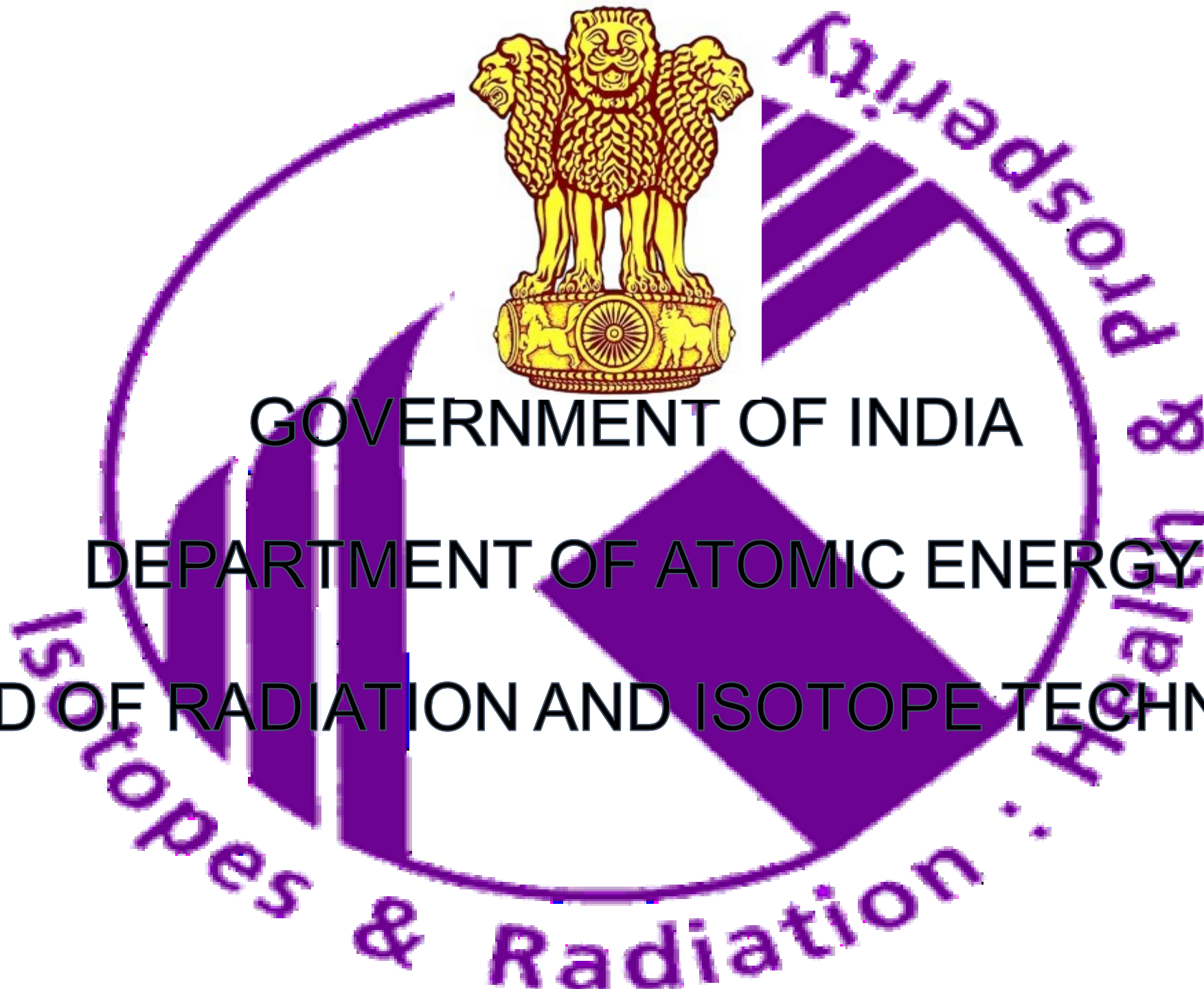




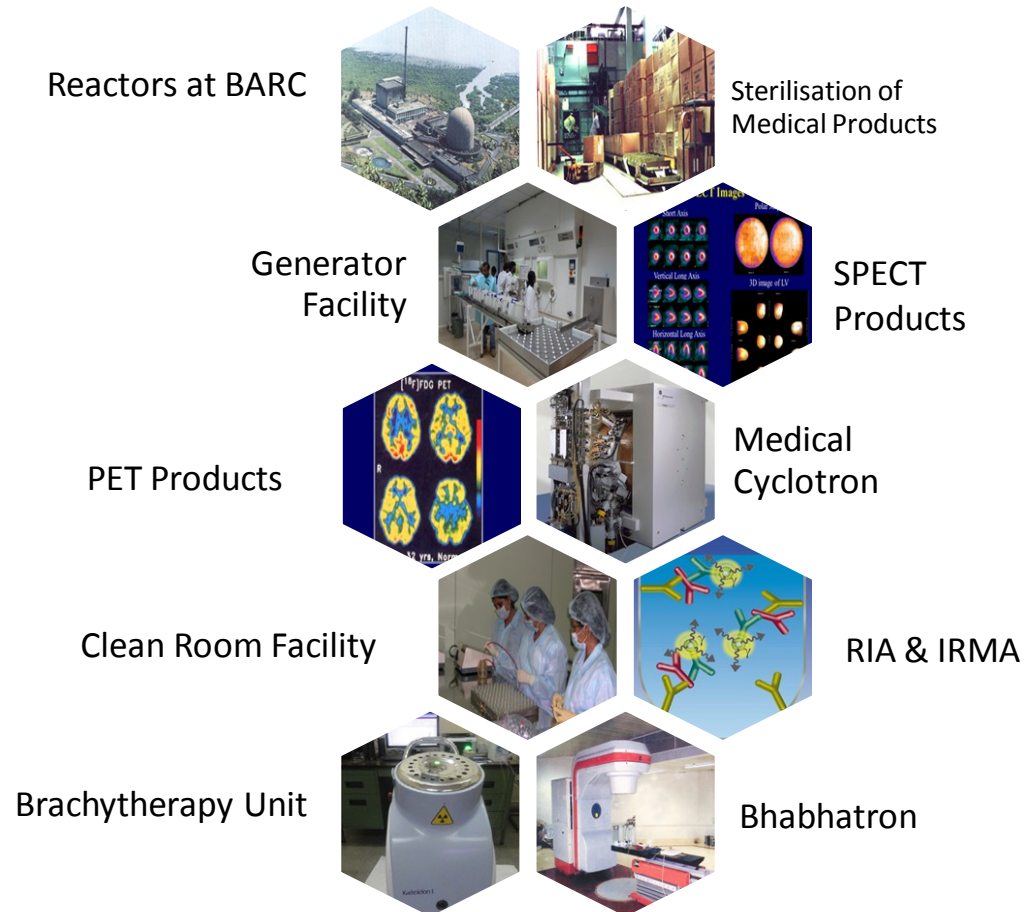
GOVERNMENT OF INDIA

DEPARTMENT OF ATOMIC ENERGY

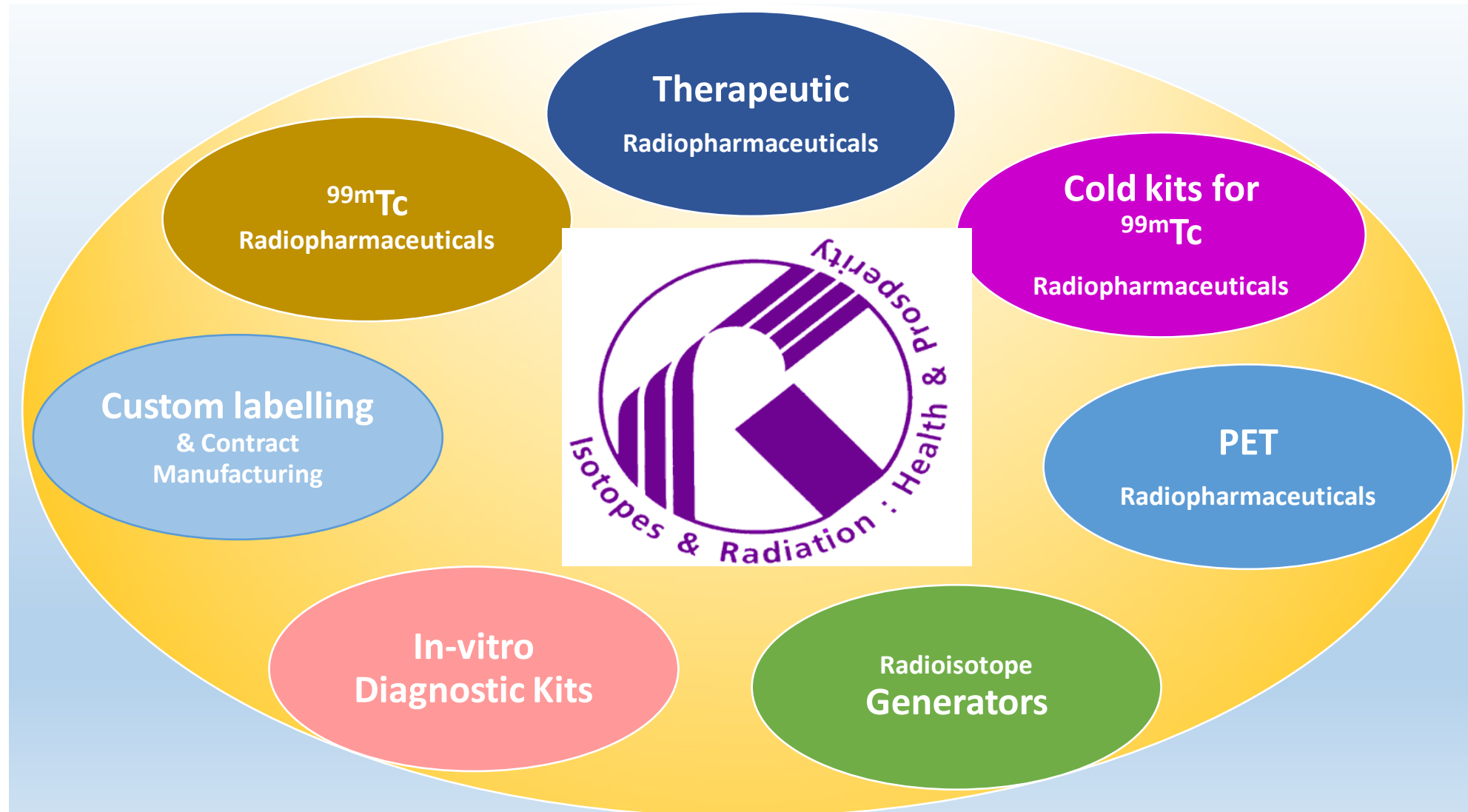
BOARD OF RADIATION AND ISOTOPE TECHNOLOGY



BRIT – USE OF RADIOISOTOPES AND RADIATION TECHNOLOGY FOR HEALTH AND PROSPERITY OF NATION

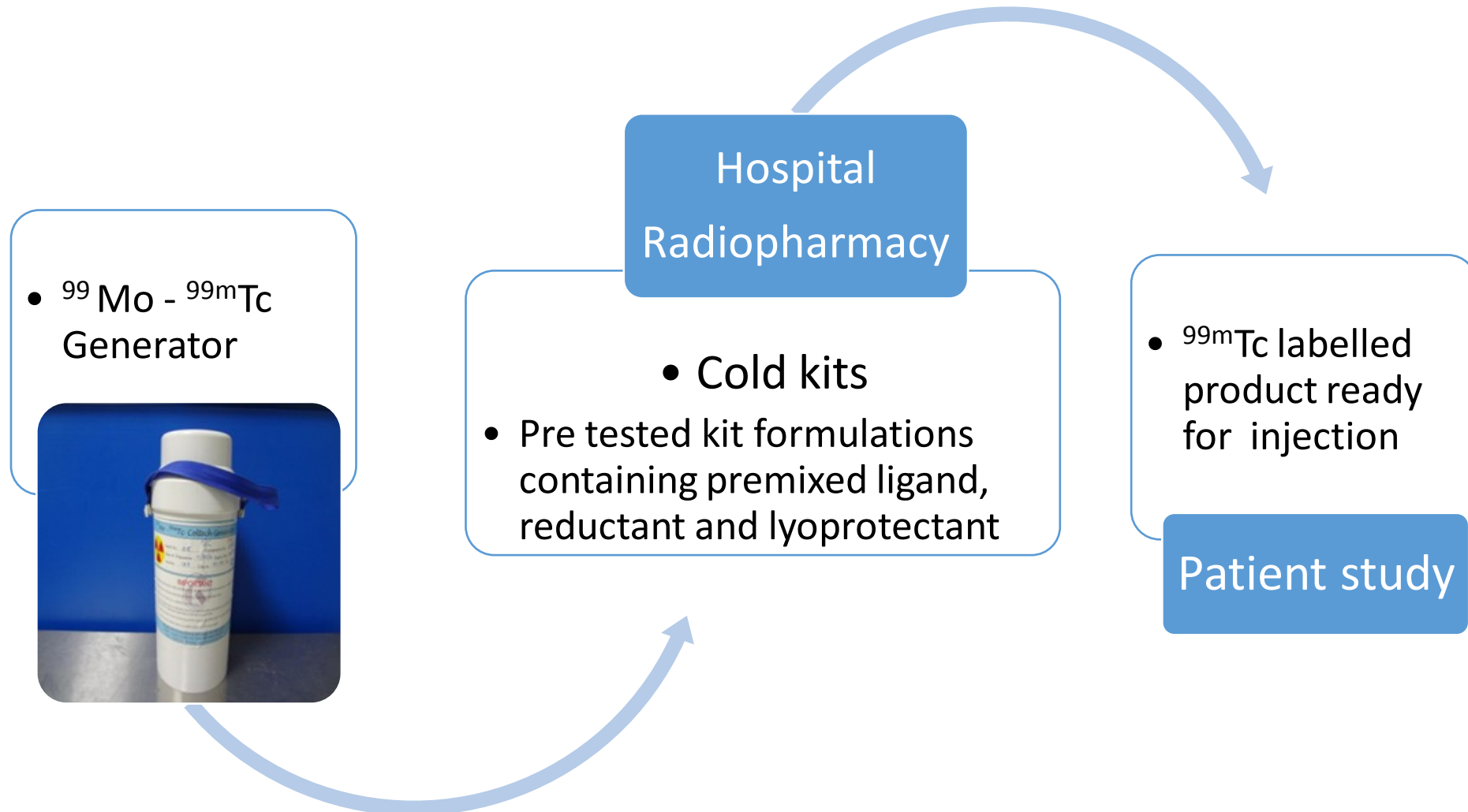


Radiopharmaceuticals

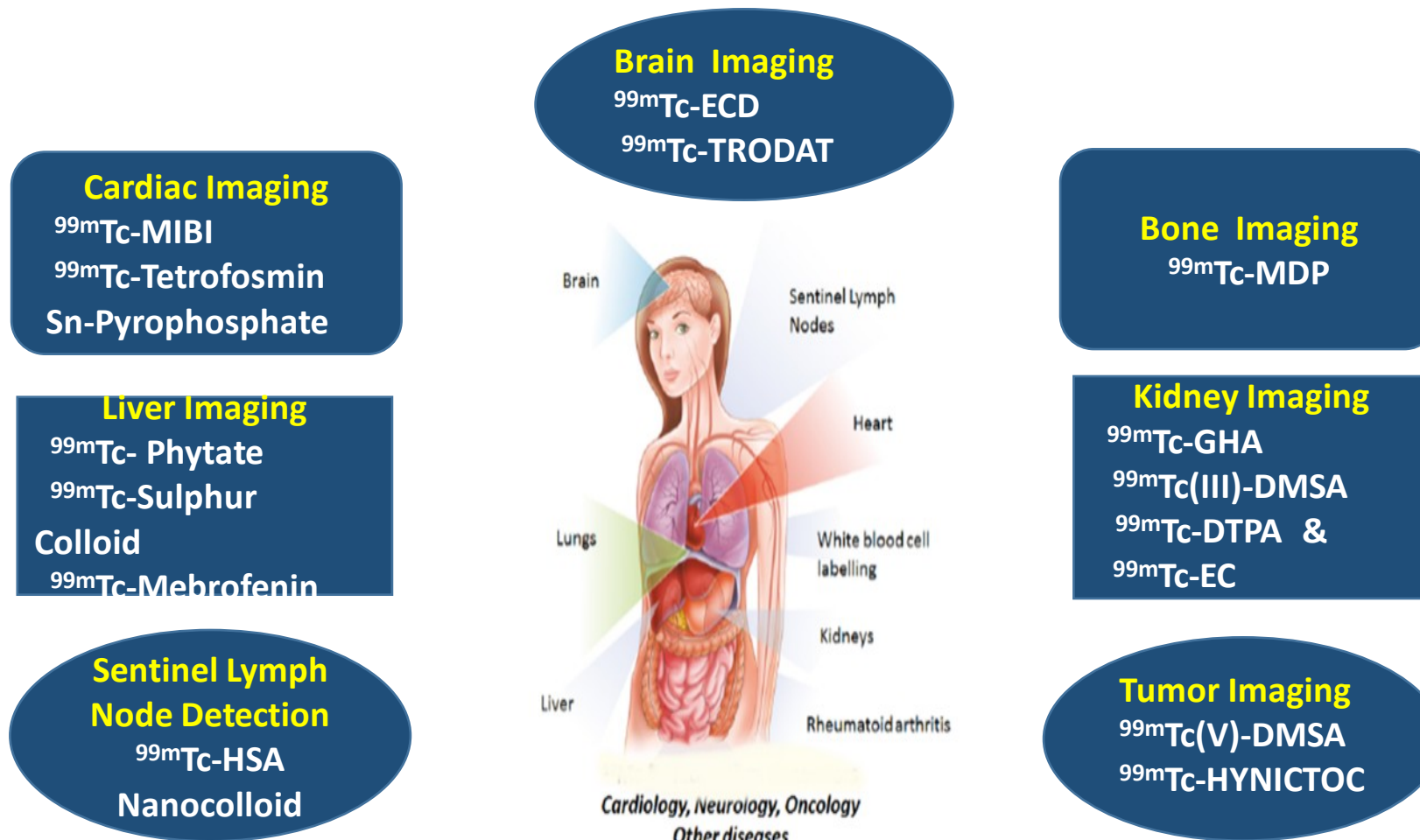


^{99m}Tc Radiopharmaceuticals

