



Professor Dalbir Singh,
President, Indian Botanical Society
1995

TEACHING OF BOTANY : CURRENT PROSPECTS*

DALBIR SINGH

Department of Botany, University of Rajasthan, Jaipur-302 004

Let me begin, as I should, by extending you all a very warm welcome to the Annual Meeting on the occasion of 75 years of existence of the Indian Botanical Society. Rightly, we are celebrating the platinum jubilee, a great event, in the history of the society, which has served all these years, the cause of botany in India I, crave your indulgence for continued participation and interest in all aspects of Botany including those which are of general public interest in the years to come.

I feel greatly honoured that the Indian Botanical Society elected me as its President for the year 1995. I am highly obliged to all the members, particularly those of the Executive Council, for the kind gesture shown to me. While thinking of a topic for my address, I thought I would share with you some of my personal views on the changing scenario of Botany and the problems in its teaching in the hope of generating some discussion. Although I shall confine myself mostly to graduate and postgraduate teaching, the general remarks would have relevance to training at higher levels. Researches in Botany have been deliberately excluded since these have been evaluated and reviewed in recent years. A few of these publications are : (1) Status Report on Biological Sciences in Indian Universities (U.G.C. 1982), (2) Science in India : Natural and Physical Sciences (P. M. Bhargava and Chandana Chakrabarti, 1987), (3) Status of Basic Science (Curr. Sci. 1992), (4) Science in India : Excellence and Accountability (P. N. Srivastava, 1994) and the excellent compilation, (5) Botany in India : History and Progress (B. M. Johri, 1994), having reviews under as many as 39 titles. Each review is written by an expert or a group of experts.

The question of teaching of botany has been discussed by several of my distinguished predecessors (1921, 1948, 1951, 1967, 1970). There are 151

universities, 28 deemed universities (R & D statistics compiled by DST 1991) and a very large number of colleges teaching science. I must concede a point at this stage that all institutions teaching Botany or for that matter any academic course in science, social science, humanities, commerce etc. do not have similar standards. The universities and colleges have been increasingly blamed during the last 2-3 decades for deteriorating standards, not only by planners, politicians and bureaucrats, but also by scientists in national laboratories. It is depressing that impoverished teaching faculty, inadequate space, laboratory and library facilities and meagre funds in majority of the colleges and university departments provide little opportunity for bringing about any significant improvement.

PRESENT STATUS

During the 70's the problems and prospects of Botany were hotly debated and several reports in this regard appeared (Commoner 1961, Bonner 1963, Laetsch 1963, Shelter 1963, Stebbins 1967). The discussion centered largely around the new aspects of cell biology, genetics, molecular biology, ecology and biochemistry and physiology indicating that the subjects of botany and zoology are artificially circumscribed and that biology is a unified science. The concept did affect the thinking in the University Grants Commission (UGC) and many universities started new Departments of Biosciences. My illustrious predecessor, Prof. K. S. Bhargava strongly argued in favour of horizontal splitting in Biology instead of the usual vertical splitting (Bhargava, 1971).

The last two decades have witnessed spectacular diversification in the Botanical Science. This is also evident in the recent "Status Report of Biological Sciences in Indian Universities" prepared under the aegis of the UGC (1982). Many old disciplines, have attained the status of subjects and

several new disciplines have emerged either under Botany or as independent subjects e.g. Microbiology, Genetics, Environmental Science, Biotechnology, Genetic Engineering, Molecular Biology, Seed Science and Technology and Marine Biology. Besides the above subjects, it is commonly agreed that Biochemistry, Biophysics, Biometrics and Computer Application should also figure in Botany syllabuses at the undergraduate and postgraduate levels.

Botany at the undergraduate level (3 years course) is taught as one of the subjects in a 3 subjects system and the choice of combinations is rather limited; mostly, the favoured combination is : Botany, Zoology and Chemistry. Recently some institutions have started offering courses in Microbiology, Biotechnology, Seed Science and Technology, Molecular Biology at the UG level. A two year M.Sc. course comprises compulsory papers and electives, often in second year only, with 1 or 2 papers in the optional discipline. A 5-year integrated course in life sciences is offered at JNU.

Teaching has many components and the academic quality of students entering a course is very important. During the past three decades, the national Council of Educational Research and Training (NCERT) has done an excellent job in developing courses in Biology for schools and in producing excellent reading material. This is also true of school education in most of the states of India. Various Boards of Secondary and Higher Secondary School Education in the states have produced books containing standard reading material. The laboratory work in most schools of course remains poor.

