

**DISERTACION PRESENTADA POR EL PRESIDENTE DE LA ACADEMIA DURANTE LA  
CONFERENCIA NACIONAL DE LA ACADEMIA DE CIENCIAS DE HUNGRIA Y COMO  
PARTE DEL PROGRAMA DE LA ICSU  
“CAPACITY BUILDING IN SCIENCE”**

**A Proposal for Improving Science Capacity in Colombia:  
Capacity Building in Biological Sciences**

by

**Luis Eduardo Mora-Osejo\***

In the developed countries scientific knowledge, technological know-how, industrial production and economical growth increase intensively, while the developing world has to face, more and more difficult scientific, technological, economical and social challenges.

To overcome successfully that situation, developing countries need an effective cooperation from the developed countries. First of all, developed and developing countries have to integrate efforts for building a scientific capacity in the developing world. The promotion of both, fundamental and applied science will be a high priority in this solidary enterprise.

Fortunately, there exists a general agreement about the issues that have a higher priority for building a scientific capacity in developing countries. Particularly, in those developing countries, like Colombia where only three decades ago, began the process of building a local scientific capacity and to consider science as a part of their culture. In any case, it will take still long time to fill the gap between the amount of scientific and technological knowledge produced and available in the developed countries and that created and available in the developing world.

Fortunately, there is also already a consensus about the protagonic roll played by the improvement of the quality of the different levels of education. Obviously, the improvement of higher education quality will have a definitive impact in Science Capacity Building, as has been emphasized in the Declaration on Higher Education, aproved by the «World Higher Education Conference» of UNESCO, held last October, in Paris.

Taking in account the general state of science development in Colombia and as a contribution for filling the urgent need to enhance scientific knowledge of our natural potencialities through scientific research and to improve science teaching and, in general, Higher Education quality; on behalf of the Colombian Academy of Sciences, let me formulate the following proposal:

**Establishment of a Capacity Building in Biological Sciences Network**

We propose to establish in the region around the colombian city of Manizales, (also called «The Coffee Axis» (a tropical andine region of the country) a Network of Educational Institutions, of different levels, narrowly interconnected around a central **Tropical Biological Sciences Research and Educational Institute**. This central, Institute will have at first the following tasks: to carry out the cientific research at all the altitudinal levels of the unique tropical high mountain and low lands

\* Prof. Dr. rer.nat. President Colombian Academy of Sciences

will perform guided-research-work and other activities, directed to enhance their knowledge about the natural resources of the region. They also need to be acquainted with the problems that affect the people of the region and their resources. Particularly, with those problems that need to be solved for maintaining and strengthening the life support systems and for creating and putting in action an economical endogenous development model, under the conditions of sustainability.

The Interdisciplinary Seminar of the Institute will be the meeting place of professors, associated academical and technical assistants, high school and primary school teachers and pregraduated and graduated students. Workshops, Symposia, Conference cycles and Meetings will be held in BIOTROP for mantaining alive the discussion of the scientific results being obtained, or the proposal of new research and educational projects and

programms to be carry out by the Unities of BIOTROP. All these activities will be held, as activities of the Central Interdisciplinary Seminar of BIOTROP.

When the scientific research and the pregraduated teaching programs have reached a high quality level and the previously mentioned objetives have been fulfilled, **Graduated Study Curricula** will be also established. Of course, only for those research fields that have rified and reached a high scientific quality at the international level.

On the other hand, all these activities will be consistent with the following statement: It is a highest priority for the developing countries to dispose of an adequate number of qualified teachers for the different educational levels and also of creative researchers for building together a scientific capacity. This capacity is also necessary for proposing and applying a sustainable development model. In the case of Colombia, this model



Asistentes a la reunión del programa Capacity Building in Science, Budapest, Hungría, Junio 25 de 1999.

life support systems and of their economical potentialities, originated in the high biodiversity of the colombian low lands and high mountain native forests; to maintain dynamical and creative interrelationships with regional Educational Institutions of different level through conforming with them an educational network.