Diagnostic Nuclear Medicine field has been dominated by ^{99m}Tc [Technetium]



Kits for preparation of ^{99m}Tc Radiopharmaceuticals

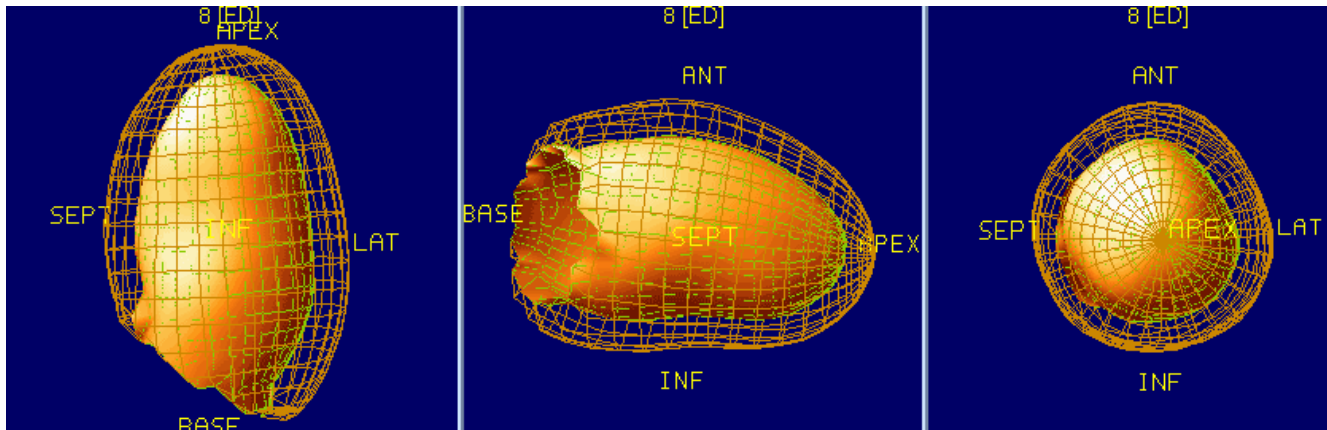


*Ready to use ^{99m}Tc Radiopharmaceuticals are available from Regional Centres of BRIT at Bangalore and Delhi under the product code TCM
 To be introduced shortly from RC Hyderabad & RMC, Mumbai*



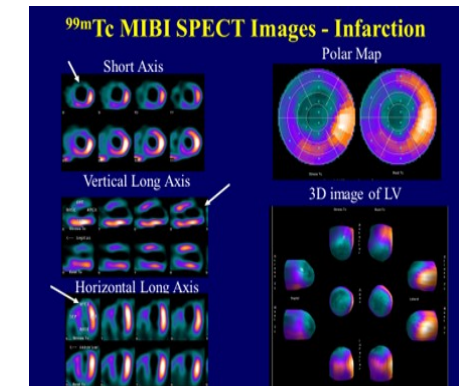
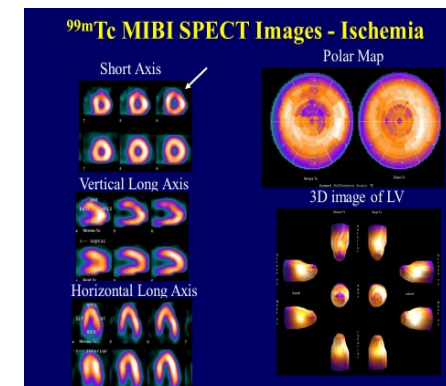
Kit for ^{99m}Tc -MIBI

