Growth of Nuclear Medicine in India

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ABSTRACT

The growth of nuclear medicine in India is linked with the developments in our Atomic Energy Programme. Self-sufficiency in radiopharmaceuticals for both in *vivo* and in, vitro use has been largely achieved. The availability of instrumentation facilities in over 90 nuclear medicine centres is indicated. The activities of the Radiation Medicine Centre, a pioneer institute, in the fields of diagnosis, therapy and training of personnel are summarised.

1. INTRODUCTION

Nuclear medicine is concerned with the use of artificially produced radioisotopes for diagnostic, therapeutic and investigative purposes.

In 1938, the first working cyclotron at the University of California had produced small amounts of radioactive phosphorous, iodine 'and sodium. To exploit the characteristics of isotopes in biology and medicine, scientists used the unique properties of radioactive decay. Since the emissions can be detected with great sensitivity and measured with precision, very small quantities can be administered to delineate organs or turnouts, to measure bodily functions or cellular metabolic processes.

2. RADIONUCLIDES AND RADIOPHARMACEUTICALS

Though artificially produced radionuclides have been in use in medicine since the last 30-35 years and nuclear medicine, has progressed by leaps and bounds 'in advanced countries, its development in India is linked and began with the introduction of the Atomic Energy Programme. For an effective and viable nuclear medicine programme, both radioisotopes tagged to suitable compounds. and instruments should be easily available. Self-sufficiency in this area has been achieved to a satisfactory extent in India. This achievement can be credited to the dedicated and committed staff of the Radioisotope Division of the Bhabha Atomic Research Centre (BARC), Bombay. Production and distribution of radioisotopes on a

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commercial scale was undertaken by BARC in 1961. Since 1989, the Board of Radiation and Isotope Technology (BRIT) was constituted to administer the radioisotope production and applications programme of the Department. Over the years the programme has expanded *pari passu* with the growth of nuclear medicine in India. About 50,000 consignments of a variety of radiopharmaceuticals were supplied by BRIT this year to the various nuclear medicine departments in the country. The regional centres set up at Bangalore and Delhi have processed 66 curies (2.44 TBq) of ready to use ^{99m}Tc products for supply to local nuclear medicine centres in the country. All this indicates that nuclear medicine in India has been growing rapidly in the last decade.

2.1 The ^{131}I Age

In the 1960s, nuclear medicine was witnessing the ^{131}I age, and radiopharmaceuticals labelled with relatively long-lived radionuclides were in vogue, for example, ^{131}I-Rose-Bengal, ^{131}I-Hippuran, ^{131}I-Fluorescein, etc., in addition to ^{203}Hg-Neohydrin, ^{198}Au-colloid, $Cr^{32}PO_4$ and many others. Most of these were being prepared and tested in BARC, Bombay. Some of the labelled compounds that merited attention at that time were ^{131}I-Berberine; 5, 5-bis-3-iodophenyl hydantoin; the synthesis and labelling of *N*-4-iodobenzene-sulfonyl-*N*″-propylurea, and 2-(5-hydroxy-2-iodophenyl) ethylamine; and the synthesis of norepinephrine analogs, etc. for testing their scintigraphic potential.

2.2 The ^{113m}In Era

The advent and widespread application of generator-produced, short-lived radionuclides (mainly radiometallics) shifted the focus onto inorganics (Table 1). It

Table 1. The narrow range of ^{113m}In radiopharmaceuticals developed in-house and used in patients referred to RMC

Radiopharmaceuticals	Organ visualised	Period of use
$^{113m}InCl_3$	Bloodpool	1968—1975
^{113m}In-colloid	Reticuloendothelial system	1968—1975
^{113m}In-DTPA	Kidneys/(brain)	1968—1975
$^{113m}InFe(OH)_3$ aggregates	Lungs	1968—1975
^{113m}In-EDTMP	Bone	1976

also resulted in the setting up of hospital-based radio/radionuclearpharmacies in major nuclear medicine departments/centres. Once again, the preparation and formulation of these products reverted back to the radiopharmacies. $^{113m}InCl_3$, ^{113m}In-DTPA, ^{113m}In-colloid and $^{113m}InFe(OH)_3$ aggregates soon followed using in-house developed technology. Prior to the standardisation of each of these products experimental (chemical and biological) work was carried out on Swiss mice.