Once this network has been established the same model, with the appropriate adaptations, could be applied in other colombian regions for Capacity Building in Tropical Biology or other scientific fields. The herewith proposed Institute will be called **Tropical Biology Institute (BIOTROP)** and the whole system: "**Research and Capacity Building in Biological Science Network**".

One of the preliminary and significative steps that must be carefully undertaken for a successful fulfillment of this proposal will be the designation of high qualified "Chair Professors" for each of the **Research and Teaching Unities** that will integrate BIOTROP. This high qualified academical staff will be responsible of the research and of the educational activities of the Unities composing BIOTROP.

When the first research programmes of BIOTROP reach some appreciable first results and the activities carried out for science and teaching improvement, in primary and secondary schools, have shown progressive improvement, **higher education curricula will be also established**. These curricula will be accesible to qualified students that have already finished their high school studies and want to become teachers or professionals of one of the different Biology related disciplines. Among other qualities, these professionals and teachers will be distinguished, particularly, by their high qualified training in tropical biology and by their capacity of proposing models for the sustentable use of biological native tropical resources.

At the beginning the Institute would, possibly operate using the laboratories and the technical assistance of the National Coffee Research Center CENICAFE. As soon as the Institute obtain its own building the laboratories and the library for the **Research and Teaching Unities** will be implemented in agreement with the Chair Professors previously designated for each Research and Teaching Unit. The appropriate equipment will be also installed in the laboratories of each Unit at and the Field Stations located at different altitudinal levels of the Western and Central Cordilleras of Colombia.

First of all, in our Proposal we reconize that the weaknesses of our Educational System are produced,

among others, by: a) confounding knowledge with information; b) memory learning of information, trasmitted in the class room or obtained through textbooks readings; c) absence of a critical analysis of the information; d) absence of motivations for building interrelationships with other issues of the same context; e) predominance of the «authority principle», that is, the acceptance as absolute truth the information, without a previous critical analysis; f) lack of motivation or interest to verify or falsify a questionable «scientific» issue by submitting it to experiment in the laboratory or to carefull observation in the field, directed to obtain favorable or unfavorable evidences.

So, we propose, as a general objective, to promote and create effective conditions for intelligent learning. They have to be conditions that stimulate thinking; so necessary for deducing general explanations about phenomena or facts being observed. In this way strenghten intelligent learning will lead to strenghten in the student's mind a conceptual network that, face to face with the natural phenomena, could induce the student to ask himself new questions to be answered and new scientific explanations to be formulated as a result of his research work, performed with his teachers orientation and help. Of course, this will be a first step, for reaching the above described objwtive what Biological Sciences concerns.

It may in some cases happen that this process could lead to the discovery of still unsolved scientific questions whose solution may imply a new explanation or the creation of a new concept. In this way one of the main strategic objectives of our proposal seeks to promote scientific creativity among the students and, of course, among the primary and high school teachers that are being trained in the Institute.

This is also the reason why, at BIOTROP, Research and Teaching have to be equally valorated and need to be considered complementary activities or aspects of the same purpose and task.

In order to enhance teaching and research quality, but also for the optimization of the operative efficiency of each BIOTROP Unit and of the Network as a whole, it will be necessary to maintain a permanent information exchange and an effective operative collaboration between the **Teaching and Research Unities** of BIOTROP and between each of these Unities and the regional Educational Institutions of the network.

The students and teachers of the high and primary schools of the region that are being trained in the Institute



has to consider the high diversity, coomplexity and fragility of the wet tropical life supporting systems whose conservation depends on their sustainable rational use.

It is also assumed that our strategic approach that consists in considering teaching and research as complementary activities will contribute strongly to the **contextualization** of all the educational programs carried out by the proposed "**Research and Scientific Capacity Building Network**".