Myocardial Perfusion Imaging Agent



- ❖ Evaluation of cardiac function wall motion using gated SPECT
- ❖ Tumour imaging especially in case of breast cancer and parathyroid

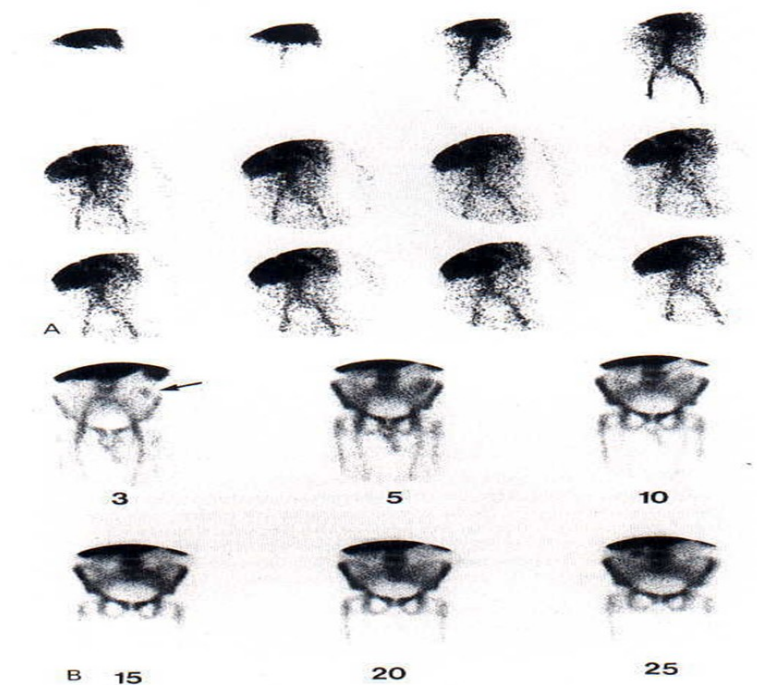
- ❖ Distinguishing poorly perfused myocardial segments
- ❖ Localising abnormality in suspected myocardial infarction



Kit for Sn-Pyrophosphate Injection

(For In-vivo labelling of RBC with ^{99m}Tc)

Blood Pool Imaging Agent



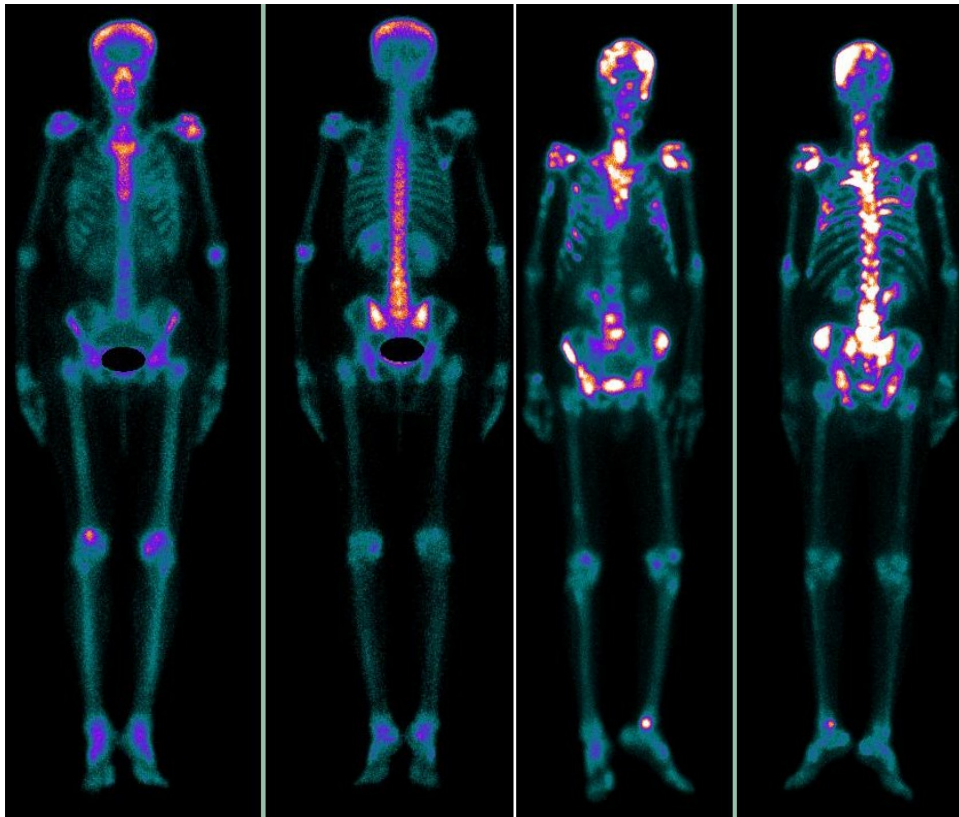
^{99m}Tc RBC Blood Pool Scan

To differentiate hemangioma of liver from hepatoma and evaluation of GI bleeding

- Cardiology – MUGA studies
- Detection of internal bleeding site

Kit for ^{99m}Tc MDP Injection

Skeletal Imaging Agent



Normal

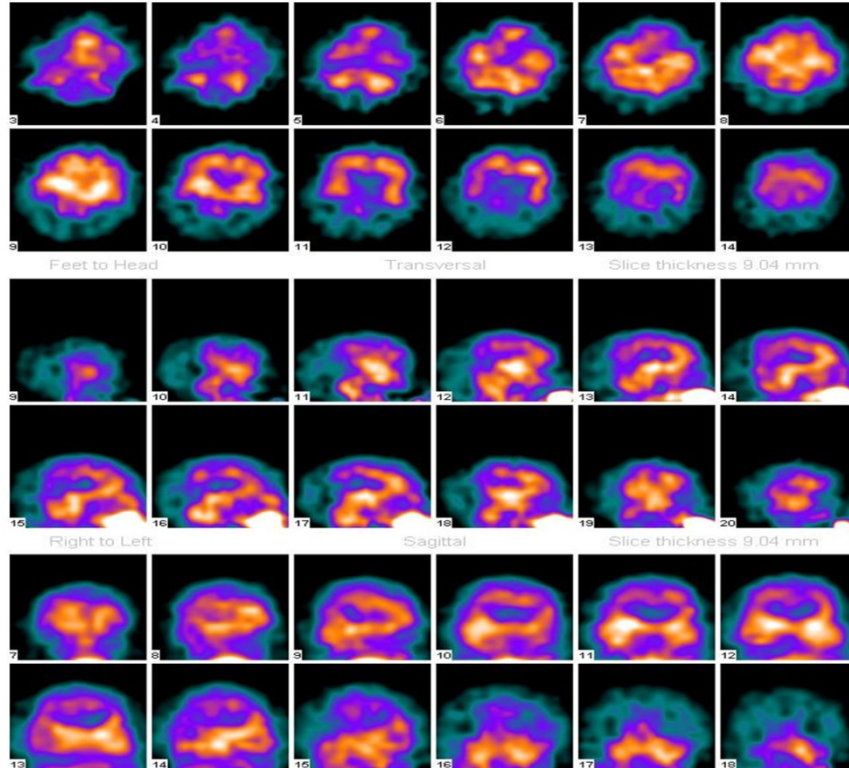
Multiple metastases

^{99m}Tc MDP Bone Scan

- ✓ Evaluation of the early involvement of bone metastases from primary malignancies
- ✓ In staging primary malignancy
- ✓ Detection and evaluation of infective bone diseases, avascular necrosis
- ✓ Diagnosis of metabolic diseases of skeletal system
- ✓ For localisation of Paget's disease

Kit for ^{99m}Tc -ECD

Brain Perfusion Imaging Agents



Brain imaging using ^{99m}Tc -ECD

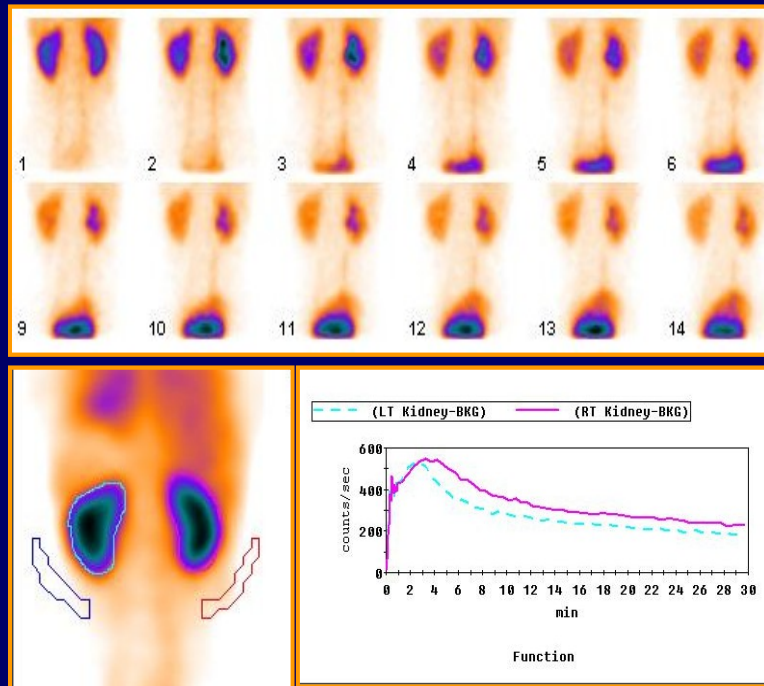
- Assessment of regional cerebral blood flow
- Mapping of regional cerebral perfusion
- Estimation of functional cerebral mass
- Useful in the study of ischemic attack, stroke, epilepsy, dementia, migraine etc.

