Ayurvedic medicine: standardization difficulties

Upadhye *et al.*[1] have discussed an interesting aspect of Ayurvedic medicines. They have considered 'involuntary adulteration' in the preparation of Ayurvedic medicines due to the use of plant species which have the same or similar names, but are essentially different constituently. In this connection we wish to draw attention towards some work conducted at the Banaras Hindu University (BHU), Varanasi on some well-known plants used in Ayurvedic medicine, namely Arjuna, Tulsi, Neem, Ashwagandha, etc. These plants (which are freely marketed) are well known and so any confusion regarding their identification is not expected to arise[2]. We collected the leaves, stems and roots of these plants from different parts of the country. The plants were studied with respect to their molecular and atomic constituents. For molecular analysis, the infrared spectrum was recorded. The spectra of these medicinal plant samples were compared qualitatively. No quantitative analysis could be carried out as absolute concentrations were not available. It was observed that there were significant differences between the molecular compounds (constituents) in the plants taken from different places. For atomic constituents, the absorption spectra of the plants/plant extracts were recorded using an atomic absorption spectrometer. The abundances were estimated by the intensity of the atomic absorption lines. Again, significant differences were noted for the same element in the sample collected from various places. For example, the Arjuna plant extract taken from Ahmedabad contained higher cadmium content than the maximum permissible limit for human use as prescribed by WHO.

These studies bring to light another aspect of the problems associated with standardization and quality control of the Ayurvedic drugs. The soil conditions, climate and the growing environment also seem to play a crucial role in the purity/efficacy of these drugs. It is therefore not surprising that the ancient texts often referred to the places from which the plants had to be collected for the highest efficacy, such as hermitages or mountain peaks. The rapid growth and civilization has probably destroyed such sources. Hence efforts are to be made now to grow these plants in a controlled environment.

For 'Bhasmas' of different types, the problems of standardization and quality control seem to be better defined. However, the preparation of the 'Bhasmas' using the ancient prescription poses certain problems. Alternative modern techniques must be evaluated for their efficiency. Since the preparation technique involves several stages, it is desirable that the chemical changes at each stage be analysed and their efficacy in treatment tested. These changes can take place in the formation of new compounds and changes in particle size and the arrangements of the atoms. Some studies have been carried out at BHU, but more detailed analysis using sophisticated equipment is required. R. B. Saper (Boston University, USA, private commun.), who had pointed out the toxicity in Indian Ayurvedic drugs due to which the export of these drugs was banned, has also emphasized the need of such studies. Such studies require close cooperation between the Ayurvedic pharmacists and practitioners on one hand and analytical chemisists and spectroscopists on the other. Our own experience at achieving such a cooperation has not been successful. Probably more sustained efforts are needed.

1. Upadhye, A. S., Rajopadhye, A. A. and Kumbhalkar, B. B., *Curr. Sci.*, 2012, **102**, 1087–1088.
2. Singh, S. K., Jha, S. K., Chaudhary, A., Yadav, R. D. S. and Rai, S. B., *Pharm. Biol.*, 2010, **48**, 134–141.

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High energy physics in 2012

Let us start with a little history. More than 50 years ago when I started my research in high energy physics (HEP), which was then called particle physics, there was no Standard Model. We were all groping in the dark. I had the good fortune to witness the Standard Model being built step by step. After each step was taken, I learnt of it with a pang of regret that I did not do it. It was an agonizing period for me. Although I was not on the stage, I was almost in the first row, seeing history in the making.

But all that is old story. By 1973, the Standard Model was in place. After that it has been a long, sterile period of almost four decades. Let me explain. During this period theorists have not been idle, but none of their theories has seen an iota of experimental support. Experimenters have also been busy, but all they have done in the last four decades is only to confirm one or the other component of the full Standard Model with three generations of fermions and all their details. I am aware that these are rather drastic statements, but they are true. For more details see Rajasekaran[1].

Experimental HEP has not made a single discovery beyond the Standard Model, except for the neutrino mass. That is the importance of neutrino physics. Expectations are high from the India-based Neutrino Observatory (INO), which is about to come up in Tamil Nadu in the Madurai–Theni region.

After this long sterile period, we now have at CERN, Geneva the Large Hadron Collider (LHC) which is capable of making discoveries. It can confirm or refute the numerous speculations that theorists have made. The day of reckoning for theoretical high-energy physicists has come. That is the importance of LHC and the excuse for this letter.

