PART

Scope for future work
While scientists grapple with the definition of nutraceuticals, companies are jostling to see who will take the lead in getting the nutraceuticals to market. Dietary supplement companies have the inside track thanks to years of research and product development. But pharmaceutical companies aren't far behind. They smell profits, defining what can and can't be said on labels.

Food companies could also be contenders. Their marketing and product development expertise is top shelf, and they have excellent distribution systems. Their only hurdle is manufacturing, which isn't up to the GMPs of pharmaceutical companies. The situation is changing, however. "Food companies could be the first to have nutraceuticals on the market, "Their manufacturing facilities have improved rapidly in recent years."
XII.1. Opportunities

For those firms having the financial, scientific and technical resources, and management expertise necessary to steer a product through the drug evaluation and approval process, approval of a food or food product intended for use as a nutraceutical or functional food can, in fact, represent an opportunity. The opportunity lies in the strong probability that very few products recognized by consumers as 'functional foods' will ever come to market, in turn conferring a high degree of market exclusivity to those firms that do choose to 'go the drug route' with their food products.

XII.2. Points of view

The complexity involving the application of biotechnology in the development of nutraceuticals represents a challenge for the food manufacturer. The industry, the consumers and the public authorities will have to find common ground to work together in order to boost this new promising market. The challenges are enormous but the market potential compensates for the risks. Most food processors see biotechnology advances coming in the short, the mid and long term. However, they find it hard to stretch beyond a 5-year payoff, and do not participate in programs that extend well beyond their horizon. On the other hand, biotechnology companies, sometimes spurred by concepts that are admittedly dreams of true futuristic thinkers, cannot always understand the reluctance of food-processing corporations to 'buy in' their ideas. A balance between these two approaches has to be found.

XII.3. Wider perspective and future

The world has focused on the production of medicinal preparations of varying degrees of refinement and in particular prescription medicines, together with the increasingly recognized possibilities for further development in the area. If the area does expand and develop as perhaps anticipated or hoped, then the major developments also seen in plant breeding, molecular biology and growth systems in recent years will have a large part to play in improving crop yields and productivities alongside greater reproducibility and consistency of raw
material supplies. Particular commercial opportunities may lie ahead for those with the technology and know-how in these areas.

XII.4. Chemical diversity

Underlying the great chemical diversity of plants is of course an equally diverse and versatile enzymology. Not only have major steps been made in phytochemistry in recent years, but also in the knowledge base of the underlying enzymology and pathways of biosynthesis. With the wide availability of cloning systems and vectors, the potential of discretely isolating and producing key enzymes for use in a variety of biotransformations begins to emerge into practical reality, making possible a combination of chemical synthesis and biosynthesis in the production of high-value molecules which in the past has not been feasible by solely chemical synthesis. Coupled with large-scale plant cell culture this may be one of the key areas for the future.

XII.5. Molecular farming

The area of molecular farming with plants and the production of high-value therapeutic proteins need a special mention. Major technical advances have been made in this area in recent years and the potentials are there to be seen. Various vaccines and antibodies have already been produced from a variety of plants and the question now appears to be one more of political will, regulatory considerations and economics than technical feasibility.

XII.6. Genomics and proteomics

Progress in genomics and proteomics has opened new gateways in therapeutics and drug discovery and development. Better understanding of the human genome has helped in understanding scientific basis of individual variation. Drug targets have evolved during the last decade, but the industry remains target-rich and lead-poor trapped in the old mindset and strategies. Traditional Indian Medicine
(TIM) and Traditional Chinese Medicine (TCM), carry many generations observations that have well-organized and documented data. Although scientific studies have been done on a large number of Indian botanicals, a considerably smaller number of marketable drugs or phytochemical entities have entered the evidence-based therapeutics. China has successfully promoted its own therapies and drugs like ginseng, ma huang and gingko with scientific evidences acceptable for the global community. Approach of integrative medicine by selective incorporation of elements of TCM alongside the modern methods of diagnosis has achieved a great success in China.

XII.7. In summary

India needs a clear policy for such integration without compromise on the strategies that are science-based. Efforts are needed to establish and validate pharmacoepidemiological evidence regarding safety and practice of Ayurvedic medicines. Pharmacoeconomic studies on TIM and TCM are rare, but can help in understanding cost-effectiveness and costbenefit of traditional medicine. In all such attempts, TCM examples would help India at various levels including policies, quality standards, integration practices, research models and the complementary integration where public health is kept at the central position. Both TIM and TCM are great traditions with strong philosophical basis and could play an important role in new therapies, drug discovery and development processes.