Kit for ^{99m}Tc – DTPA Injection

Renal Dynamic Functional Imaging Agent

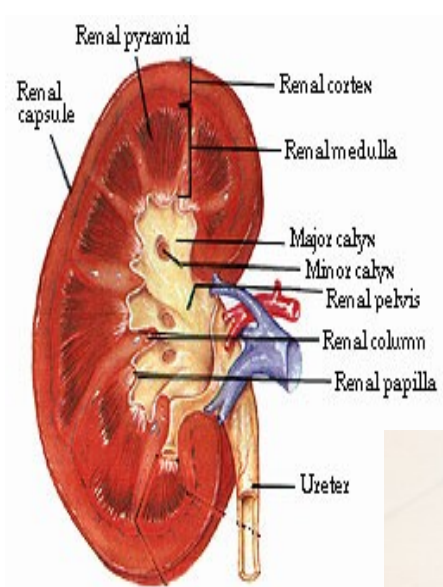


Sequential Images & Renogram



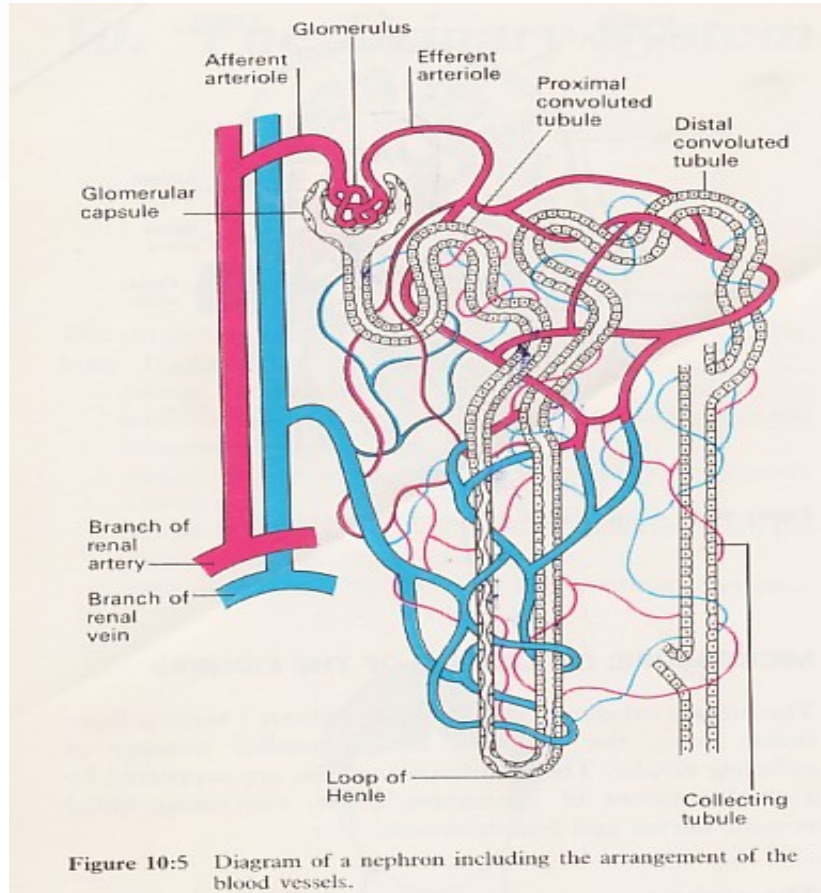
^{99m}Tc - DTPA images

- ✓ Evaluation of renal function
- ✓ Estimation of glomerular filtration rate(GFR)
- ✓ Functional assessment in post renal transplant
- ✓ Delineation of intracranial lesions, altered blood brain barrier



Kit for ^{99m}Tc -EC

Renal Tubular Functional Imaging Agent



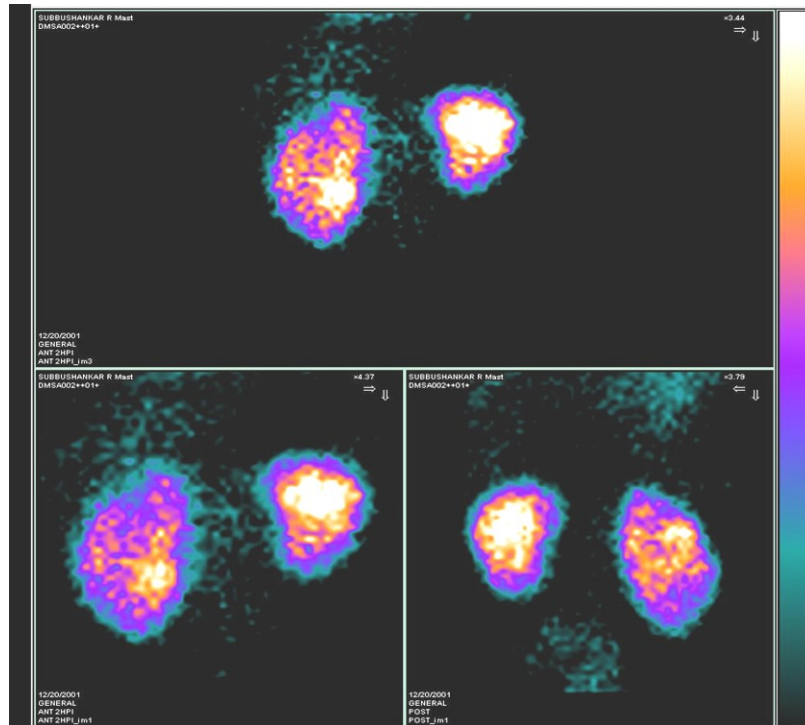
- Preferred use in poorly functioning kidneys & in infants
- Estimation of renal transplant in terms of perfusion, secretion and excretion - aids in predicting early rejection of transplanted kidneys
- Assessment of surgical graft during perfusion phase
- Follow up for functional assessment of renal transplant

Kit for $^{99m}\text{Tc}(\text{III})\text{-DMSA}$ & $^{99m}\text{Tc}\text{-GHA}$

Renal Static Imaging Agents



^{99m}Tc DMSA- Renal Cortical Image

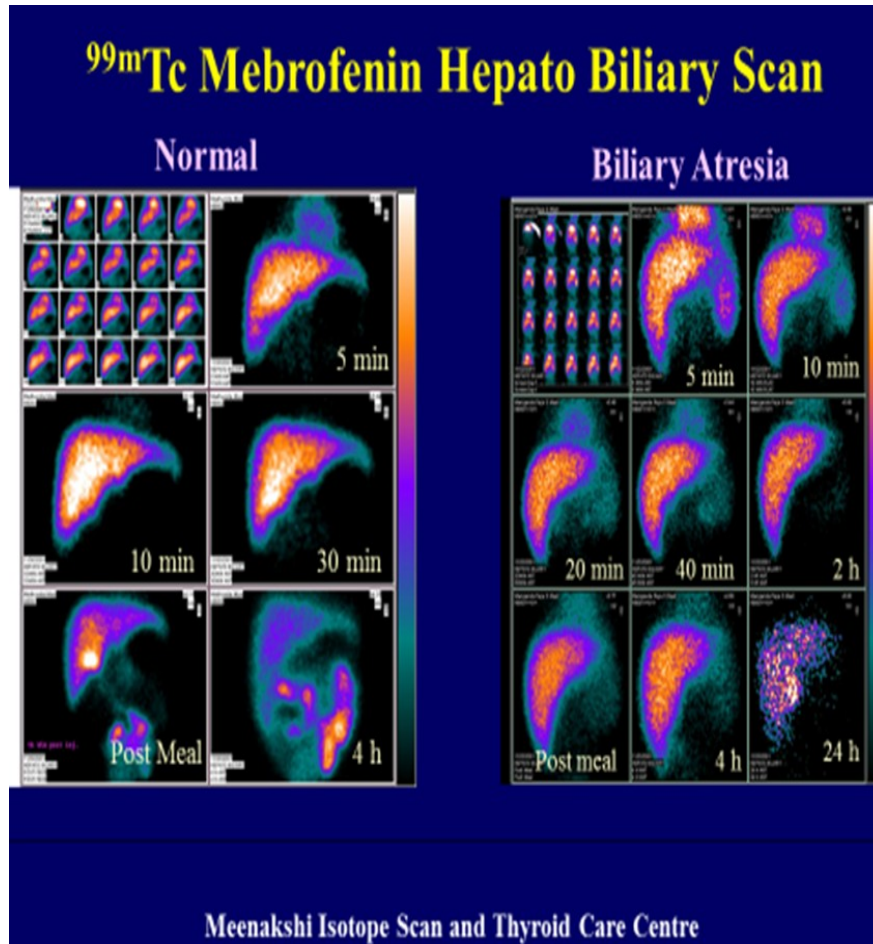


Contracted left kidney, Scars over both poles of the
Right Kidney

- ✓ Assessment of size, shape, location and relative cortical mass of individual kidneys
- ✓ Delineation of renal cortical scarring in children with vasico ureteric reflex
- ✓ Quantitative estimation of relative function of left and right kidneys

Kit for ^{99m}Tc -Mebrofenin

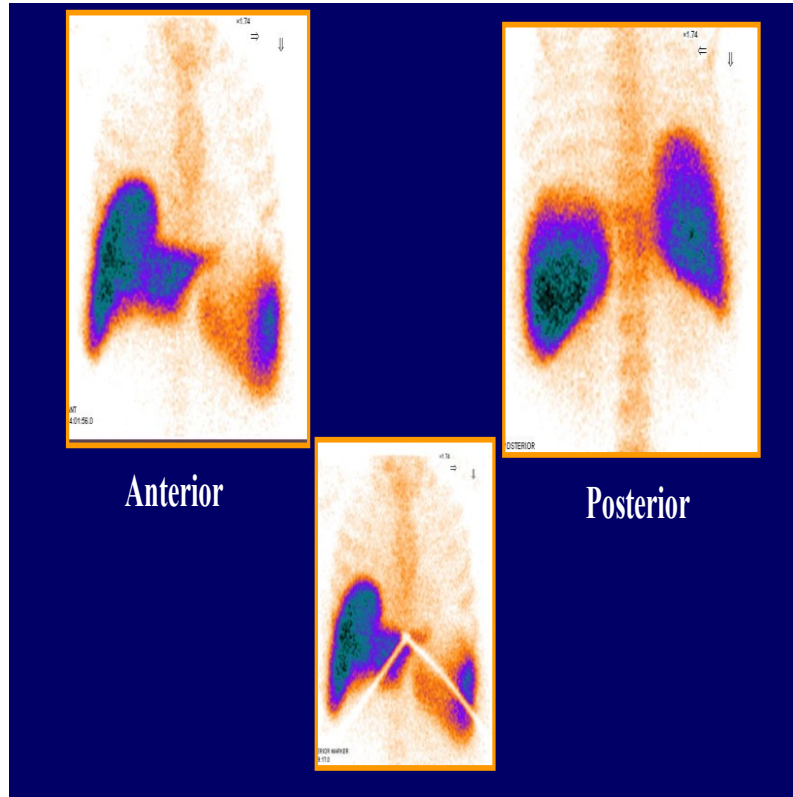
Hepatobiliary Functional Imaging Agent



- ✓ Assessment of hepatobiliary patency
- ✓ Evaluation of intra as well as extra hepatic biliary obstruction
- ✓ Diagnosis of acute cholecystitis
- ✓ Diagnosis of biliary atresia in children with neonatal jaundice
- ✓ In conjunction with cholecystokinin the contractibility of gall bladder is estimated quantitatively

