me to develop my own research project and generate my own funds to support the work. Unless, I could manage that, my Ph D would not be complete and I would have to leave the programme with a Master's degree.

The basic types of research that could be carried out were also categorized. First, the most basic and 'safe' type of research was popularly described as 'me too' research. Under this category, one would apply known principles and technologies to a problem in a different geographical area (e.g. fieldwork in some other country) and come up with results which are not new in principle or technology but just add to the global database. At the next level, research could involve using known technologies to solve a new problem. Alternatively, new technologies may be developed to address old questions and improve upon the available answers. Efforts to use tools routinely used in one discipline to address questions in another would fall under this category of research. Finally, the most exciting research would consist of developing new tools and technologies and applying them to completely new problems. This would invariably involve researching in completely unchartered territory and building-up solutions to problems brick-by-brick resulting in a strong niche and specific expertise for the researcher.

As far as teaching was concerned there was a very systematic lay-out to all undergraduate and graduate courses. The graduate courses had very few time-bound, in-the-hall examinations keeping with the philosophy that it was important to know what was in the books and the published research papers but it was more important to learn how to apply the knowledge to new research. In keeping with this, examinations in graduate-level courses, if conducted, were of take-home type or at least open-book. The flip side of this is, for course, that the ability to remember things and have information at the finger-tips is lost gradually and books and papers need to be referred to even on occasions when other people can pull the information right off the top-of-their heads. During job interviews, however, interviewers were more interested in how innovative my research was and the difference it had supposedly made to the existing knowledge than how much of the published literature I actually remembered. More often than not, even if I did not make the cut, I walked out of the interview with critical comments on my research that helped me improve the quality of my research work.

I developed a certain instruction philosophy as a result of taking a wide variety of undergraduate and graduate courses. I realized that all instructions must be based on a lucid and succinct presentation of material based on the following guidelines: (i) At the introductory level the scope of (earth) sciences must be defined to include any systematic knowledge (arts, sciences or engineering principles) applied towards understanding the processes that were or are operative; (ii) At the next level, the systematic and logical approach to understanding and solving problems must be discussed; (iii) At the advanced level, the focus of instruction must shift from merely 'informing' students to encouraging independent thinking in them.

One of the most difficult aspects of my Ph D was securing financial support for it. My advisor had a tradition that every Ph D work coming out of his laboratory had to survive the ultimate litmus test he had formulated, namely to submit the research project as a NSF proposal for funding. The proposal had to be submitted in the name of the advisor, and if the proposal was successful, funds were also released to and administered by him. The student got salary and logistic support out of the grant and was also responsible for completing the work approved in the proposal. The entire process of getting such a grant and working under such conditions was extremely stressful to say the least. When the $80,000 NSF grant did come through and I knew that my ideas had survived the ultimate test, there was more relief that elation. After that it was a question of execution of the work and five full-length papers later I had my Ph D all worked out.

MALAY MUKUL

Centre for Mathematical Modelling and Computer Simulation,
Bangalore 560 037, India

Bioprospecting – Options for India

The convention on Biological Diversity held at Rio and subsequent national level meetings organized in India recognized the sovereign rights of the countries over their biodiversity, the biological capital of different countries. Till the end of 20th century, the biotechnologically-rich developed countries continued to exploit the bioresources of biodiversity-rich developing countries through their gene technology, leading to a situation of 'biopiracy' or 'gene robbing'.

It is now an urgent issue for the biodiversity-rich nations like India to identify their useful plants, their phytochemicals, genes controlling them and to document their bioresources. Such an effort will certainly be useful in conserving and sustainably utilizing indigenous biodiversity. Even if any developed country tries to exploit the valuable biodiversity of a developing country, she will have to pay the desired amount of money proposed by the country having the sovereign right. Thus 'bioprospecting' has become the most relevant issue for the biologically-rich countries and gene prospecting and chemical prospecting (drug prospecting or pharmaceutical prospecting) are the frontier issues of the 21st century.

During recent years a worldwide interest has been created in the field of ethnomedicine, ethnopharmacology and ethnopsychiatry to find new and effective herbal drugs. Herbs are staging a come-back and a 'herbal renaissance' is blooming across the world. Herbs have been prized for their medicinal, flavouring and aromatic qualities for centuries and find diverse uses in the society, from medicine to pesticides[1].

