Symposium preview:

Nuclear medicine in developing nations

by Mohamed M. Nofal

When IAEA was established as an autonomous member of the United Nations family in 1957, a prominent assignment was to "seek to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world". The inclusion of "health" reflected an important fact – that medical uses of radiation and radionuclides were among the first and most widespread applications of "atomic energy".

Today – because of their diversity – radiation and radionuclides for medical and biological purposes are used in more countries and in more laboratories than any other application of atomic energy.

This diversity has established the character of the Agency's programme in the field: Instead of a few large projects, many small activities are supported, tailored to the needs and wishes of individual countries, particularly developing ones.

Support takes a number of forms – seminars, training courses, workshops, research contracts, and technical assistance projects, for example. Throughout the programme, close collaboration with the World Health Organization (WHO) and other intergovernmental agencies has been maintained, while emphasis has been placed on solving the problems of a region in the region itself.

International symposium in 1985

In 1985, the Agency will be holding an International Symposium on Nuclear Medicine in Developing Countries from 26 to 30 August in Vienna, Austria. As background to that meeting, this article reviews Agency work in this field.

Every year, IAEA organizes one or two symposia at which specialists from developed and developing nations review progress and present their latest findings on a specific subject. Additionally, several smaller meetings of experts are convened to examine particular topics in depth, to plan future programmes or to review results achieved in research activities.

An important component here is the provision of information via technical reports of various kinds, as well as publication of meeting proceedings. All publications are available to the public, some free, some at cost.

More than 100 labs supported

Through other mechanisms, IAEA sponsors integrated research at a substantial number of institutions and over a considerable range of activities. At an early stage, the research programme came to be heavily oriented towards the needs of developing nations, either by promoting a new application or, more commonly, by adopting available techniques relevant to local problems.

Since then, the Agency's role in supporting research has become not just a catalytic one, but also a co-ordinating one. Limited funds, combined with the international character of the Agency, provide strong impetus for developing research programmes in which groups of institutes work on well-defined themes. To ensure proper co-ordination, chief scientific investigators meet periodically, and the timespan for most programmes is set at about five years.

Additionally, the use of research agreements was introduced to provide for the participation of selected institutes, mostly from developed nations, without financial reimbursement.

Overall, more than US $700 000 are distributed annually in IAEA's Life Sciences programme, with more than 100 laboratories receiving support at any one time.

Fellowships, training courses

In the biomedical field, Agency activities currently account for about 8% of IAEA's overall Technical Co-operation programme, which in general has seen its funding more than triple during the last ten years. Today, the Technical Co-operation programme amounts to about US $27 million.

Projects in life sciences are broad. Young scientists, primarily those from developing countries, have the opportunity under a fellowship programme to undergo specialized training or to do research in more advanced institutes, after nomination by their governments. Many

---

Dr Nofal is Director of the Agency's Division of Life Sciences. His article is adapted from a paper he presented at the Third Asia and Oceania Congress on Nuclear Medicine, 27–31 August 1984, in Seoul, Republic of Korea.

of the early Fellows have been serving in leading positions in their countries for some time, IAEA records show.

Additionally, training courses and study tours are offered – in 1984, there were six in the area of medicine and biology, each for groups of about 30 candidates.

Experts in particular fields also are sent to institutions and laboratories in developing countries for periods of a week to a year or more. They install or introduce equipment and train local staff so that activities can continue after they depart.

Moreover, the Agency provides specialized radiation measurement equipment or related apparatus to particular laboratories, often in conjunction with the work of experts.

Important to note is that all technical co-operation projects are channelled through governments, which submit requests and are responsible for the effective use of resources provided.

Emerging nuclear medicine trends

Based on reports from IAEA participants at the Third Asia and Oceania Congress on Nuclear Medicine, current trends in nuclear medicine show some new possibilities. Attended by 768 participants from 23 countries and held in Seoul, Korea, in August 1984, the Congress featured symposia and scientific presentations from experts on a range of topics.

