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Invited Commentary

From medicine to phytomedicine

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As per the UNESCO Science Report (2010), India's contribution to research publication in the world lay around 3.7%, whereas that of China and USA around 10.6% and 27.7%, respectively. Our major contribution in scientific research relates to Chemistry and Agricultural Science and forms 6.5% and 6.2% of the global output, respectively. In terms of scientific manpower, each of China, USA and Japan has about 20% of the total number of researchers in the world, while India has a 2.2% alone. For every one million of human population, there are 1070 science researchers in China, 4663 in USA and 5573 in Japan, but only 137 in India. Our position in the world race in biomedical research is especially pathetic.

The story of the progress of biomedicine is interesting. Consequent upon new advances in biomedical research and a progressive assimilation of subjects like biology, chemistry, genetics, physics and physiology over the last couple of centuries, 'medicine' has emerged as a young, and more comprehensive than ever, scientific discipline. Precise and focused intensive research in medicine (or allopathic medicine) has made it branch into numerous specializations and sub-specializations so as to achieve a quick and targeted cure or alleviation of human ailments. Overspecialization, however, carries some inherent disadvantage, as it narrows down the work area and confines opportunities of mutual discussion and knowledge dissipation to smaller but more unified groups of expert. Describing this situation, Benitez-Bribiesca (1999) stated, "generalists have vanished, yielding to the younger breed of specialists".

Fragmentation of knowledge causes loss of coherence and neglects interactive effects. Although this is now a common trend with all sciences, yet it merits greater attention when it comes to medicine, which deals direct with human well-being. It does not auger well when a human being is not treated as a whole entity, and different parts of his body are supposed to be examined and treated separately by different specialists. One can genuinely be afraid of the day when a patient suffering from pain in the ear goes to ENT specialist but the doctor desists from attending the patient because he has specialized on the left ear whereas the patient's problem relates to the right ear.

In ancient times, physicians used to be many-in-one, normally having a good knowledge of literature, philosophy, logic, chemistry, botany, and often of mathematics and astronomy; in many cases, they would excel in spirituality and theology too. Even in the recent past, doctors used to be capable of (a) treating patients in the clinic, (b) conducting experiments in the laboratory, and (c) contributing to academics in seminars and conferences. This versatility has now disappeared from the world of medicine. As a sequel to growing specialization, new scientific disciplines, each with a narrow but sharp focus, have emerged and still are emerging, giving a boost to specialized research and journals with a fractal scope and limited area of activity. The popularity and significance index of broad-based biomedical journals have gradually shifted to super-specialized periodicals, which are too numerous to count.

However, many experts still advocate for the broad-based interdisciplinary endeavors so as to portray a larger and more complete picture, covering most of the relevant aspects with a holistic approach. Whether the holistic or the specialized approach deserves preference and promotion today, is a point of serious debate. The philosophy that a whole can be understood better by knowing more about its component parts, is not befitting the living organisms, despite that the dawn of molecular biology, with its dominant mechanistic view, has lent tremendous support to this philosophy. It is argued that living organisms are not mere assemblies of different parts/particles (or aggregations of molecules); these are very complex systems, being much more than only a sum of the constituent entities and evolving new interactive phenomena now identified as "emergent properties". If we adhere to the mechanistic models, for instance, we may not be able to appreciate the role of about 95% of our DNA, which is used for integrative activities (Capra, 1996). It appears that even though the study of minute parts of a living system is essential, it is not enough for full comprehension of the system and its responses to different stimuli.

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Application of systems theory and non-linear dynamics to living organisms and their health problems has given new dimensions to the understanding of bioprocesses with a coherent and integrated approach. It is due to these factors that the disciplinary boundaries within the natural sciences have once again started disappearing, giving way to hybrid domains (Wilson, 1998). This also applies to biomedical science. The merger of neurology and immunology with endocrinology and psychiatry, and that of molecular genetics with clinical oncology are some prominent examples. And this is not the end. Coherence and consonance are being sought even between science and humanities in order to create a universal knowledge of interactions among various systems developing and operating in the world or, for that matter, in the universe.

The emerging integrative paradigm of biomedicine has also masked the long-standing distinction between the modern system and traditional systems of medicine or between the synthetic drugs and natural drugs. Taking the modern system as well as some other less known but convincingly effective systems of treatment in its stride, the new paradigm is now asserting on integrated disease management. A major proportion of human population now prefers a plant-based treatment of diseases due to its little or no adverse side effects. Consequently, the traditional healing systems, such as the Chinese, Ayurveda, Unani and African systems of medicine, are coming to the fore. About 80% of people in the developing countries depend for their primary healthcare on traditional systems of medicine, largely based on plant material. About 5000 species of higher plants have been investigated as potential sources of new drugs, and over 125 chemical compounds extracted in pure form from nearly 90 plant species (Beigh *et al*., 2002). The WHO has included traditional medicine among priorities for its future action plan.

For long, medicinal plant research was restricted to isolation of new compounds from plant species, carried out mainly by chemists; pharmacologists used to test their therapeutic efficacy. However, in the current fast-changing global scenario, the onus of medicinal plant research has shifted largely to botanists with reference to authentication of botanical identity of drugs, standardization of techniques for cultivation of medicinal plants, and analysis of the impact of environmental degradation/climate change on their active ingredients. Most of the medicinal plants are still collected from the wild, which poses several problems like (a) sparse species distribution, difficulty in access and transport, indiscriminate collection leading to species extermination, mass-scale forest destruction, and mixing of genuine plants with spurious material. This situation emphasizes upon the need of a planned cultivation of medicinal plants.

Many a times, several plant species belonging to different genera and even to different families are known by one and the same vernacular or commercial drug name or, on the contrary, the same plant species is used for several different drugs. In order to ascertain which of the so many species used is the actual drug, quantification of active ingredients of all such species becomes indispensable. But this requires an extensive research plan, because the amount of biocompounds within the plant varies with so many factors like soil characteristics, agro-climatic conditions of the habitat, plant genotypes, plant parts, stage of plant development, nitrogen-use efficiency of the plant and degree of environmental pollution (Iqbal *et al.*, 2011a). Environment may affect not only the quantity of these compounds but also their quality; for instance, the relative proportion of component fatty acids may change in oils known for therapeutic uses (Iqbal *et al*., 2011b). In its extreme condition, this situation can alter the degree of efficacy of the given oil (or the plant species). All these aspects have to be investigated carefully as part of the prospective quality control plan for phytomedicine.

The current increasing attention on medicinal plants in the field and the lab has given a fillip to several research journals devoted to herbal drugs, which deal largely with chemistry of natural products, their pharmacognosy and pharmacology. However, journals dealing with medicinal plants in totality, including their botany, ecology, physiology and cultivation *etc*., are still few. 'Annals of Phytomedicine' is a new but significant addition to the list of wide-range periodicals on medicinal plant/plant medicine. Sufficiently cautious regarding its general appearance and the quality and range of its contents, it seems to carry a great promise and potential to serve the cause of phytomedicine. Let us accord it a warm welcome and join hand with its editors in pushing it to new heights of academic excellence.

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