2.3 The ^{99m}Tc Epoch

If ^{113m}In was short-lived, the ^{113m}In era was even shorter with the emergence of the ^{99}Mo-^{99m}Tc epoch. The indigenous solvent extraction-based process technology for the preparation of $Na^{99m}TcO_4$ from neutron activated low specific activity ^{99}Mo

was available in 1971-72. It came alongwith a disclaimer in the package insert that the onus for the use of the $Na^{99m}TcO_4$ product was solely with the user. This raised many apprehensions in the minds of the radiopharmacists and clinicians. However, following extensive animal studies, very soon the oral produce was subjected to terminal steam sterilisation and itkas available as a parenteral.

Among the several radionuclides in use, ^{99m}Tc is recognised as the most ideal. It can be produced cheaply and in large quantities by means of generators. The generators supplied in India are based on the solvent extraction technique which require considerable skill and manipulation and at times may be difficult to handle in smaller centres. A new concept of 'hospital pharmacy' was introduced, wherein, the ^{99m}Tc and other generator produced radionuclides had to be handled 'in-house' at the site of use. Also, some centres with the expertise and knowledge built over the years were able to prepare their own kits and radiopharmacy. Table 2 shows some of the programmes usually undertaken at the Radiation Medicine Centre (RMC) Hospital Pharmacy Department.

Table 2. The broad spectrum of ^{99m}Tc radiopharmaceuticals developed in-house and formulated and used in patients referred to RMC—a diary of events

Radiopharmaceuticals	Organ visualised	Date introduced
(a) $Na^{99m}TcO_4^-$ (oral)	Thyroid, (brain)	17 August 1971
(b) $Na^{99m}TcO_4^-$ (iv)	Thyroid (brain)	26 April 1972
(c) Na $^{99m}TcO_4^-$ (improved iv)	Thyroid (brain)	17 August 1973
^{99m}Tc-HEDP (iv)	Bone	'27 September 1973
^{99m}Tc-pyrophosphate (iv)	Bone	1 February 1974
^{99m}Tc-phytate (iv)	RES	20 February 1974
^{99m}Tc-sulfur colloid (iv)	RES	25 April 1974
^{99m}Tc-pyridoxylidene glutamate (iv)	Hapatobiliary	28 January 1975
^{99m}Tc-clucoheptonate (iv)	Kidney	20 August 1975
^{99m}Tc-LIDA (iv)	Hepatobiliary	4 October 1975
^{99m}Tc-citrate (iv)	Kidney/(brain)	30 October 1975
^{99m}Tc-MAA (iv)	Lung	15 June 1978
^{99m}Tc-EDTMP (iv)	B o n e	26 July 1978
^{99m}Tc-DTPA (iv)	Kidney/(brain)	23 October 1978
^{99m}Tc-MDP (iv)	Bone	29 October 1979
(a) ^{99m}Tc-Sb_2S_3 colloid (iv)	RES	23 September 1980
(b) ^{99m}Tc-Sb_2S_3 colloid (subcut)	Lymph node	9 October 1980
^{99m}Tc DIPIDA (iv)	Hepatobiliary	5 October 1983
^{99m}Tc iodotrimethida (iv)	Hepatobiliary	30 July 1985
^{99m}Tc bromotrimethida (iv)	Hepatobiliary	

N.B. Some of the above formulations have also been used as aerosol dosage forms. iv= intravenous