Among general trends observed for the region:

Clinical nuclear medicine: New technetium-99m radiopharmaceuticals are making studies of the bile system (specifically, hepatobiliary studies) more common and more effective. While cardiology still retains its top position as a most worthwhile and clinically useful area of nuclear medicine, lung seems to be a neglected area. The use of radioactive aerosols for the study of chronic bronchial and early obstructive pulmonary diseases seems to hold possibilities.

Radiopharmaceuticals: Day-to-day nuclear medicine studies increasingly are using thallium-201, gallium-67, iodine-123, and indium-111, with indium turning out to be very useful for labelling monoclonal antibodies in imaging studies. Cyclotrons are becoming a more versatile source of radiopharmaceuticals.

Monoclonal antibodies: While presently there are no true markers for any specific pathological site or type, monoclonal antibodies offer exciting possibilities. The approach could lead to revival of radioisotope therapy, in addition to its well-recognized role in tumour detection.

Radioimmunoassay (RIA): Assays for free hormones, especially for thyroid, are being considered increasingly useful for diagnostic purposes. New areas are being explored regarding tumour markers, and interest is surfacing in RIA for infections and parasitic diseases.

Nuclear imaging: Rotating gamma cameras producing single-photon emission tomography are becoming more and more accepted for many imaging studies, especially of the brain, heart, and liver. Quality control problems are complex, however, and difficulties in this respect are beginning to be recognized. Providing a serious challenge to computer tomography imaging is nuclear magnetic resonance (NMR), which increasingly is looked upon with awe and respect for its capabilities.

Nuclear medicine: 60 countries

Agency activities in nuclear medicine are directed towards effectively applying techniques to the diagnosis and management of patients attending nuclear medicine units in about 60 developing countries. A corollary purpose is to use these techniques in investigations related to control of parasitic diseases distinctive to some of these countries.

Through such efforts, the aim is to improve health standards through better diagnosis, and to achieve a better understanding of disease processes as well as their prevention and management.

One particular project now engaging a group of laboratories is a co-ordinated research programme assessing the efficiency of optimization of nuclear medicine procedures for diagnosis and management of thyroid disorders by the proper selection of both *in vitro* and *in vivo* tests.

Another programme – directed at diagnosis of liver diseases – will start soon with the participation of leading nuclear medicine laboratories and specialists from Asia. In many countries, patients with liver diseases constitute one of the largest groups referred for *in vivo* radionuclide investigations, mostly imaging.

Quality control of nuclear procedures also is an area of interest. Regarding radioimmunoassay procedures of thyroid-related hormones, reference serum samples are distributed to different laboratories for measuring these hormones, and for helping to assess accuracy, reliability, and consistency of the results obtained with these techniques.

For internal quality control of radioimmunoassay, data processing programmes for use with inexpensive programmable calculators are being applied. The objective is to reveal the quality of analytical results and to stimulate improvement through this feedback, without the need for sophisticated computers.

