Chemical Education Applied to World Needs
August 6, 2000 16th International Conference on Chemical Education
Budapest Hungary

"The Two Faces of Undergraduate Study Abroad: Education and Training for the Global Society of the Third Millennium." James E. Boggs, Department of Chemistry and Biochemistry, The University of Texas, Austin, TX 78712, jeb@ne059.cm.utexas.edu

A year of studying science in a foreign university is increasingly recognized as a valuable component in the education of chemical scientists. There are two benefits from such a program; one in the development of the student as an individual and, the other, as an increasingly vital element in the training of leaders in our new global scientific and industrial community.

Education, *n*, (Lat. *Educere*, to lead out or draw out). Every educator has marveled at the changes that occur in the best students as their consciousness expands to encompass broader concepts of their disciplines, their world, and their place in both. A year of immersion in a foreign culture and a foreign language while studying science in a foreign university is a powerful stimulus for bringing about a revolutionary change in the student involved. Students who return from such an experience are different people from those who embarked on it, changed in self-awareness, self-confidence, ability to handle unexpected situations, deal with strange people, and value the existence of diversity in a fascinatingly large and varied world.

On the other side, the trend toward globalization of chemical science and chemically based industry is accelerating. If chemistry is to make a contribution toward solving world needs, transnational companies and intergovernmental agencies will play a large part in it. Actual experience in a foreign culture is a valuable asset to a graduate seeking employment in many companies. A CHEMRAWN conference (CHEMical Research Applied to World Needs) is now being planned under the auspices of the International Union of Pure and Applied chemistry to address the question of how people should be educated to enter into this global effort. Certainly one of the most valuable introductions is through an undergraduate study abroad program that, for example, takes a student from a farm in central Texas through a couple of years at a Texas university and then thrusts him into life at, as one possibility, the Université Pierre et Marie Curie in Paris. If, as the African proverb says, "It takes a village to raise a child", it is also true that it takes a world to educate scientists to lead us into the new millennium.

"Industry Expectations in Regard to Chemical Education Standard." Parry Norling/DuPont, USA and J. A. Kopytowski Industrial Chemistry Research Institute, Maltansalia 6135, PL-02-761, Warsaw, Poland

Historically, the majority of students educated in chemistry express their knowledge of the subject in industrial settings. The rapid globalization of chemically-oriented industries suggests the need for educating chemistry students for transnational work places. We present here the results of a survey designed to describe the perceived optimal profiles of chemists who would be successful in large and medium sized transnational industrial environments. The profile is the result of a survey of selected large and medium-sized industries initiated by the CHEMRAWN Committee, but involving members of the Committee on Chemistry in Industry. We review the results of this survey and their implications on the curriculum—the education—of professional chemists.

"Education for Sustainable Development: from Slogans to Actions." Natalia P. Tarasova, Department for the Problems of Sustainable Development, D. Mendeleyev University of Chemical Technology of Russia. tarasova@glasnet.ru

Sustainable development has been put on the agenda of educational institutions with great urgency by UNCED in 1992. By that moment, the complexity of the problems, and the need for a multidisciplinary approach have become clear. Of course, scientific developments and technological applications are considered to be of primordial importance in order to develop environmentally benign energy sources, to achieve improvements in agricultural production and food processing, to create effective drugs and vaccines, etc. But it has also been obvious that there is more: insights should be applied, plans should be implemented, instruments should be utilized. Citizens should become willing to prioritize sustainability, consumers should become aware of the choices they can make and the influences they have on production and marketing, companies should broaden their vision, showing too often a mono-concentration on short time, financial objectives at present. The immediate questions that arise at this point are as follows: which social or economic powers could force nations or national governments to combine the forces into the desired direction, and how could and should the human behaviour be changed? Normally it is recommended to "expand environmental education in every possible way". There is no argument about this, but is it enough just to expand it? Education for sustainability (if compared to environmental education) might be defined as the continual refinement of the knowledge and skills that lead to an informed citizenry that is committed to responsible individual and collaborative actions that will result in an ecologically sound, economically prosperous, and equitable society for present and future generation. Several examples of the implementation of programs on education for sustainable development at different levels will be given.

