

**CHEMISTRY IN THE DEVELOPMENT OF AFRICA
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CONCLUDING REMARKS:**

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SUMMARY:

We address some of the central issues raised and discussed, together with some proposals and conclusions of the IUPAC-AAPAC meeting On Chemistry in the Development of Africa.

1. Human Capital Development;
2. Chemistry education at all levels;
3. Research infrastructure
4. Reduction of braindrain;
5. Bridging gap between donors and developing countries;
6. The Chemical Industry;
7. Chemistry and the environment;
8. Science – Society and Government Interface;
9. The revolution in electronic scientific communication;
10. Liaison between IUPAC and AAPAC;
11. Broadening of geographical base of IUAPC in Africa on regional and national basis;
12. Proposal for two joint programs for IUPAC-AAPAC collaboration. The first program is the planning of the electronic communication scientific highway for Africa. The second program will be proposed by the AAPAC;
13. Acknowledgements.

With respect I deliver this concluding address. Our meeting inspires deep respect to the chemistry community of Africa, facing difficult problems and adopting firm commitment and a sense of purpose for the future.

I shall touch on some of the central issues raised and discussed, together with some proposals and conclusions of our fruitful and most instructive meeting.

Human Capital Development. We addressed all levels of **chemistry education** and research. While our mathematician colleagues maintain that mathematics is a basic language, it is imperative to remember and to convey the message that chemistry constitutes the conceptual framework of all sciences, from physics, material science to biology. This is the basis for education in chemistry. We addressed central problems of scientific literacy on the elementary and high school level, education infrastructure, teaching equipment, teacher continuous education technical training for specific goals, University education, and the important issues of the interfaces between teaching-learning, contact-distant open modes, book-electronic virtual information dissemination were referred to. Goals, objectives and programs for education on all levels require long-term strategic plans.

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This brings us to **Research Infrastructure**. Research in the African University system is not only necessary, but is essential. The research system has to rest on uniqueness and response to local needs. Chemistry in Africa has to choose carefully its research directions. It has to combine intrinsic contribution to knowledge, together with extrinsic service of chemistry to health, environment, sustainable development and quality of life, which will be promoted by research.

The development and advancement of the University training and research systems brings us to the important issue of the preservation of advanced research manpower. The promotion of the development of young scientists, doctorate students, post-docs and young faculty members should constitute a top priority. I am happy to announce that the IUPAC Berlin Congress in 1999 will bring 20 young chemists from developing countries to actively participate in this central scientific activity on the Frontiers of Chemistry. This is a significant step in an important direction.

A central issue in this context of Human Capital pertains to the preservation of advanced research manpower, taking proper steps towards the **reduction of braindrain**. I strongly believe in the basic principles of freedom of motion of scientists. Let the young people be completely free to choose the scientific system and the country to which they will contribute. However, I strongly recommend that the research systems of Africa will take initiatives to bring back young, outstanding, scientists after their training abroad (e.g., in the U.S.A. or Europe). It is impossible to compete with the material and research conditions of the developed countries. However, the research systems of Africa have to advance special programs for sustaining their manpower. What I have in mind is a program of research grants of 20,000-40,000 US\$ over a period of 4-5 years for young scientists who return to Africa, which will allow them to maintain continuous scientific contacts with the research system where they were trained. This will be accomplished by visits of these scientists to the centers and by inviting foreign scientists from abroad to the African research center. Continuity and stability is the key for success of such a program. But, most important, the young people have to be guided by ideology and vision regarding their seminal, unique future contribution to science in their country. Vision, combined with concrete serious programs, will be of central importance for the future of science in Africa.

A final comment regarding Human Capital. We are not, by any means, aiming towards global ownership of human capital. But rather, we strive towards global collaboration in building, developing and preserving the Human Capital capacity in the developing countries. I believe that it is the moral responsibility of the entire world chemistry community to join forces with and help Africa in building its education and research Human Capital at all levels. This should be accomplished by exterior support of well-defined plans and programs.

An important issue was raised concerning **bridging the gap between donors and developing countries**. In spite of difficulties on the international and local governmental levels, we should look into a possible buffering and coordination of the contributions of IUPAC as an independent, authoritative, non-governmental, politically neutral body. Another aspect where IUPAC may be of help pertains to the distribution, management and accountability of research funds in Africa. IUPAC can contribute its expertise for external refereeing of research proposals.

Other issues pertained to **regional and international collaboration** of the chemistry community in Africa. It was pointed out that regional collaboration is often more limited in scope than collaboration with other countries outside Africa. Collaboration within Africa is hampered

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because financial support comes only from outside Africa. Another issue of regional collaboration pertains to joint publication. A possible avenue, which has to be explored, is an Electronic Journal of Chemistry in Africa.

The problems and challenges of the **chemical industry** were raised, touching on clean industry with the curbing of pollution, upgrading industrial technology, regional cooperation, and industry-University collaboration.

The issues of **chemistry and the environment** were highlighted, pertaining to pollution problems, food water and health problems, i.e., malaria, lack of chemical-environment technology, training programs of technical manpower and sustainable development.

It was sagely pointed out that African countries are poor-rich countries, rich in natural resources but with poor populations. The future contributions of chemistry to society in Africa will provide the avenues to a change to rich-rich countries.