3. INSTRUMENTATION

Scintigraphic imaging of the organs forms the main bulk of the investigations done in a nuclear medicine department. Apart from the radiopharmaceuticals, instrumentation is an important component of the study. Imaging of the organs in the early 60s and 70s was performed using rectilinear scanners (both fast and slow). Hard copies obtained were either dot scans or photoscans. For many years the rectilinear scanners were the mainstay in the procedures carried out in the nuclear

medicine centres in India. Even now some of them are still dependent on rectilinear scans. Since the mid-70s, however, improvements in instrumentation have progressed with the development of scintillation gamma cameras. The state-of-the-art machines now have online computers with ever increasing sophistication of software packages offered by manufacturers. Single photon emission tomographic (SPECT) cameras and positron emission tomographic (PET) machines are the more recent developments. In India in 1972, there was only one gamma camera in the country (at RMC), but the latest data show (Table 2) that there are now 56 gamma cameras- and 11 SPECT systems available in the 87 nuclear medicine centres in the'country. Until 5 years ago, there were less than 20 gamma cameras and in the last five years, their number has more than doubled. Table 3 shows the distribution of gamma cameras in the various parts of the country. So it can be seen that the growth of nuclear medicine in India has depended to a large extent on the.development of radiopharmaceuticals and the availability of instrumentation. At this stage it is to be noted that the installation and maintenance of a nuclear medicine department is expensive and, not within reach of

Table 3. Number of gamma cameras in India as on 25th June 1990

S.No.	City	No. of institutions	No. of cameras
1.	Bombay	9	14
2.	Delhi	7	9
3.	Calcutta	4	4
4.	Madras	4	6
5.	Hyderabad	4	4
6.	Lucknow	1	4
7.	Indore	1	1
8.	Cuttack	1	1
9.	Chandigarh	1	1
10.	Trivandrum	1	1
11.	Ahmedabad	1	1
12.	Surat	1	1
13.	Bangalore	1	1
14.	Hubli	1	1
15.	Bhilai	1	1
16.	Srinagar	1	2
17.	Guahati	1	1
18.	Jaipur	1	2
19.	Rajkot	1	1
20:	Ludhiana	1	1
	Total	43	57
Cameras on Order			
	Coimbatore	1	1
	Manipal	1	1
	Pune	1	1
	Calcutta	1	1
	Jamshedpur	1	1
	Madras	1	1
	Delhi	1	1
	Total	7	7

Table 4. Routine procedures which can be carried out in a nuclear medicine department

Organ	Radiopharmaceutical	Dose (mCi)	Route	Conditions	Per week
Static Scans					
Liver	^{99m}TcS-colloid ^{99m}Tc-phytate	3	iv	Abscess, cirrhosis, primary carcinoma and metastasis	30
Lymph node	^{99m}TcS-colloid ^{99m}TcS-colloid	0.75	SC	Primary disease and secondaries	On request
Bone marrow	^{99m}TcS-colloid	6–10	iv	Extent of bone lesion into marrow; myelofibrosis and to localise site for biopsy	-do-
Hepatobiliary	^{99m}Tc-bulida pipida	5'	iv	Obstructive jaundice, CB disease, etc	3-5
Bone	^{99m}Tc-MDP	20	iv	Most often in respect of secondaries, also done in osteomyelitis, osteoid osteoma, AVN, etc	15–18
Brain	$^{99m}TcO_4$ ^{99m}Tc-DTPA	15 20	Oral iv/im	Carebrovascular accident, subduralhaematoma space occupying lesions, secondaries	g-10
Lungs	^{99m}Tc-phytate aerosol ^{99m}Tc-DTPA aerosol ^{99m}Tc-MAA for perfusion	3 10	COPD PTE iv	Pre-operative evaluation in lung surgery	3–5
Kidneys	^{99m}Tc-GHA	10	iv	Renal lesions	2–4
Cardiac	See the last section				7–10
Thyroid	See later sections				40–50
Dynamic ***Studies***					
Cerebra1 blood flow (CBF)	$^{99m}TcO_4$ or any ^{99m}Tc-labelled RP	15-20	iv	Cerebrovascular accident, subdural haematoma, arteriovenous malformation, vascular sols, carotid tumors	4–6
Liver blood flow	^{99m}Tc-phytate ^{99m}Tc-RBC, any ^{99m}Tc-labelled RP	5 15	iv	Hepatoma and vascular tumors	3-4
Delayed blood pool	^{99m}Tc-RBC	15	iv	Hemangiomaof the liver	
Delayed hepatobiliary	^{99m}Tc-BIDA	5	iv	Choledochal cyst	
SVC/IVC grams	Any ^{99m}Tc-labelled RP		iv	SVC/IVC obstruction	3-2
Renograms	^{99m}Tc-DTPA	4	iv	Hypertension, renal artery stenosis; obstructive	4–6