Unfortunately, in spite of the brilliant performance of LHC and its detectors, no discovery has been made so far. But it is

only the beginning. Many more years are to come. Hopefully nature will be kind to us and LHC will make discoveries.

Now what are the theoretical speculations?

Supersymmetry: An elegant idea. But if it is right we have to discover a whole new world of particles equalling our known world. Remember we took hundred years to discover the known particles starting with the electron. So, maybe, patience is required.

Technicolour: A whole new world of strong interactions! Having lived through the old strong interactions in the 50s and 60s without knowing what they are, that is not my cup of tea. But if nature had decided to repeat her tricks, who are we to refute her? There is one point that is striking. Technicolour had to be replaced by Extended Technicolour and then came Walking Technicolour. All this has to be done to take care of one phenomenological detail or the other. Are we building epicycle after epicycle?

Extra dimensions: Again we are building a whole new world of extra dimensions. It took us thousands of years to understand the four (three space plus one time)-dimensional world where we live. Now the theorists are constructing worlds with more dimensions added to the three-plus-one. Can this be done so fast? Many of the constructions in extra dimensions again remind us of Ptolemy: fitting phenomenogical details with epicycles after epicycles.

Dark matter: In contrast to all the above topics, dark matter has been already established to exist. This discovery is due to astronomers. But its nature is left to physicists to discover. Dark matter is more abundant than visible matter (about 4–5 times). Dark matter may also have all the variety and complication of visible matter, which we took 100 years to understand. So, characterizing dark matter by one or two parameters (like the relic density and the mass of the dark matter particle) may be far from the truth.

I have mentioned Ptolemy. Real progress may need a Copernicus, or at least a Copernican idea. These are deeper questions.

Our immediate situation is positive. The LHC machine and its array of detectors – ATLAS, CMS, ALICE and LHCb – are all performing beautifully. Thousands of experimenters and theorists working together are bound to discover something new.

A word about India: More young people must be brought into HEP (both experiment and theory). This is the right time since LHC has started working. Many new institutions in India are opening up and we must see that strong HEP groups are built up in most of them. India is a big country. We must think big. No small measures or small steps will do. Our agenda is to discover whole new worlds.

1. Rajasekaran, G., In *India in the World of Physics: Then and Now* (ed. Mitra, A. N.), Pearson Longman, Delhi, pp. 361–392; www.arXiv.org:/physics/0602131.

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Nardostachys jatamansi DC. is at risk in the Himalayan region

Nardostachys jatamansi DC. or '*jatamansi*' is a small, perennial, dwarf, rhizomatous, herb and the most primitive species within the family Valerianaceae (tribe Patrinaeae; Figure 1). This high-value medicinally active plant is distributed in the Himalayas from Pakistan, India, Nepal, Tibet and China between 3300–5000 m asl. The plant grows to a height ranging from 10 to 60 cm and has stout and long woody root stocks. But owing to overexploitation it has been listed as an endangered species.

This species is traditionally employed in the treatment of disorders, including those of the nervous, digestive, circulatory, respiratory, urinary and reproductive systems as well as skin problems. All parts of *N. jatamansi* are used and are effecitve antipyretics, antiseptics, anticonvulsants, antispasmodics, antibacterial, antipyretics, antifungals, antiemetic and analgesics. Essential oil (Spikenard oil) from the rhizome possesses useful biological activity and is used in 26 Ayurvedic preparations.

Due to overexploitation of rhizomes for medicinal and aromatic uses, habitat degradation and other biotic interferences, the species has been declared critically endangered and survival of the herbs is at risk[1–3]. Using available information, it is assumed that the causes of degradation are largely overexploitation and low regeneration in the natural habitats.

A reconnaissance done by a research team working at the High Altitude Plant Physiology Research Centre (HAPPRC) at Srinagar-Garhwal, Uttarakhand in the area, including Dayara, Hari Ki Dun, Kunwari Pass, Panwali Kantha, Tungnath, The Valley of Flowers, Bedni Bugyal, Rudranath, Madmaheshwar and others parts of the Garhwal Himalayas, reveals that only a few pockets of *N. jatamansi* are present in these regions today. In fact, the remaining intact patches are also decreasing rapidly due to invasion by several biotic and abiotic factors. Steady increase in human population, overexploitation of natural resources, extensive clearing of forests and grazing have been responsible for the loss of natural habitat. The causes of failure in regeneration include lack of

Figure 1. Naturally growing *Nardostachys jatamansi.*