The issue of **Science, Society and Government in Africa** is complex and most important. This issue involves the public understanding of science and government science policy under conditions of inherent and intrinsic instabilities in developing countries. The internal building of a critical mass of scientific activity and the spreading of the message of the importance of chemistry for development are crucial. The possibility was raised of education and science planning by the science community. But self-reliance is not enough in this important context. The important issue was raised of IUPAC's assistance to the African chemistry community in science-government interface. IUPAC's strategic plan (1998) contains the goal of representing the interests of chemistry in governmental and non-governmental forums. However, IUPAC will not undertake projects, which will cast it in the role of local governmental policy development. Such an approach will erode IUPAC's authority as a non-governmental, politically neutral body, diminishing its effectiveness in serving the world chemistry community. IUPAC can contribute to the representation of the interests of the chemical community of Africa in governmental forums by AAPAC-IUPAC collaboration.

One of the hallmarks of our era is the revolution in global communication, manifested by electronic computer communication. For the science community of both developing and developed countries the construction of the global scientific communication highway will lead to major changes in scientific research modalities, collaboration, accessibility and dissemination of scientific information. **The revolution in electronic scientific communication** has the potential of a major impact on the progress of science, and in particular chemistry, in Africa. IUPAC is already making use of the internet/WEB for global communication. Electronic publishing of IUPAC's scientific books and journals is being advanced. IUPAC will look favorably into the modalities of making this information available to developing countries. Subsequently, efforts will be made to broaden the scope of the chemical scientific electronic information to developing countries. The informative scientific highway for Africa will require as its first stages:

- Setting up of a computer (PC) network and of communication channels.
- Maintenance of the infrastructure.
- Availability of databases.
- Training programs in Africa for electronic communication manpower.

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The US National Academy of Sciences plans to have a communication satellite network ready for use for electronic scientific communication by developing countries towards the year 2001-2. In conjunction with availability of databases and electronic publications, this program has the potential of revolutionizing chemistry in Africa.

The liaison between IUAPC and AAPAC in promoting the contribution of chemistry in the development of Africa will be of considerable importance. The AAPAC is the regional chemistry society of Africa and AAPAC-IUPAC collaboration will constitute regional-global collaboration with four possible modes of cooperation:

- (1) Dissemination of information for Africa as a central issue, e.g., education, industrial legislation and environmental problems.
- (2) Joint addressing of regional programs, with mutual input for international governmental bodies, e.g., UNESCO and WHO, as well as for non-governmental bodies, e.g., ICSU and other scientific unions.
- (3) Joint planning of programs for Africa, including:
 - Electronic communication network;
 - Electronic African chemistry journal;
 - Sustainable development;
 - Education at all levels;
 - Training programs;
 - Research infrastructure.
- (4) The Chemistry-Government interface for Africa.

The AAPAC will provide a bridge between the national chemical societies of Africa and IUPAC. To strengthen AAPAC-IUPAC ties it will be very significant if AAPAC will join IUPAC as an Associated Organization, as is the case for other regional societies, such as the Federation of European Chemical Societies. Concurrently, I am calling for the broadening of the geographical base of IUPAC in Africa, with African countries joining the Union, first as observer countries and subsequently as full-member National Adhering Organizations. This will reflect on the globalization of IUPAC.

I would like to adopt a pragmatic approach to IUPAC-AAPAC's future collaboration. In addition to current programs of IUPAC for developing countries, in collaboration with UNESCO, ICSU, WHO and UNINDO, **I propose that AAPAC and IUPAC will undertake two joint programs:**

The first program is the **planning of the electronic communication scientific highway for Africa**, as an AAPAC-IUPAC collaboration.

May I suggest that the second joint program for AAPAC-IUPAC collaboration will be proposed by the AAPAC.

Deep thanks and appreciation are due to all those who made central contributions to this meeting:

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Professor P. S. Steyn, member of IUPAC's Executive Committee, who organized our meeting, shaping the scientific program, showing wisdom and perception in bringing us here and taking care of all the perfect local arrangements.

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Dr. E. D. Becker, the Secretary General of IUPAC, who initiated the regional meetings between IUPAC and the world leadership in academic and industrial chemistry.

Dr. J. M. Malin, Administrator of the International Activities of the American Chemical Society, who kindly accepted our invitation to participate in our meeting, for his contributions, input and help.

Most important, deep gratitude is due to all the participants in this important meeting. Thank you for coming, for your outstanding contributions by your lectures, presentations, input and perceptive comments. We are grateful to the chairmen of the session, Professor P. S. Steyn and Professor H. M. Salem for their leadership.

Our unique and memorable conference was conducted in the true spirit of scientific exchange. We addressed the major issues of chemistry and service of chemistry in Africa. The problems are difficult, but not insurmountable. The challenges are immense. Your admirable approach rested on the combination of realism and vision. You inspired hope and a firm sense of purpose for the future of the chemical sciences and their contribution to the developing countries of Africa. This message of hope has to be conveyed to the young generation of chemists. The objectives, initiatives and contributions of chemistry in Africa must succeed. IUPAC will be privileged to contribute to this central regional-global endeavor. Let us join forces for the future of Africa and of Mankind.