Organ	Radiopharmaceutical	Dose (mCi)	Route	Conditions	Per week
Renograms (with aorotorenal transit time, cortical transit time, peaking time and T1/2 and estimation of GFR and ERPF)	^{131}I-hippuran	0.4 (also with diuretic and captopril challenge)		uropathy, post-operative evaluation, donor and recipient evaluation in transplants	
Micturating cystourethrogram	- do -	- do -		Vesico-ureteric reflux	1
Gastro esophageal reflux	^{99m}Tc-colloid	0.5	as a capsule	PO Symptomatic points, duodenal ulcer, asymptomatic patients	1-2
Gastro intestinal bleeding sites	^{99m}Tc-RBC ^{99m}Tc-colloid	10 5	iv iv	When suspected	On request
Detection of Meckel's diverticulum	$^{99m}TcO_4$	10	iv	- do -	- do -
Three-phase bone scan	^{99m}Tc-MDP	20	iv	Osteomyelitis, osteoid osteoma, cellulitis, etc.	- do -
cardiac *Studies*					
First pass dynamics	Any ^{99m}Tc-RP, preferably ^{99m}Tc-DTPA	25	as a bolus	Cardiac transit times, congenital cardic shunts, cardiac tumors, aneurysms of great vessels	8-10
Blood pool (static)	^{99m}Tc-RBC	15	iv	Cardiac chamber size, pericardial effusion, aneurysms	- do -
Multi gated acquisition (MUGA) (global and regional LVEF, global and regional wall motion stroke volume, ejection fraction and paradox images, peak ejection and filling rates, phase and amplitude images)	^{99m}Tc-RBC (rest, exercise & postnitroglycerine)	25	iv	Left ventricular ejection fraction estimations invarious clinical situations, for example, drug monitoring, valvular lesions, ischeamic heart disease (IHD)	- do -
Mycocardial scintigraphy (LV size, myo/pulm ratios permanent and transient defects)	^{201}Tl ^{99m}Tc-TBI at exercise and at rest		iv iv	Screening in IHD, angina, equivocal stress ECG, stree ECG +ve/pt. asymptomatic, stress ECG −ve/pt. symptomatic, post-myocardial, infarct evaluation, post-coronary angiography , pre- and post-CABG, pre- and post-angioplasty, cardiomyopathy (ischemic)	- do -

im = intramuscular; iv = intravenous; RP = radiopharmaceutical

many medical colleges and university departments. Many private hospitals and research centres in large cities have taken the initiative of establishing well-equipped nuclear medicine centres. The Jaslok Hospital in Bombay was the first of its kind in India to establish this facility in a private hospital, There has, of late, been a spurt of such centres now all over the country. At present, there are 14 departments in the so-called private sector.

Table 4 shows some of the more common procedures carried out in a nuclear medicine department.

Although there are several SPECT systems available in the country, its full potential is still not realised, especially in the study of the central nervous system, since the new radiopharmaceuticals useful in such studies are not available in India as yet and the commercial products are prohibitively expensive and hence cannot be used on a large scale and day-to-day basis. At present, there are no PET systems in the country but hopefully in the near future, one or two centres in the country would be fortunate enough to install this'instrument. Another great lacuna in our programmes is the non-availability of monoclonal antibodies for radioimmunoscintigraphy which has been a considerable setback in our efforts to keep pace with progress.

4. RADIOIMMUNOASSAYS AND *IN* VITRO NUCLEAR MEDICINE

Although the word nuclear medicine often conjures images of gamma cameras, SPECT and PET machines and organ scanning, one of the most useful and widespread applications in the use of radioisotopes is the technique of radioimmunoassays (RIAs). Since the early reports of development of RIAs in USA, India has been a keen and ardent advocate of this aspect of nuclear medicine. Since 1968, RIA procedures were developed at RMC. For many years, the use of the technique was limited to a few centres in the country who had the expertise and need to develop the assays in their laboratories. However, in the late' 1970s and early 1980s, the Radioisotope Group of BARC had considered commercialisation of RIA kits. Several assay kits are now available, as shown in Table 5. Short training courses on RIA methods have been conducted at BARC since the last S-10 years. The easy availability of the kits and the training programmes have given a boost to many scientists and technologists in the country. From a single laboratory doing RIAs in the early 1970s, at present, there are over 500 laboratories doing RIA using locally manufactured and imported kits. It has in fact-become a 'get rich quick' enterprise.