Various efforts have been made at national and institutional levels to reorient teaching programmes. A commendable effort towards this objective was made in 1971 in the binational conference on "Biological Sciences and national Development : Strategy and Progress", sponsored by national Council of Science Education Foundation, UGC (India), U.S. National Science Foundation and U.S. Agency for International Development (U.S.A.I.D.). The published proceedings of this Conference were made available to all the university departments and leading biologists in India. Recently the UGC set up a committee - "Curriculum Development Com-

mittee in Plant Science" to prepare model syllabuses at undergraduate and postgraduate levels. Copies of this document have also been sent to all the universities. Both of these publications include detailed reports and valuable recommendations on teaching requirements, laboratory equipment and library facilities, and financial needs. Although the universities and autonomous colleges have widely used these recommendations to improve their syllabuses, other vital recommendations of these committees have mostly remained neglected or the pace of implementation is so slow that it has produced negligible impact.

CONCEPTS FOR SYLLABUS DEVELOPMENT

There should be a co-ordination between undergraduate and postgraduate teaching. The undergraduate syllabus should be so broad based, as to be terminal as well as complementary to higher education. A look at the model syllabus for B.Sc. prepared by the Curriculum Development Committee in Plant Science' fully reflects these concepts. However, my personal opinion is that it should include at third year level one or two elective papers of an applied subject; this should create an awareness of direct application of Botany and also possibilities of job opportunity or self employment.

The postgraduate teaching needs radical thinking and changes. Modern developments in Botanical Science make it necessary to redefine the concepts which underlie the framing of the syllabuses. It is time to realise that (1) no student can master all aspects of botany, (2) no department can have experts to teach even the major disciplines and (3) no department can develop infrastructure and other facilities for optimum training in all disciplines. The postgraduate courses must aim at specialisation with a broad base and interdisciplinary approach in the speciality. Foundation courses common to all specialities or separately for each speciality need to be identified and developed. The idea of offering extra-courses during regular time or vacations may be encouraged and credit given to the candidate. PG teaching must insist on project work. It might seem that the programme suggested is the one followed broadly in the U.S. universities. I might indicate that the Agricultural Universities in India are following a fairly flexible pattern.

The M. Phil. courses should be at the level of superspeciality.

LABORATORY WORK AND STAFF

The training in laboratory or field work has suffered over the years. No discipline can be properly learnt unless it is backed up by appropriate laboratory work. The syllabus for practicals should match topics covered in theory and field work must be made compulsory.

Earlier the practical work in Botany used to be largely morphology based and the teacher was given the responsibilities for collection of material, and for providing it to the students in the class. Exercises in physiology, ecology, genetics and plant breeding were limited and consisted of mostly demonstrations. Most departments had (may still have) one laboratory per class. With the change from predominantly morphology based courses to experimental based courses such as biochemistry, physiology, ecology, microbiology and molecular biology, etc., the concept of a single make-shift laboratory has become totally out-dated. There should be separate laboratories at least for major functional disciplines with adequate equipment. The Curriculum Development Committee in Plant Science has made detailed recommendations for developing UG and PG laboratories. Only time-bound joint efforts of funding agencies, educational administrators and the teaching faculty can help upgrade the laboratories.

The quality of laboratory staff is currently of little help to teaching faculty in effecting any improvement in laboratory exercises. The Binational

Conference on Education and Research in Life Sciences, as early as 1971, recommended the following supportive staff.