India enjoys the benefits of a varied climate from alpine in the Himalaya to tropical in the south, from arid in Rajasthan to highly humid in Assam and West Bengal. This has consequently given rise to a rich and varied flora which includes several plant species associated with medicinal properties. India is being considered as one of the megabiodiversity centres in the world having 45,000 plant species of which about 2000 are being extensively utilized for treatment of various ailments.

The higher plants of tropical and subtropical countries like India face a greater number of stress factors challenging their survival than their counterparts in temperate zones. As such these plants develop much evolved defence mechanisms on account of the presence of wide varieties of chemicals in the form of secondary metabolites. In India the high mountain ranges of the Himalaya form a range of distinct climate specially at higher altitudes. It has been estimated that about 5000 dicotyledonous species or about 30% of Indian dicot flora are endemic to the region, most of which are medicinally important. India is said to harbour more endemic plant species than any other region of the world except Australia[2]. About 75% of the Indian dicots are polyploids while in China, the other biodiversity-rich country, these are mostly diploids. Because of this India holds sovereign rights on its biodiversity and the plants growing in Indian conditions would be different in chemical properties.

In India higher plants and their products are being used in different traditional medicines since time immemorial. Because of their long history of use in medicine, most of the drugs of plant origin are believed to be safe.

Efforts have to be made now to screen our flora regarding their different medicinal values. The wild plants which are in ethnomedicinal use should be scientifically tested and efforts should be made to conserve and cultivate them without losing their medicinal potency.

To date many compounds are being isolated from the plant kingdom as antineoplastic and anticancerous agents. The alkaloids of *Vinca rosea* (vinblastine and vincristine), podophyllotoxin (lignan) from rhizomes of *Podophyllum peltatum*, curcumol from *Curcuma aromatica* (clinically effective against cancer of uterine region), taxol (with taxane ring) isolated from the bark of *Taxus brevifolia* (showing prominent anticancerous activity) are some of the recently standardized drugs of plant origin. These plants grow luxuriantly in different parts of India. Development of novel clinically useful anticancerous drugs of plant origin would depend on the screening system and the selected cancer cell line. On the basis of phytochemical leads, the Indian plants should be tested during both *in vitro* and *in vivo* conditions and should attract the world market before such drugs are formulated by the developed countries.

Apart from medicinal value, in recent years considerable attention has been directed towards research and application of plant-based pesticides (botanical pesticides) in the management of crop pests in place of synthetic pesticides, most of which have residual toxicities even to the beneficial organisms. There has been a renewed interest in botanical pesticides because of several distinct advantages. Pesticidal plants have been a component of nature for millions of years without causing any adverse effect on the ecosystem. Thus the pesticides of plant origin are much safer than conventionally used synthetic pesticides. Such plant-based pesticides would be renewable in nature. The costs for research and development of the botanical pesticides from discovery to marketing would be less when compared to synthetic pesticides[3]. Some of the bioactive plant products like azadirachtin (from *Azadirachta indica*), pyrethroids (from *Chrysanthemum cinararaeafolium*) and carvone (from *Carum carvii*) are in use as botanical pesticides and are termed as 'fourth generation pesticides'. Presently, there is demand of aroma therapeutants for cure of aspergillosis as well as deep mycoses.

It has been estimated that only 5 to 10% of the existing plant species in India have been surveyed for biologically active compounds. Even this is an over estimate, as the investigated plants have been partially screened for a single or at best few types of activity. Due to rapid deforestation, phytologists may have only a few decades left for surveying and cataloguing the fast disappearing flora[4]. The attention of many multinational companies is focused on exploiting the vast commercial potential of Ayurvedic plants. The developing world's annual losses due to 'genetic piracy' by multinational companies are enormous. If India does not want to be left behind in the global race to patent her own rich biological wealth, the time has come for some quick action on the government's part.

It is high time that Indian botanists, specially the plant taxonomists, begin playing a key role in the protection of the sovereign right of our country over their biogenetic resources through chemical and gene prospecting. Through this 'crisis management programme', the plant taxonomists may convert the bioresources of the country to economic wealth. Taxonomists should not only collect and identify the plants, but they also have to play a key role in bioprospecting the plant resources and in the discovery of newer drug plants as well as in the development of data bases for national and international bioinformation sectors.

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N. K. DUBEY

Department of Botany,
Banaras Hindu University,
Varanasi 221 005, India