4.1 Biomedical Research

Radionuclides as tracers play an important role in various aspects of biomedical research. As these research projects are often individualistic and special to each laboratory, any efforts to enumerate or describe such applications would often be futile.

4.2 Tracer Kinetics,

Thyroid uptake studies form one of the most important applications of tracer kinetics using $N^{131}I$ The first thyroid uptake measurements were done in 1960 by Dr. R.S.Satosker at the KEM Hospital, Bombay. Later the standardisation and uptake measurements were established at RMC. Even today almost all the 87 centres in the

Table 5. *In* vitro products and kits

Description	Code
Angiotensin I kit	RIAK 6
Angiotensin I standard	RIS 5
Antiangiotensin I serum	RAS 5
Anti HCG serum	RAS 6
Anti HPL serum	RAS 2
Anti insulin serum	RAS 1
Anti T_3 serum	RAS 3
Anti-Thyroxine serum	RAS 4
Digoxin kit	RIAK 8
HCG kit	RIAK 7
HCG standard	RIS 6
HPL kit	RIAK 2, RIAK 2A
HPL standard	RIS 2
Iodinated (I 125) HCG solution	IOM 56
Iodinated (I 125) HPL solution	IOM 55
Iodinated (I 125) insulin solution	IOM 20
Insulin kit	RIAK 1, RIAK 1A
Insulin standard	RIS 1
L-Thyroxine T_4 standard	RIS 4
Radioassay kit for vitamin B_{12}	RAK 1
Triiodothyronine T_3 kit	RIAK 4, RIAK 4A
Triiodothyronine T_3 standard	RIS 3
Thyroxine T_4 kit	RIAK 5 RIAK 5A

country have a thyroid uptake system and this forms the major work of the departmeuts. A variety of other tracer kinetics for compartmental analysis, and biochemical studies are done at centres with specific projects pertaining to such studies.

5. THERAPEUTIC APPLICATIONS

Unfortunately therapy in nuclear medicine has a very limited and selective role to play. The two isotopes commonly used for therapy are ^{131}I as $Na^{131}I$ in the treatment of thyrotoxicosis and thyroid cancer and ^{32}PNa orthophosphate for the treatment of polycythaemia vera. As early as 1958 Dr Mazumdar had pioneered the use of radioiodine for thyroid diseases and cardiac diseases in India. RMC was the only centre offering all these modalities of therapy for several years. Although ^{131}I for treatment of thyrotoxicosis has been instituted in many centres all over the country, at present only three centres in India offer ^{131}I therapy for thyroid cancer and perhaps 3 or 4 centres use ^{32}P for treatment of polycythaemia vera. Figures 1 and 2 show the use of radionuclides for therapy at RMC over the past 25 years.

6. TRAINING PROGRAMMES

Since its inception in 1963, Radiation Medicine Centre has laid considerable emphasis on the training aspects of nuclear medicine. As a pioneer institute, it has