N. Mohamed[1] and Z. Ismail[2]
[1]School of Chemical Sciences, [2]School of Educational Studies, Universiti Sains Malaysia, 11800 Penang, Malaysia. email: [1] mnorita@usm.my, [2] zurida@usm.my

PERCEPTIONS OF STUDENTS' DIFFICULTIES IN FIRST YEAR CHEMISTRY COURSES

The understanding of chemistry on three levels, namely macroscopic, microscopic and symbolic, might make Chemistry difficult to learn. An additional factor to add to the complexity of Chemistry is the frequent use of mathematical symbols, formulas and equations to express relationships at the macroscopic and microscopic levels. Students of Chemistry have to learn the basic concepts and then integrate and apply these concepts to solving problems. A survey was conducted with first year chemistry undergraduates to find out why Chemistry was difficult or easy for them to learn. The responses were then grouped into categories such as course-related factors, student controlled factors and factors inherent in the nature of Chemistry. An exercise was also conducted with the faculty involved in teaching first year Chemistry to ascertain their perceptions of students' difficulties.

Chemical Education Applied to World Needs
August 7, 2000
16th International Conference on Chemicfal Education
Budapest Hungary

"Chemical Education Responding to Developing World Needs." J. D. Bradley, RADMASTE Centre, University of the Witwatersrand, Johannesburg, South Africa,
bradley@aurum.chem.wits.ac.za

More than half the world's population lives in developing countries. At a basic level, their needs are the same as those of people anywhere. However, the extent and manner in which they can be satisfied varies enormously. Chemical education should always be provided with the real needs in mind and should always be relevant to the environment. The influence of the developed on the developing countries tends to work against this; teachers in developing countries too often are trained to believe that they will serve their students best by trying to follow the example of developed countries. There may be some truth in this belief, but local realities must be decisive. Both content and methodology need to be carefully chosen for this purpose. A key change that most teachers need to make is from teacher-centred to learner-centred methodologies. Herein lines the chance to encourage students to do things and think for themselves, which is essential for development. The challenge is to bring such changes about when little money is available

"Preparation for Industrial Research: What is Wanted and What is Not Wanted - A DuPont Perspective," **Dr. Parry M. Norling** and Dr. Joseph A Miller, DuPont, Experimental Station 328/410, P.O. Box 80328, Wilmington, DE 19880-0328

In DuPont, we seek researchers who have the needed skill base; have the technical edge to talk with credibility; have the ability to use modern computational skills, modeling, and information technology; know how to take an idea and turn it into something of substance; have the ability to collaborate and work in teams; are able to be non-conformists; and are courageous and committed. Universities are providing the education to develop some of these attributes, are not providing others, and should not attempt to provide still others. We will outline DuPont's perspectives on the current state of the preparation for researchers in the firm. We will also compare and contrast this experience with the recent findings of the Council for Chemical

Research - an organization of more than 200 companies, universities, and government laboratories in the United States that conduct research in chemical sciences and engineering.

CHEMRAWN X, Preparing Scientists and Engineers for the 21st Century: A Panel Discussion."
J. J. Lagowski, Department of Chemistry and Biochemistry, The University of Texas at Austin, Austin, TX 78712 USA, Telephone and FAX: 512/471-3288, jjl@mail.cm.utexas.edu

This is a panel discussion designed to produce significant recommendations to the organizers of CHEMRAWN X, the "Chemical Education" CHEMRAWN, which is entitled "Preparing Scientists and Engineers for the 21st Century. Comments and suggestions by ICCE participants are sought and valued. The recommendations developed in this session will be forwarded to the organizers of CHEMRAWN X for inclusion into the program for that meeting.