Kit for ^{99m}Tc -Sulphur Colloid & ^{99m}Tc - Phytate

Liver Imaging Agents



A case of cirrhosis showing increased splenic uptake

Liver & Spleen Scan (RES)

➤ ^{99m}Tc -Sulphur Colloid

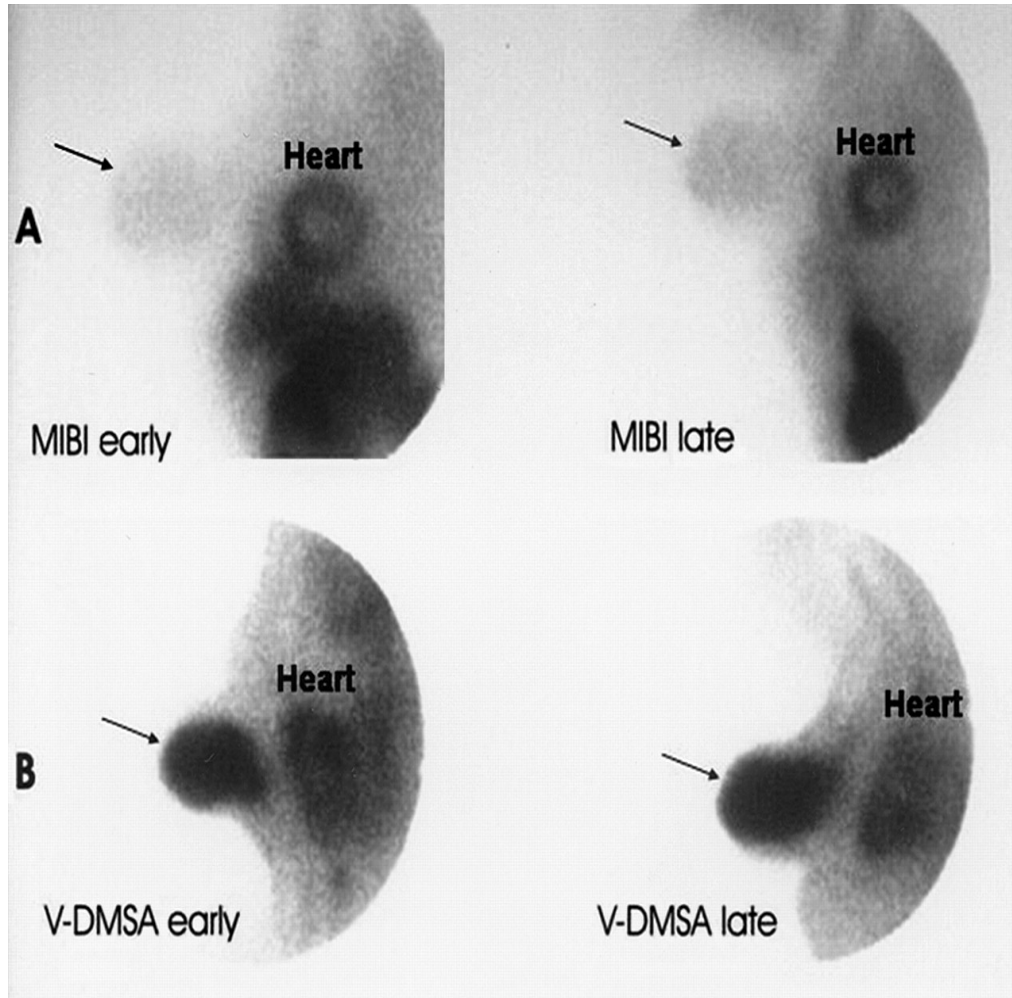
- ✓ Evaluation of functional morphology of reticulo endothelial system
- ✓ Quantitative assessment of parenchymal liver disease
- ✓ Delineation of space occupying lesions in liver
- ✓ Differentiating fatty infiltration in liver in conjunction with sonography

➤ ^{99m}Tc - Phytate

- ✓ Evaluation of functional morphology of liver

Kit for ^{99m}Tc (V) DMSA

Tumour Imaging Agent

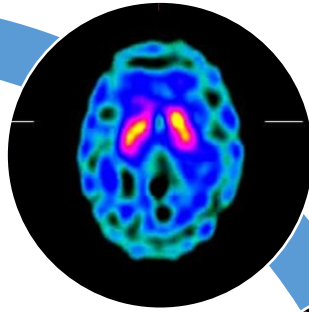


^{99m}Tc -MIBI and ^{99m}Tc (V)-DMSA Breast Tumour

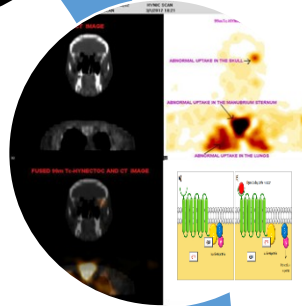
- A tumour imaging agent, primarily in cases of medullary carcinoma of thyroid
- Shows avid concentration in solitary nodule of thyroid in patients with high calcium and calcitonin levels
- Delineate metastases in lymph nodes in medullary carcinoma of thyroid post surgery



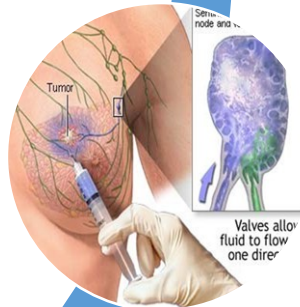
NEW
PRODUCTS
LAUNCHED



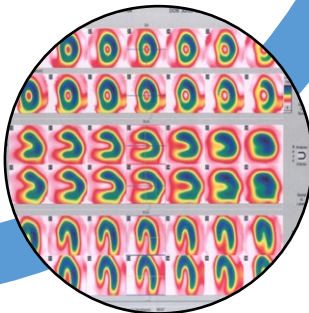
Kit for
 ^{99m}Tc -TRODAT



Kit for
 ^{99m}Tc - HYNIC-TOC



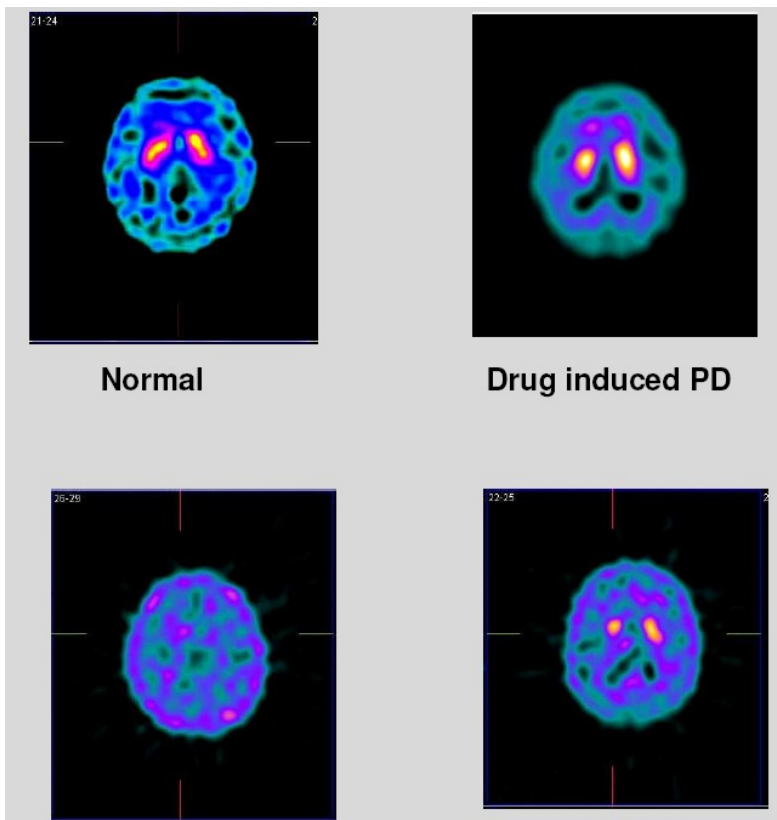
Kit for
 ^{99m}Tc -HSA Nanocolloid



Kit for
 ^{99m}Tc -Tetrofosmin



Kit for ^{99m}Tc -TRODAT



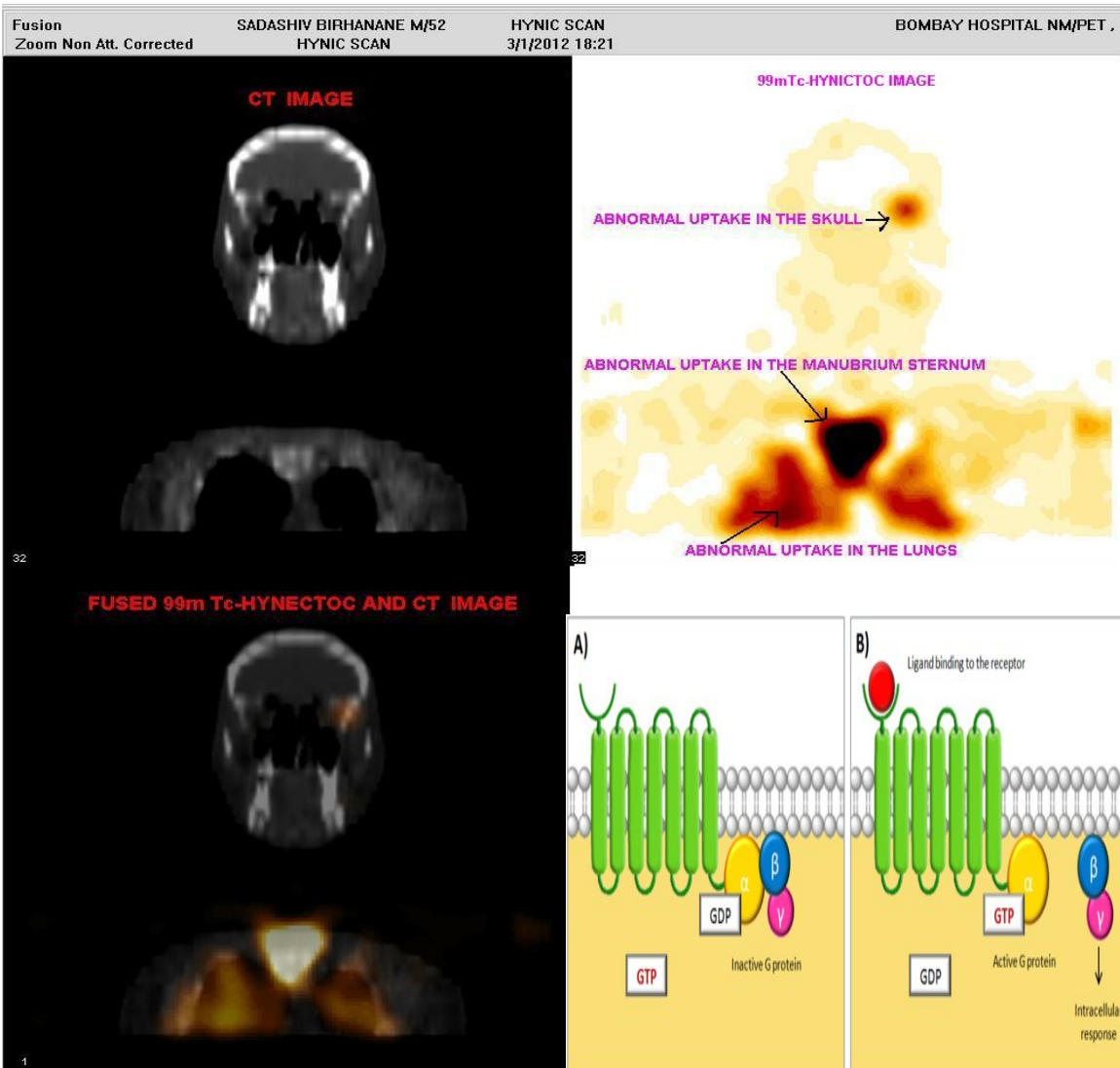
Parkinson's Disease

^{99m}Tc -TRODAT SPECT Images of Brain

- ☐ Receptor specific imaging agent for studying the central nervous system
- ☐ Dopamine transporter imaging in patients suffering from neuro-degenerative diseases like Parkinson's disease
- ☐ Evaluating the brain function in normal and disease states