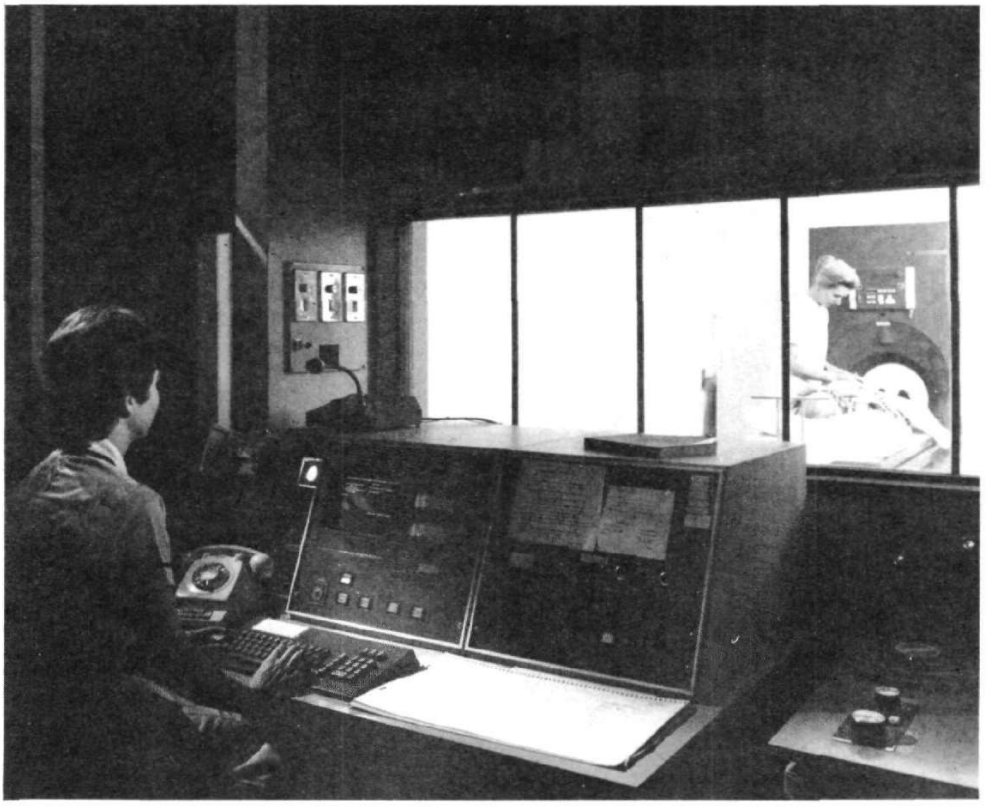
Controlling parasitic infections

The use of nuclear techniques to control parasitic infections of man and of disease vectors enlists several Agency components. These are designed to encourage research into developing new techniques, evaluating existing methods, and promoting expertise among institutes in the developing world.

One component is designed to evaluate immunoradiometric assays using monoclonal antibodies for the detection of circulating parasite antigens in patients with filariasis, schistosomiasis, and malaria.

To monitor malarial vectors, the Agency also is working in the evaluation of immunoradiometric assay for detection of malaria sporozites in mosquitoes. This provides an easy and more rapid alternative to conventional dissection of mosquitoes for determining the disease's transmission rate.

Efforts against schistosomiasis – a disease caused by parasitic worms – involve the development of a vaccine based on antigens present in irradiated larvae.



Nuclear imaging systems, such as this gamma scanning equipment, have become key tools for diagnostic diseases of vital organs, such as liver, kidney, brain, and heart. As the camera tracks the flow and concentration of a short-lived radioisotope injected into the patient, a computer processes the information to help doctors accurately diagnose illnesses. (Credit: UK AEA)

Instrument reliability: problems to overcome

Instrumentation is closely tied with nuclear medicine's development, but often neglected.

In developing countries, the type of instruments suitable for nuclear medicine applications may be rather different from those applied in industrialized nations. To assure that clinical test results are free of errors caused by faulty performance, quality control of these devices is absolutely essential. Problems in instrumentation can lead to incorrect clinical interpretation that results in a wrong diagnosis of the disease.

To address this problem, IAEA has organized a co-ordinated research programme to establish national projects to investigate the performance and reliability of quality control of *in vivo* procedures of nuclear medicine instruments in Asia and Latin America. Each participating country designates a local counterpart to visit nuclear medicine laboratories and set up and correct quality control procedures, including the use of phantoms designed by IAEA and WHO.

In developing countries, maintenance of nuclear instruments presents numerous difficulties. Many factors account for this – environmental conditions, lack of proper servicing, lack of trained local technical staff, shortage of spare parts, as well as administrative and financial problems.

To guarantee reliable results of clinical investigations, and to most effectively use invested capital, the Agency has established a programme covering preventive maintenance, power and air conditioning, and related problems. (See "Experts Wanted" in this issue for a review of professionals currently being sought.)

So far, 45 laboratories in Asia and Latin America have research projects, training courses, and workshops to implement IAEA's maintenance programme. Some courses are designed to train the trainers, who later can conduct their own national workshops.