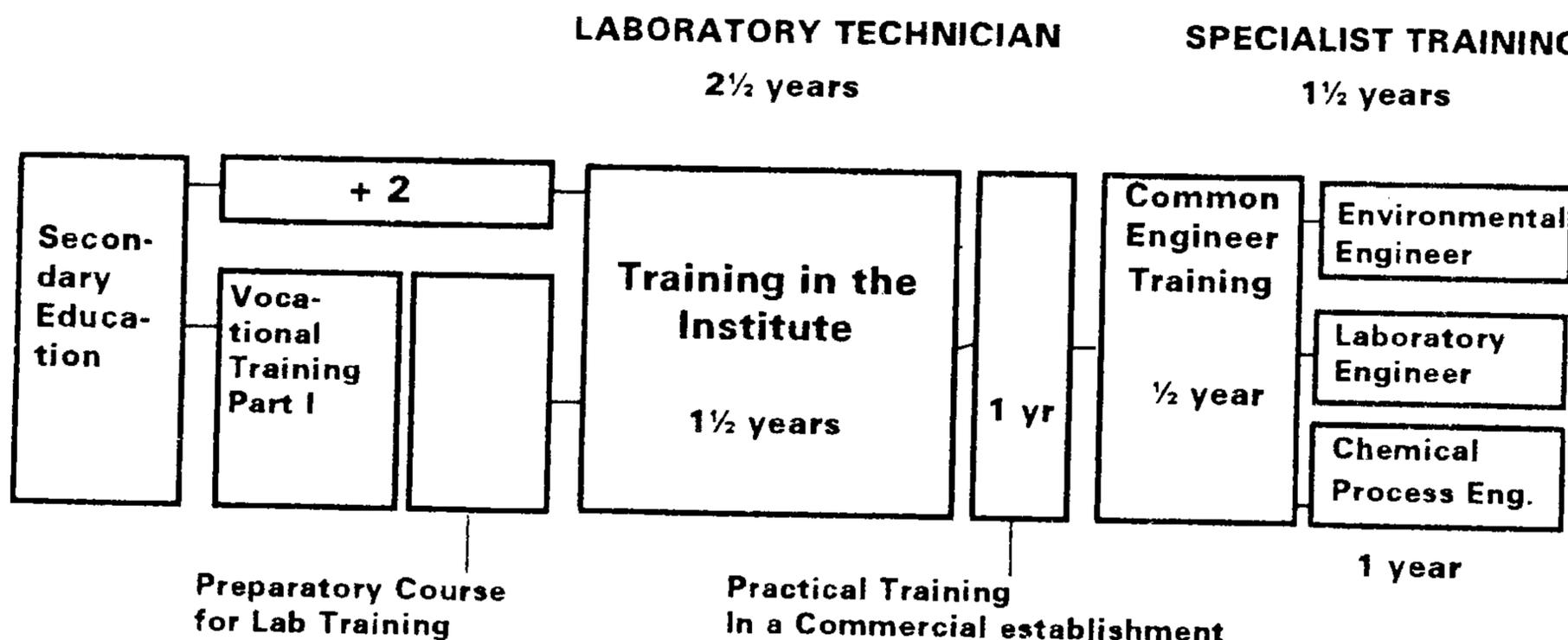
'Laboratory technicians, for preparation of teaching materials; electronic technicians for design as well as repair; audio-visual technicians; secretarial assistance and para-administrative personnel; glass blowers; curators; and artists.'

'It was further mentioned that curricula should be developed for the training of technicians (perhaps at polytechnics) and their valuable contribution to teaching, and to society as a whole should be recognised.'

Central workshop facilities for instruments have been established in many universities but the concept of training and employing trained laboratory technicians has not been accepted so far. There is no institute for training of laboratory technicians in India. A small country like Denmark has 11 training institutes for laboratory technicians. A modified picture of the training system for laboratory technicians in Denmark is given below. The training of laboratory technicians lasts for 2½ years and enables the student to manage both the theory and practice of analysis development and handling and maintenance of equipment including sophisticated instruments. A further training of persons designated as Laboratory/Environmental/Chemical Process engineers, is carried out for 1½ years with the help of a common foundation course of 6 months, followed by specialised training of one year.

LIBRARY

The deteriorating conditions in libraries during



the last two decades have reduced them to a pathetic state. A look at the gradually declining power of a university/college library to purchase books and journals is indicative of this phenomenon. Considering the ever rising cost of books and journals, and the explosion of knowledge resulting in the addition of numerous books and new journals each year, it appears almost impossible to effectively equip the libraries in individual colleges and universities. It calls for a thoughtful planning so that this vital facility is placed within the reasonable reach of students and teachers. The college or departmental library may take care of text-book sections and reference books required in teaching. A leading institute or university library should co-ordinate with the libraries in other institutions in the town/region for providing reference books, journals, annual reviews etc. A state or regional library may be so established that it is in the easy reach of students and scholars; it should co-ordinate with the university libraries in the state on the one hand and the National Libraries and Information Centres on the other. It should house costly books, reference books, Annual Reviews, Abstracting Journals etc. and should cater to the needs of researchers and other scholars. This 3-tier system will make it possible for an efficient use of the limited funds available for the libraries.

TEACHING FACULTY AND ITS IMPROVEMENT

All the facilities that I have discussed above and others which may follow later on are important; but more important is the human resource. I attach great importance to the availability of a well informed and trained teaching faculty. The current scenario is dismal with imbalanced faculty, often without a teacher in the major and also in a new discipline. The causes for such a situation (opening a new course without additional staff, inbreeding, immovility of staff) are well-known. Another serious problem is employing and retaining staff in an interdisciplinary subject, e.g., biochemistry, biophysics, biometrics etc. The interdepartmental collaboration can help overcome this problem. However, it is not uncommon that the departments in a campus seldom work in co-operation. Adoption of the course-system, to begin with at the PG level, can help to create a healthy atmosphere for such co-operation. It is widely prevalent in institutions abroad and in Agricultural Universities in India. I

am strongly in favour of inculcating this concept in teaching in basic universities. The department offering a course to students will also conduct the examination.