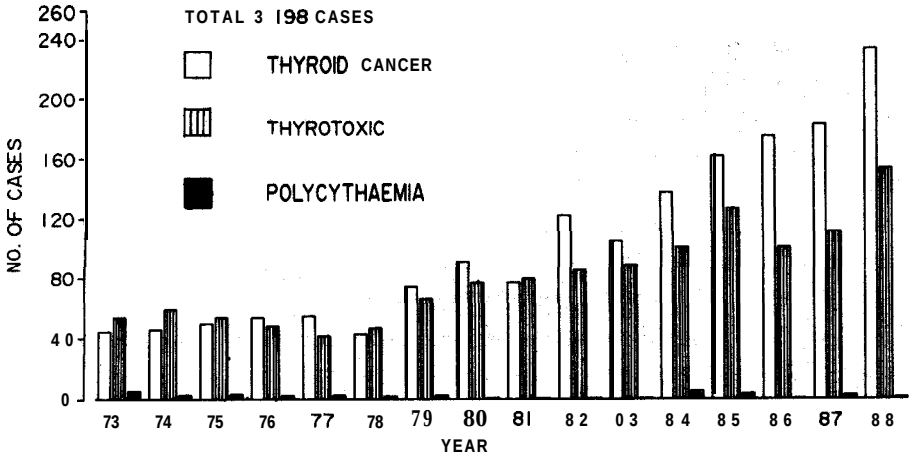

Figure 1. **Number of cases** treated with **radionuclides** at **RMC during 1973-88.**

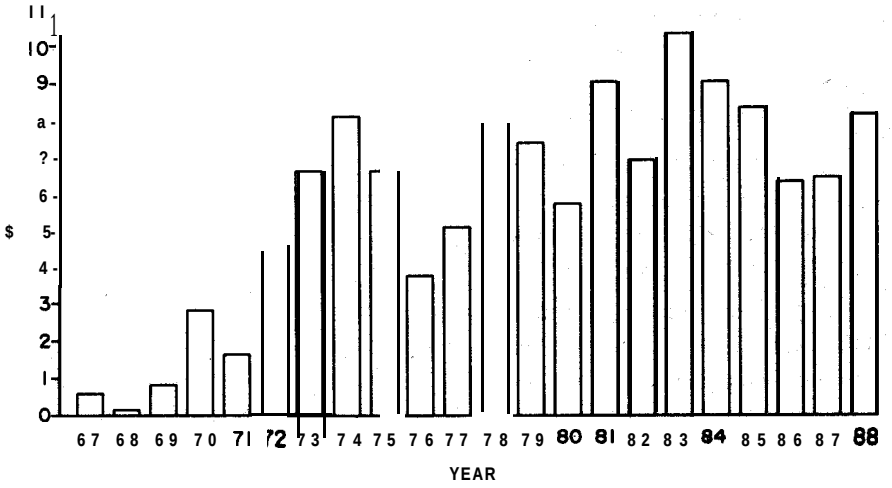

Figure 2.

been our endavour to impart knowledge of nuclear medicine to **medical and** paramedical personnel so as to enable them to practice nuclear medicine in their respective Institutes.

The prime objective of a training programme in a nuclear medicine is to make the trainees proficient in medical radioisotopic techniques. Adequate knowledge of the elements of nuclear physics, instrumentation, mathematics, statistics, radiation biology, radiation protection, biochemistry, anatomy and physiology are essential for a safe and effective practice of nuclear medicine.

6.1 Short-TermTraining Course (1965–1977)

The first introductory course of five weeks duration on medical use of radioisotopes, was held in 1965. The course was conducted annually until1 1977. A total of 162 (130 medical and 32 paramedical) personnel'were trained over the period

of 12 years. The participants came from 18 states within the country and one each from Burma and the Philippines. In a recent review, it was observed that only 47 per cent (i.e., 76 out of 162) of the total number of trainees who attended the short course are actively involved in practicing nuclear medicine. The purpose of the training was to acquaint the clinicians in the country with the scope and the utility of nuclear medicine.

With the advent of ^{99m}Tc and gamma cameras; and with the associated phenomenal increase in the number of radioisotopic investigations, it became apparent that the five week introductory courses were totally inadequate.

Bombay University introduced a one year diploma course-Diploma in Radiation Medicine (DRM)-for doctors and a one year diploma course-Diploma in Medical Radioisotope Techniques (DMRIT)—for science graduates in 1973.

6.2 One Year Post-Graduate Training Programme (1973-1988)

A full time formal training programme spread over one academic year was started. at the Radiation Medicine Centre in 1973 for medical and science graduates, Selection of trainees for DRM and DMRIT courses is on all India basis and the selected students are awarded fellowship by the Department of Atomic Energy during the course of study. In addition, sponsored candidates from the various institutions of the country as well as other countries are also trained.