Through the scientific research accomplished by the **«Research and Teaching Unities»** of the **Institute of Tropical Biology** the different problems that affect the complex and fragile natural reality will be identified and submitted to study. Students will participate in this study according to their respective level of training. So, students and teachers of different educational levels will become acquainted with such problems and also with the methodology and scientific approaches used in the search for solutions. They will so understand the importance of contributing to solve such problems. All this in contrast with the traditional formalistic teaching of our **Higher Education System** and with their metodological orientation, not contextualized in our natural, economical, social and cultural reality.

For instance, one of the topics that deserves to be introduced in the conceptual framework, necessary for reaching **contextualization** of education and research activities in the tropical region research, is the concept of **tropicality**. Under this concept one has to understand the strong daily thermo-climatical oscillation characteristic of the whole tropical region, different from the annual thermo climatical regimen of the Temperate Regions of the world, from where the predominant developmental model proceeds. It is important to introduce this concept because **tropicality** combined with the intricate mountaineous topography, among other factors, determinates the high complexity and fragility of our life support systems, the human life support systems included.

Among the long term objectives of the proposed **«Research and Scientific Capacity Building Network»**, some of them are directly related with the already mentioned objectives, while others are inderectly connected with following objectives:

To contribute to strenghten the colombian economical sector by the application of the new scientific knowledges obtained through the Network research activities. Particularly, those referring to the identification of the

economical potentialities of the huge colombian biodiversity. In such a way new internationally competitive products can be developed. In other words, products and technologies that would be able to cope sucessfully in the more an more global economical market. On the other hand through a better understanding of life support systems, we hope also to be able not only to maintain the natural biodiversity but also a healthy environment.

### Proposal Evaluation

This proposal, has been evaluated during the last two years by different institutions, private or public, of Manizales, the capital of the colombian Departamento de Caldas. It has been also presented in seminars and lectures. Its contents were discussed with recognized personalities of the region who have evaluated it positively. They will also be willing to coloborate for getting financial resources needed for its establishment and to give it logistic support.

The following colombian Institutions have considered positively this proposal: University of Caldas; National Research Center for Coffee (CENICAFFE) and Biotropical Foundation-Manizales.

The proposal will be also presented for its evaluation to the following Institutions of the Ministry for the Environment: Institute for Hydrology, Meteorology and Environmental Studies, IDEAM; Natural Parks National System and Strategical Colombian Ecosystems.

By the opportunity of this **ICSU-Capacity Building in Science Conference I** should like to emphasize that for the sucessfull fullfillment of this proposal it is also necessary to have financial support from International Scientific Capacity Building Programs, among other possible financial sources.

For the attainment of success of this proposal it will be also very important to obtain International Academical Support. Particularly, it will be necessary to link to its research and educational activities scientists from developed countries. Particularly, scientists with a deep knowledge and a good experience, in tropical high mountain Ecology, Bioclimatology, Edaphology and Genetics, among other disciplines. In the same way, we hope to obtain some coloboration for getting scientific equipment for both, the Laboratories and the network of Field Stations of the Tropical Biology Institute (BIOTROP) that will be installed in the most representative and strategical ecosystems of tropical low land and of the different altitudinal levels of the Cordilleras, of Colombia.

At the beginning the BIOTROP will probably make use of the CENICAFE laboratory facilities. It is also possible that the scientific staff of this Institute will participate in research projects and teaching activities of BIOTROP.

Another priority activity will be to perform, with the participation of the University of Caldas and other Regional Institutions, particularly, the Biotropic Association, a critical study of the present problems affecting the Educational Institutions of the Department of Caldas. The results of this study will be given high relevance in the

configuration of the interdisciplinary educational programs of the proposed Tropical Biology Institute.

It has been calculated that at the beginning the annual costs per student will be approximately US\$6.752.00. For a total of approx. 230 students of diverse proceeding (Teachers of Primary and Secondary Schools included), once the different basic and advanced **blocks and cycles** of the **Biological Sciences Academic Curriculum**, annexed to the text of this proposal will be offered.

Budapest, 25 June, 1999.