NEW

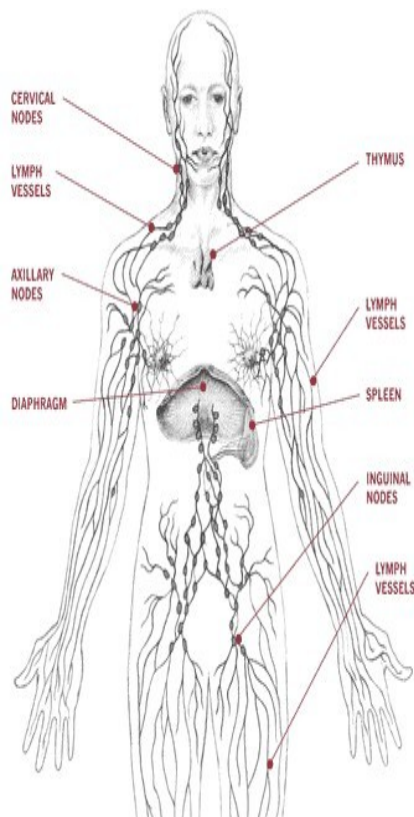
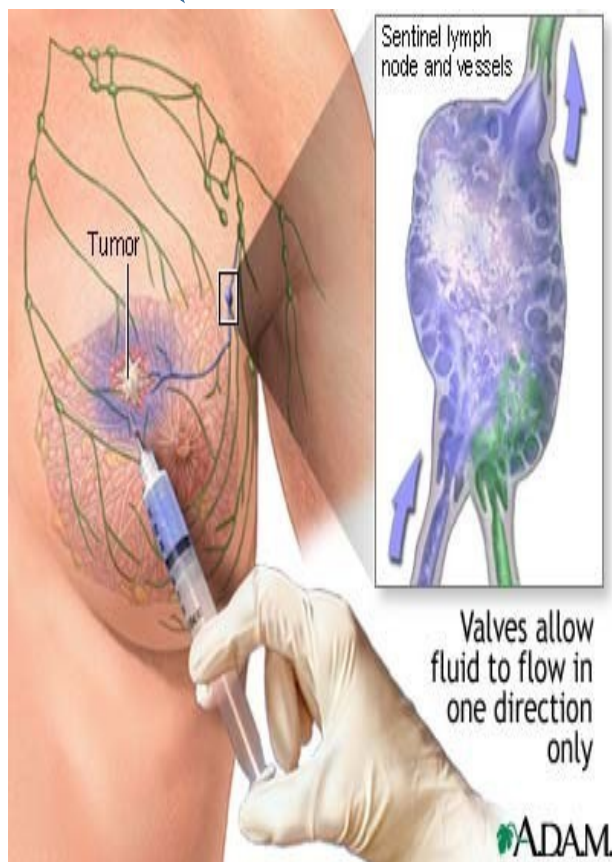
Kit for ^{99m}Tc HYNIC-TOC



- Evaluation of neuro endocrine tumours (adrenal pheochromocytoma)
- Valuable tool for the diagnostic imaging of somatostatin expressing tumours
- Somatostatin receptors are overexpressed in Medullary carcinoma of thyroid
- Useful imaging agent in the follow up of patients with Medullary carcinoma of thyroid
- Evaluation of active Graves Ophthalmopathy

NEW

Kit for ^{99m}Tc -HSA Nanocolloid



For Sentinel Lymph Node (SLND) Detection

- Sentinel Lymph Nodes (SLNs): are the first nodes receiving lymphatic drainage from tumour region. Especially important in cancers of breast, skin, GI tract, head & neck etc.
- Absence of tumour cells in the SLN indicates low likelihood of further tumour spread
- Identification and selective removal of SLNs from the region of primary tumour reduces side-effects to patient
- Also reduces sample load for biopsy, allowing for more sophisticated analysis and accurate prognosis

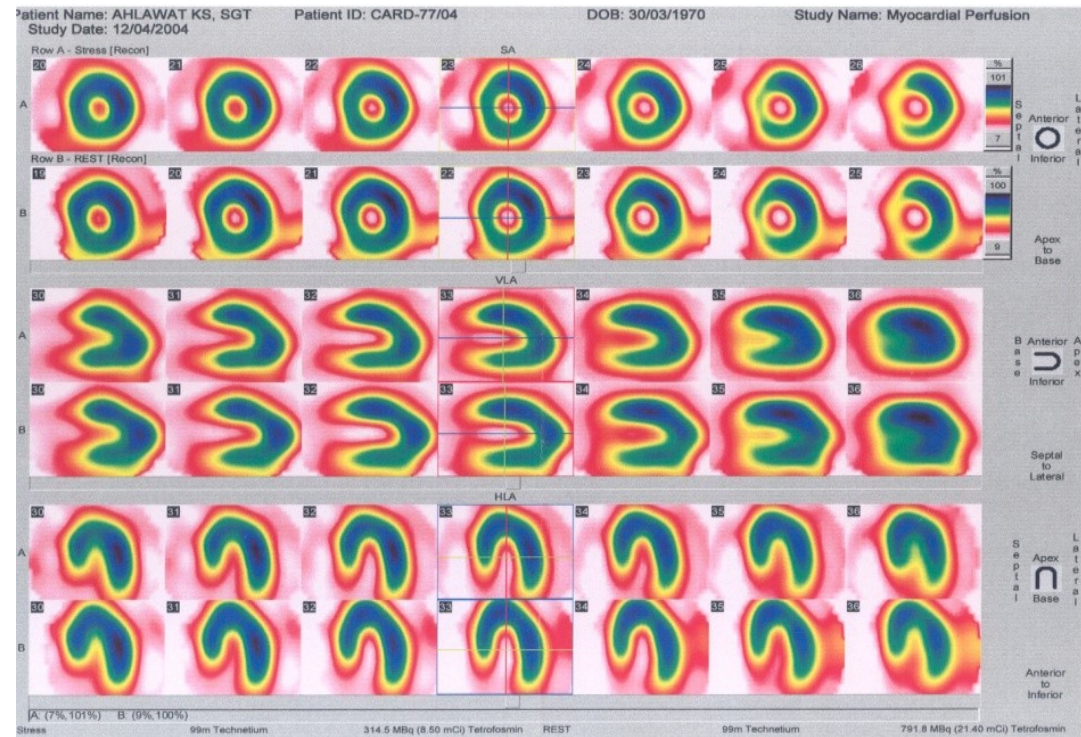


Kit for ^{99m}Tc -Tetrofosmin

Myocardial Perfusion Imaging Agent



- Single day protocol for rest and stress imaging



Generator systems for $\text{Na}^{99\text{m}}\text{TcO}_4$

- Alumina column based $^{99}\text{Mo} - ^{99\text{m}}\text{Tc}$ generator

COLTECH

- Sodium molybdate- ^{99}Mo in Sodium Hydroxide

■ Solvent Extraction Generator

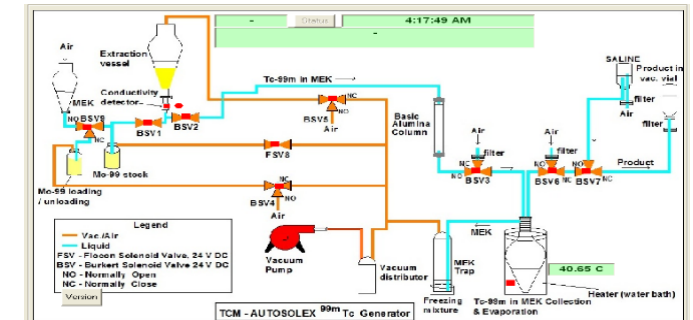
■ Autosolex

- ❖ New product awaiting regulatory approval
- ❖ Useful for Indigenous low specific activity ^{99}Mo
- ❖ Available shortly for institutes using ^{99}Mo 1Ci and above

- Zirconium molybdate- based $^{99}\text{Mo} - ^{99\text{m}}\text{Tc}$ generator: **GELTECH**



Activity: 11.1 GBq (300 mCi), 18.5 GBq (500 mCi), 22.2 GBq (600 mCi) & 37 GBq (1Ci)
Calibration : Monday at 9 00 h.
Frequency of Supply : Weekly



Flow Diagram of the TCM-AUTOSOLEX



Activity :
5.55 GBq (150 mCi), 9.25 GBq (250 mCi), 15 GBq (400 mCi)
Calibration : Monday at 09 00 h

PET Radiopharmaceuticals

Positron Emission Tomography (PET) technology is fast growing and becoming an important tool in the field of cancer imaging and diagnostics