The University Grants Commission has provided various schemes to utilise the services of experts. Academic Staff Colleges (nearly 50) have come into existence to organise (1) Orientation courses (New teachers), and (2) Refresher courses. The latter mostly include lectures and discussions with little laboratory work. Refresher courses should be organised by departments with active research group in the discipline. Centres of Advanced Studies and Departments with Special Assistance Programmes and COSIST may do so. Course work should include new developments in the subject and must be backed by intensive practical work. The duration will depend on the contents but I feel it should be around 4-6 weeks.

As far as new disciplines are concerned, regular 'training' refresher courses' should be organised in institutions/departments having competent faculty and facility for practical work until adequate manpower is created. The duration of such courses should be 2-3 months. Additional funds may be made available to these departments for organising these courses. Even international co-operation for training of teachers in new disciplines will be a welcome step.

PUBLIC INTERACTION

It is usually argued that higher education in Botany has failed to create a mass impact on the public. The under utilisation of trained personnel in their own specialist field and unawareness among students regarding career opportunities are widely observed. Although no data has been collected by me, talks with the students during the past 10-15 years reveal that a majority of them after postgraduation want to pursue studies for M. Phil./ Ph.D. or a job in teaching or research. Only recently they have started seeking jobs in plant based industries.

During the past two decades, several plant based industries (Seed Industry, Seed Production, Seed Processing, Mushroom cultivation, Processed Food Industry, Specialised Biotechnology based industries Floriculture, Vegetable Hybrid Seed produc-

tion etc.) have developed in India. It is now for the teaching departments in the region to interact with them so that they could absorb the trained manpower available for such industries. Students may be offered courses (elective) in these disciplines with emphasis on practical training. Departments or Universities should have publicity programmes for people in industry and in other walks of life. Exhibitions and workshops on specialised aspects for persons in a particular trade (similar to Kisan Melas in Agricultural Universities) should be organised. Such new ventures as "Problem Solving Courses" depending on local needs, temporary or permanent, extending consultancy in areas in which a department holds expertise, and making organised professional efforts to assist in the identification and control of plant disease problems (similar to Plant Clinics in Disease Diagnosis and Education in U.S.A.) are also some of the aspects to be considered. I have particularly mentioned control of plant diseases as it has tremendous scope in a predominantly agricultural country like India and majority of the departments in colleges and universities have persons trained in plant pathology. However, they have to acquaint themselves with practical aspects, learn extension techniques and develop facilities to undertake the work.

CONCLUDING REMARKS

I have attempted to indicate the challenges and opportunities in the teaching of Botanical Science. It is not impossible to overcome the problems inherent in the present system. However, it will require a sincere effort in which various academies and subject societies interested in Botanical Science or science in general can play an important role. Perhaps, a comprehensive panel of scientists need to be established to extend an advisory role. Scientists in various specialities in Botany (classical and modern disciplines) drawn from the above panel, academies and societies, may form a working group to plan for the desirable reorientation in the teaching of Botany in the university system. It is necessary to determine an order of priorities and to develop a phased time-bound programme. Let me state clearly that in the development of any nation, good edu-

cation is not only vital but can act as a catalyst to hasten the pace at which the objective (social and developmental) can be achieved. I would also like to emphasise that the controversy between the school education and the higher education, which is often used as an argument against promoting higher education, is highly misleading. Each one has distinct objectives which are complementary, so far as the national development is concerned.

Regarding the financial allocations, we in the developing countries must ask for no more than the essentials to make meaningful changes. The funds allocated must be released in timely instalments. It is then the responsibility of academicians to optimise the expenditure. To deny these essentials to universities and colleges is to virtually cause stagnation and in the long term, deprive the country of the development of quality human resource. The University Grants Commission has permitted institutions to open self-financed courses. I may add that I am not against financial assistance from private sector or from the trainee. But if it is used only to raise funds at the cost of proper training, it should be abandoned. It may also be mentioned that the various committees or agencies which are meant to act as watchdogs for the maintenance of standards in the education system have gradually lost efficacy.

May I remind the members of this august society that in 1949, late Professor A. C. Joshi (President, IBS) emphasised the need for a standing committee to constantly look into the question of teaching of Botany. This idea was reiterated by Prof. K.S. Bhargava in 1970. I wish to submit that the Indian Botanical Society has an obligation to be concerned about the problems of teaching of Botany in India. The problem is much more acute at this juncture. I ardently hope that this society will play an important role in gathering support of the sister societies and also of all the important science academies in India for effecting improvements in the teaching of science in general and Botany in particular in our country.

I thank you all for the patient attention.