On an average there are two lectures daily and the rest of the working hours are devoted to the experiments, demonstrations, special clinics, scan sessions and apprentice programme where there is a rotation through various sections of the centre.

Most lectures, demonstrations and experiments are common for DRM and DMRIT trainees, It is only with respect to practical and apprentice training that the programmes are different. While technologists spend more time with procedures, the doctors spend more time with patients in the clinics. In addition, a series of lectures are given to DMRIT students on human anatomy and physiology.

DRM/DMRIT training programme comprises the following :

Lectures	210
Experiments	30
Demonstration .	5
Scan sessions (1 hour each)	30
Special clinics (1 hour each)	30
Audiovisual programmes, including films	13
Apprenticeship programmes, 2 week rotation	10 areas
Quiz sessions	10
Student's symposia	2
Dissertation on a special topic.	

During the period of 1973-1988, 95 medical personnel were trained for DRM and 87 obtained their diplomas, while 82 science graduates underwent DMRIT programme of which 74 obtained the diploma. Out of the 171 persons trained, one medical graduate and three technologists were from other nations. In addition, five trainees from other countries also underwent training for a period of one year without taking the examination.

7. CONCLUSION

For the healthy growth of any discipline, a continuous endeavour to develop new techniques and to test out old methods in more varied applications and aspects is not only a necessity but 'the very breath of life and survival. Lack of such outlooks would lead to stagnation and death. The greater the competition among the various institutes in the country, the better are the prospects for the programme of nuclear medicine in our country. The discipline of nuclear medicine is a happy meeting ground for physicians, physicists, biologists and chemists. With such a wide ranging interest of multidisciplines, there can be no dearth of skill, expertise and intelligence and progress can be rapid and **far reaching.**

Guest Editor's Note on the Society of Nuclear Medicine, India

As a continuation of Dr. Samuel's account of the growth of nuclear medicine in India, a short account of the Society of Nuclear Medicine, India, is given in the following paragraphs.

Early in 1966, Dr. R. S. Satoskar, Head, Radioisotope Lab., KEM Hospital, Bombay, convened a meeting of workers in the field of nuclear medicine. It was then decided that a society should be formed and that its membership should be open to all medical and non-medical persons who are concerned with the use of radioisotopes for medical purposes. Consequently, the Society of Nuclear Medicine (SNM) was formed and a formal constitution was adopted in 1967 and the Society was registered. The aims and objectives of the Society are :

(i) To promote, encourage and help the development and advancement of nuclear medicine as a speciality;

(ii) To encourage research work in the field;

(iii) To provide a meeting ground for scientists actively associated with the use of radioisotopes in medical sciences; and

(iv) To take all steps to develop better understanding and to promote the application of radioisotopes among the medical profession in India.

Dr. Vikram Sarabhai (Chairman, AEC), Shri H. N. Sethna (Director, BARC) and Dr. A. R. Gopal-Ayengar (Director, Biomedical Group, BARC) agreed to be patrons. Dr. K. Sundaram was the first President and served for two terms (1969 and 1970). Brig. Mazumdar was the. second President and also served for two terms (1971 and 1972).

The Society has a membership, at present of, about 330 (including about 20 foreign members). It started publishing a 4-page *Newsletter* in 1973. Till 1986, ten volumes (each with 4-6 issues) were brought out with reasonable regularity. The *Newsletter* ceased publication in 1986 when the *Indian Journal of* Nuclear *Medicine* was started as an official publication of SNM, largely through the initiative of Maj. Gen. B. N. Lakshmipathi. Four issues are brought out per year.

SNM organises three memorial orations every year which are delivered at the time of the annual meeting of the Society, in honour of Homi Bhabha, Vikram Sarabhai and Brig. Mazumdar.

The Indo-American Society of Nuclear Medicine was formed in 1984 and works in close liaison with SNM, India. The membership of the Indo-American Society consists of Indians working in USA in nuclear

medicine (roughly half the-total. membership) as: well as American experts in nuclear medicine. A few Indian and American menibers of the Society regularly attend the annual meetings of SNM, India, and this interaction has been very valuable.

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