–11].

Keeping in view that *P. frutescens* bhanjira can play an important role in national economy as a functional food source, we started some experiments on it under Doon Valley climatic conditions of Uttarakhand (Figure 1). The seeds were grown in experimental area consecutively during three sowing times (from 20 May with 25 days interval) with

Figure 1. Full bloom stage of *Perilla frutescens.*

four different spacing and fertilizer treatments. Harvesting was made at the time of crop maturity and a total of 36 seeds samples were collected for fatty acid analysis. The average oil content of the studied samples was 51%. The fatty acid composition of *Perilla* seeds was dominated by omega-3 and omega-6, ranging from 24% to 54% and 8% to 19% respectively, followed by oleic acid (5–13%) and palmitic acid (4–9%). Other compounds present in small amounts were lauric, myristic and stearic acids. The results of the study showed that *Perilla* oil was similar to linseed oil. On the contrary[12], other fatty oils such as sesame, soya and safflower were rich in omega-6.

Functional foods, nutraceuticals, pharmaco-nutrients and dietary integrators are all terms used commonly for nutrients or nutrient-enriched foods that can prevent or treat diseases. The high content of omega-3 fatty acids, absence of mercury risk from fish sources and the beneficial effects of *Perilla* oil make it the best supplement to achieve balance in these valuable fatty acids. *Perilla* can help in diversifying the cropping system in the hills and can be a good crop for utilization of waste and under-utilized land of the hilly areas.

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We thank K. S. Valdiya for his interest in the Giosan *et al.*[1] study on the evolution of the Harappan fluvial landscape published last year in the *Proceedings of the National Academy of the United States of America* (*PNAS*). Regrettably, in his article on the origin of the mythical Sarasvati[2] Valdiya attributes a series of quotes from another source[3] to ourselves and our co-authors, which, we would like to believe, results from a confusion on his part that needs to be corrected.

We never wrote that a 'geological narration constructed without rigorous evidence has been promoted to support a theory of cultural evolution in northwest India', or that we suspect that one theory compared to another 'had more emotional appeal and gained acceptance' among Indian geologists. Or that previous work needs to 'be revised or at the very least these geologists need to admit that their theory has been seriously challenged'. The sources of these comments are not our paper or communications, but are the comments of another individual on a personal blog[3], who has no connection to ourselves or our co-authors.

We protested this false attribution where and when it was made (i.e. the discussion group 'India Archaeology'[4] and his caretaker S. Kalyanaraman quoted by Valdiya as his source of information). For example on 21 June 2012, Giosan wrote to both venues: 'There is NO such text in our paper (…). There are a lot of glosses on our work, some informed and some tendentious, so please read the text as published by *PNAS* before attributing any quotes'. However, Valdiya[2] still believes that Giosan *et al.* 'accuse us (Indians) of having a dogmatic approach in constructing a narration on the Saraswati prompted purely "on emotional appeal" '. The Giosan *et al.* paper is a scientific study and does not pass any judgement on Indian science, within whose ranks we count our collaborators. Our admiration for the Indian culture and interest for the history of the subcontinent is long lived, and we have the utmost respect for the Indian civilization and its achievements.

We are sure that Valdiya agrees that authors are only responsible for their work and opinions, and not for claims and interpretations made by others. We hope that Valdiya's misattribution of quotes and his resulting misrepresentation of our intent[2] will be promptly corrected.

In the meantime, we are preparing a response addressing relevant scientific issues raised by Valdiya's article and also invite him to send his critique to *PNAS*, the journal that originally published our work. We appreciate the considerable geological and archaeological evidence gathered by Indian colleagues in northwest India and look forward to the opportunity for discussions toward an improved understanding of the Holocene fluvial landscapes in the western Indo-Gangetic Plain and how these relate to past human settlement and subsistence.

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