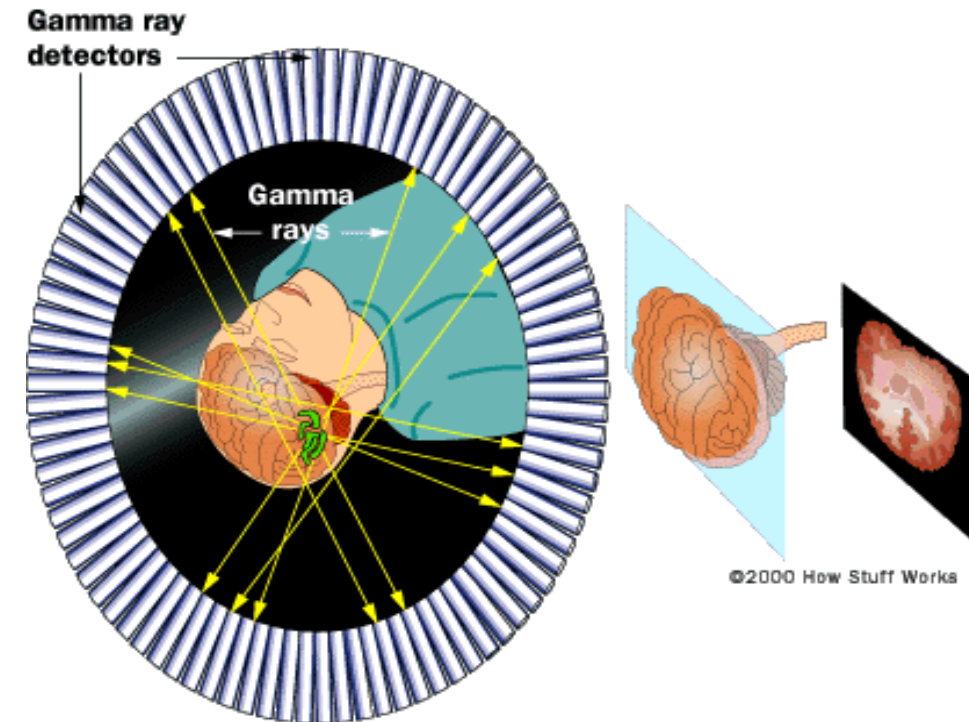
☐ ^{18}F -FDG

☐ ^{18}F -NaF

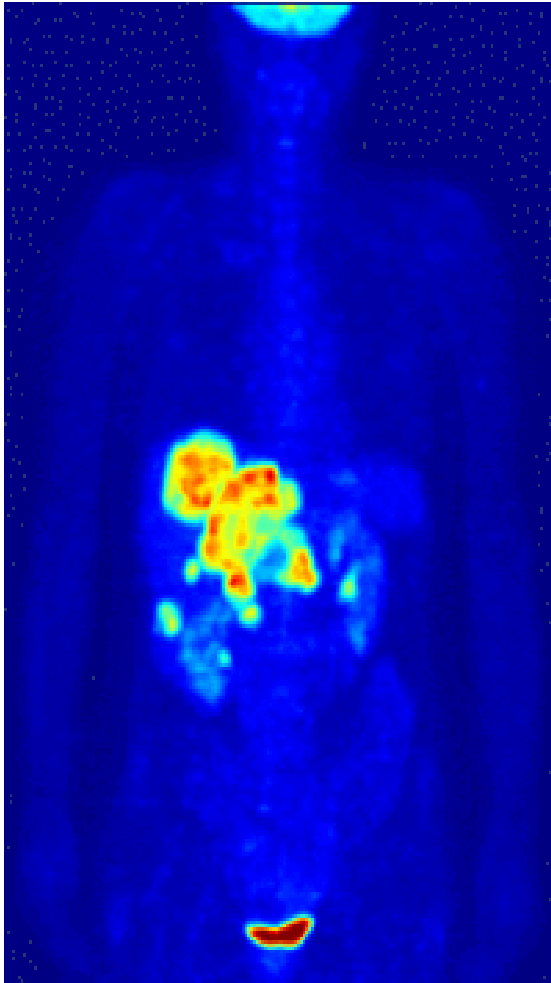
☐ ^{18}F -FLT

☐ ^{18}F -FMISO

☐ ^{18}F -DOPA [Under development]



^{18}F Fluorodeoxy Glucose Injection



➤ ^{18}F -FDG is the **work horse of PET**

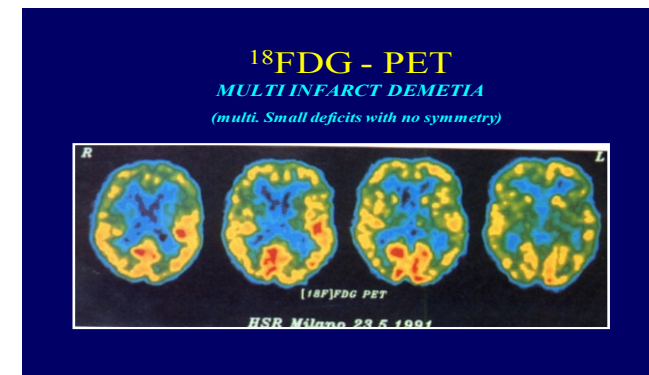
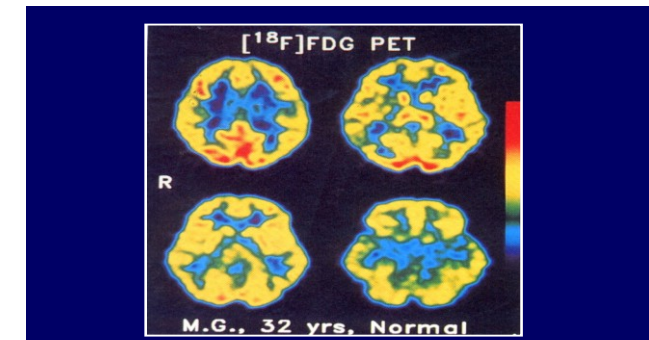
As a glucose analogue, widely used radiopharmaceutical in

❖ **Oncology**

❖ **Cardiology**

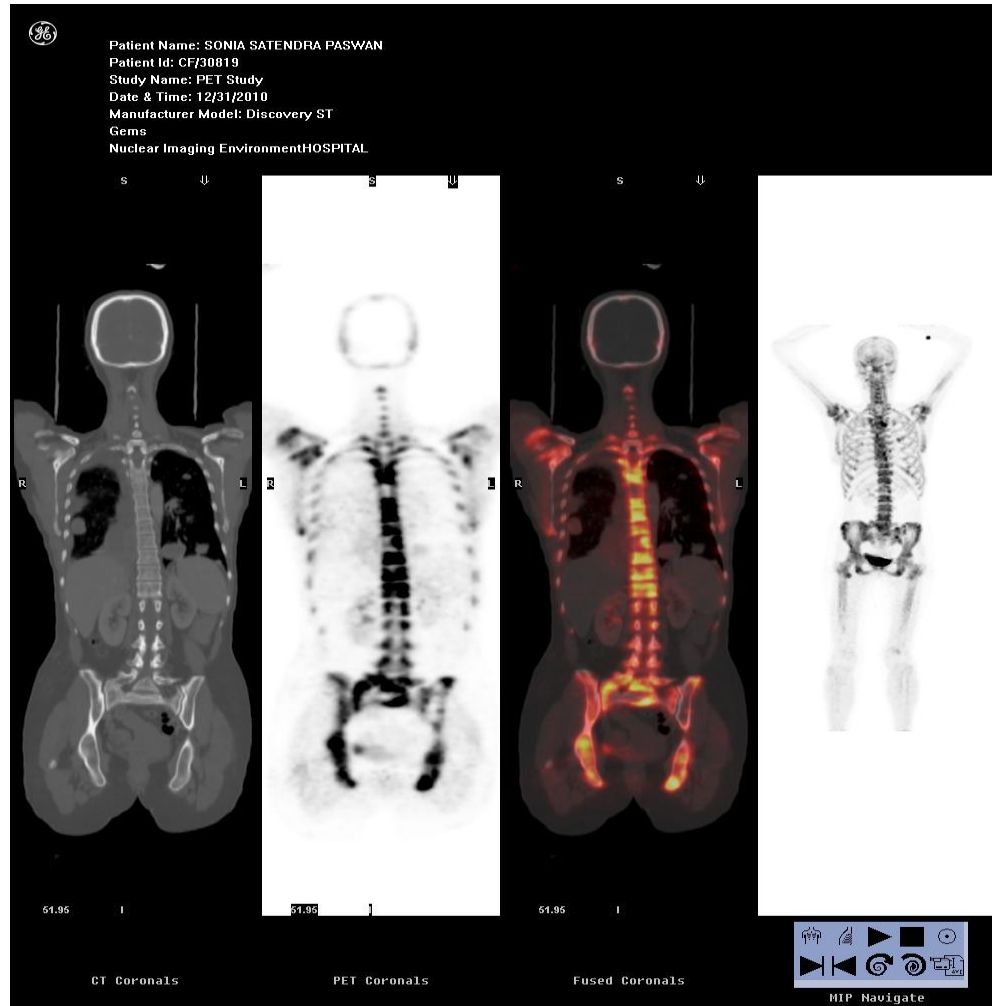
❖ **Neurology**

❖ **Infection**



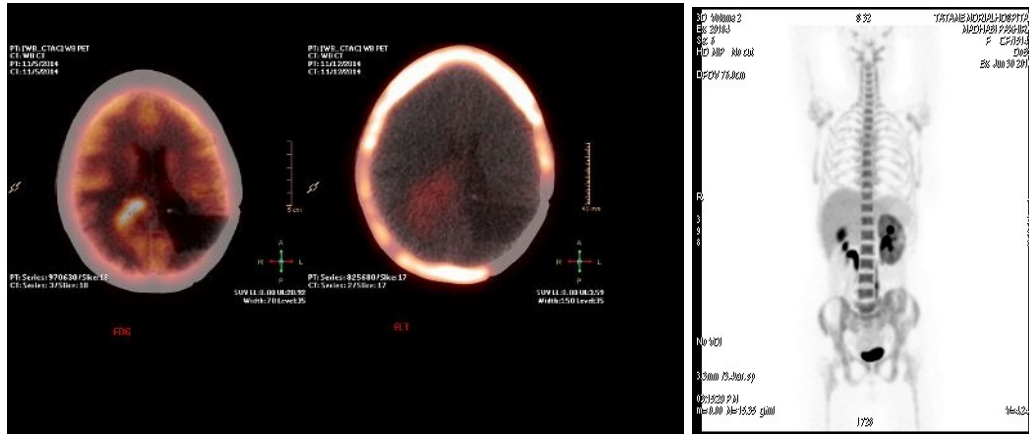
[Na¹⁸F] Sodium Fluoride Injection

Bone Imaging Agent



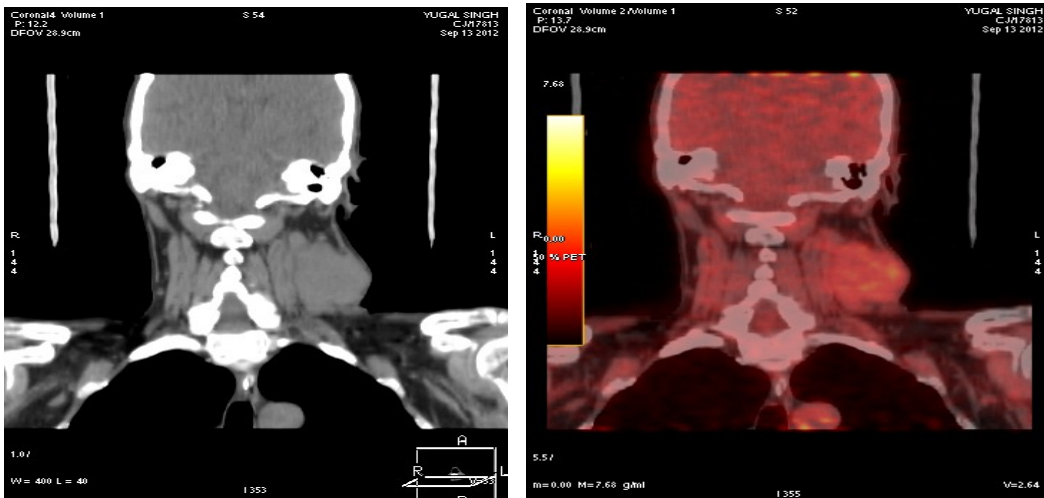
- ❑ It is the second most often applied in oncology in detection of bone metastases and primary osteoblastic tumours
- ❑ Very useful diagnostic agent for bone metastases, especially in carcinoma of breast
- ❑ To delineate areas of altered osteogenesis
- ❑ BRIT introduced this product in 2006

^{18}F - FLT and ^{18}F - FMISO



^{18}F - FLT

- ^{18}F labeled Fluorothymidine is considered a better alternative to image cancer cells.



^{18}F - FMISO

- ^{18}F labeled compound FMISO is widely used for imaging hypoxic cells

^{131}I Capsules for Diagnosis & Therapy



**Diagnostic Capsules:
25 & 50 μCi**

- Thyroid function Studies

Therapeutic Capsules: 3, 5 & 10 mCi

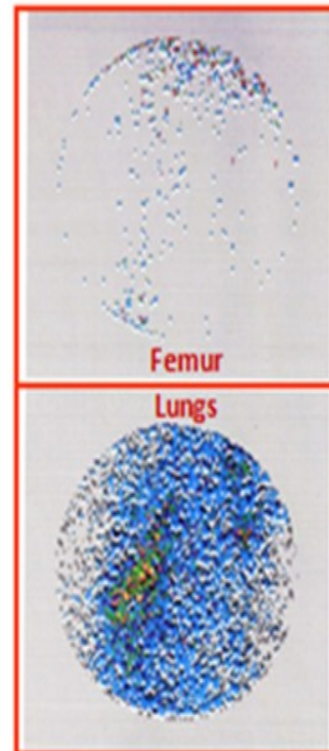
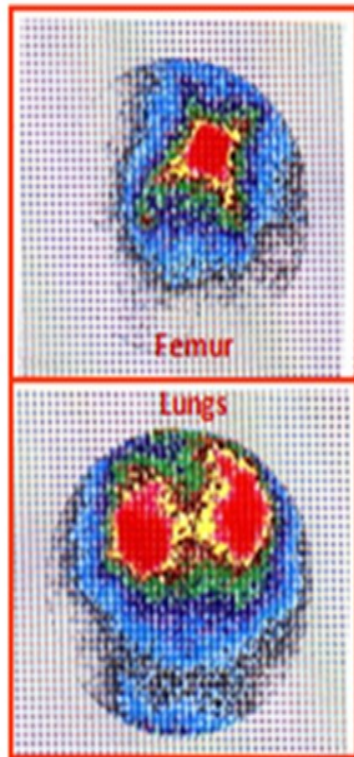
- Therapy for thyrotoxicosis
- Whole body scan

Therapeutic high dose capsules: 25, 50 & 100 mCi

- Thyroid metastases
- Thyrotoxicosis and ablation of remnant cancerous thyroid tissue post surgery

Sodium Iodide [^{131}I] Solution

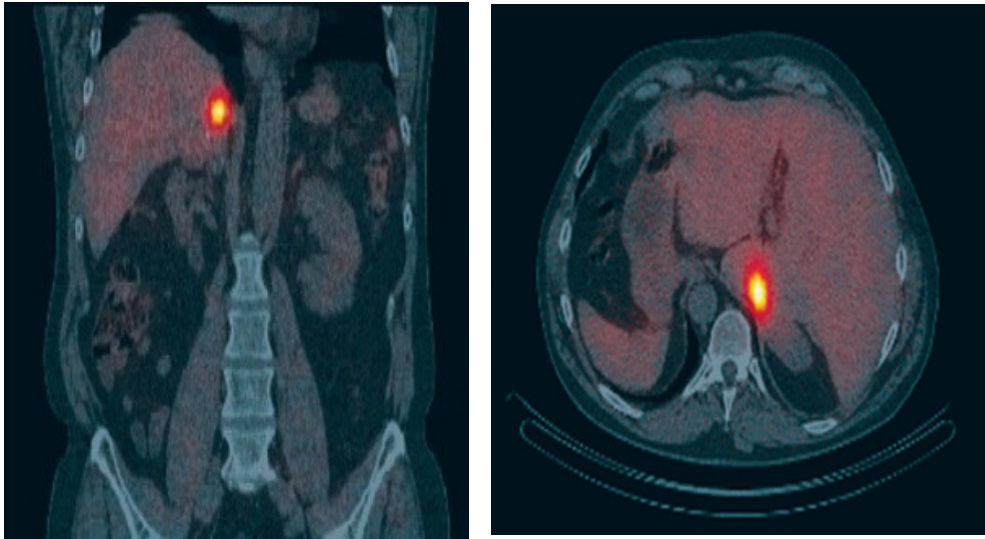
7 days post therapy scan 6 month post therapy scan



➤ **Therapeutic doses : 25 – 500 mCi**

- ✓ **Used for treatment of thyrotoxicosis**
- ✓ **Ablation of remnant thyroid cancerous tissues**
- ✓ **Treatment for thyroid cancer metastases**

^{131}I -MIBG Injection



Available weekly

☐ Diagnostic

Available pack size: **[1 - 4 mCi]**

- ✓ Imaging of Neuroendocrine Tumours
(Adrenal medullae tumours, medullary carcinoma of thyroid, parathyroid hyperplasia)
- ✓ Staging of Cancer

☐ Therapeutic

Available pack size: **[100 mCi]**

- ✓ Treatment of Neuroendocrine Tumours
- ✓ Specific to Adrenal Medullae Tumours-
Pheochromocytoma and Neuroblastoma

Radiopharmaceuticals- For Bone Pain Palliation

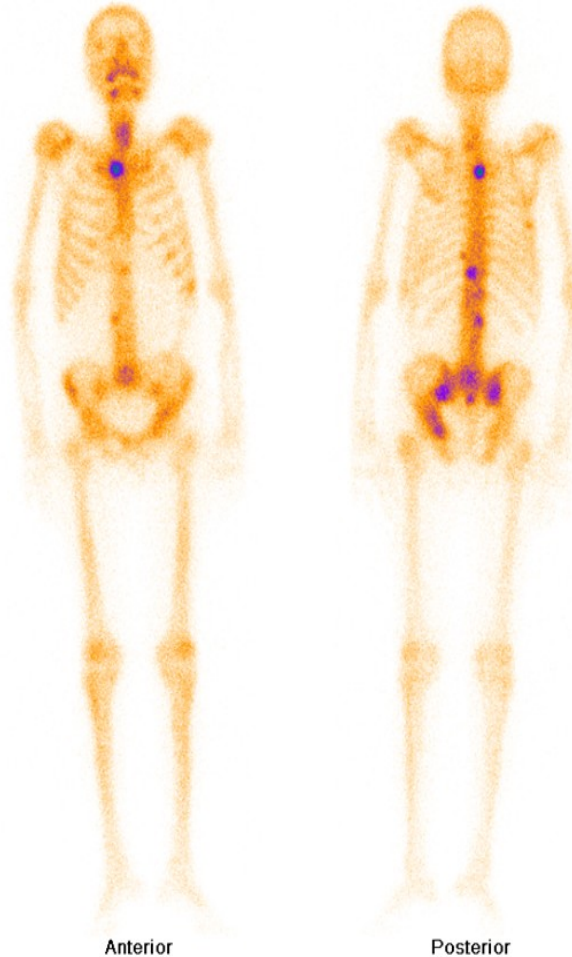


➤ ^{153}Sm -EDTMP Injection

Available pack size: 75 mCi (multiples)

- ✓ ^{153}Sm - EDTMP is an excellent theranostic radiopharmaceutical
- ✓ E_{β} max of 0.81 MeV suitable for the treatment of painful skeletal metastases
- ✓ Imageable E_{γ} of 103KeV
- ✓ Preferred in cancer patients with low myelotoxicity

Available weekly



➤ ^{32}P -Sodium Ortho Phosphate Injection

Available pack size: 7-15 mCi

- ✓ Treatment for palliation of bone pain due to metastases
- ✓ Useful in cancer patients with satisfactory haemato profile

➤ Kit for ^{177}Lu -EDTMP

- ✓ ^{177}Lu -EDTMP is an attractive theranostic radiopharmaceuticals for palliative treatment of bone metastases with low bone marrow toxicity

NEW

^{32}P -Colloidal Samarium Phosphate Injection

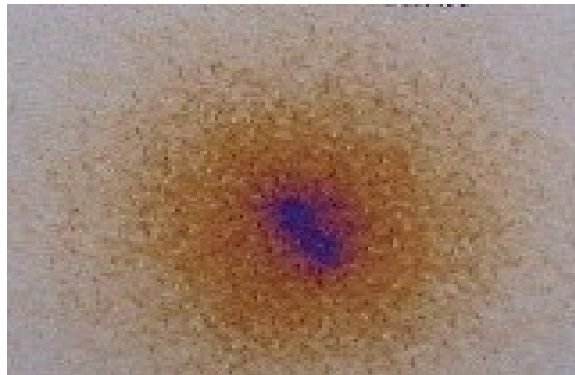
Radiation synovectomy treatment with radio-colloids



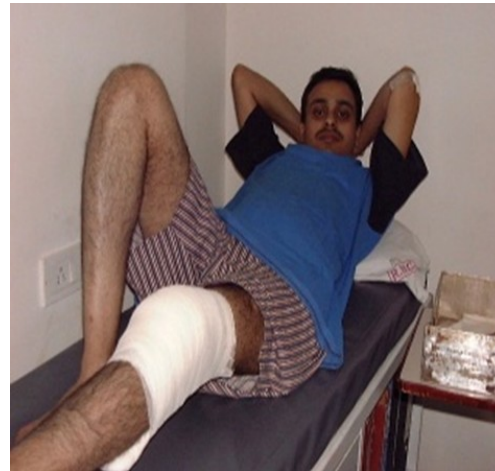
Treatment of inflammatory joint disorders in

- ✓ Rheumatoid arthritis
- ✓ Osteoarthritis
- ✓ Haemophilic orthropathy

Available pack size: **1- 2 mCi**



**Colloidal Samarium Phosphate
[^{32}P] Injection**



➤ **Patient feels “Pain relief”
one week after treatment**

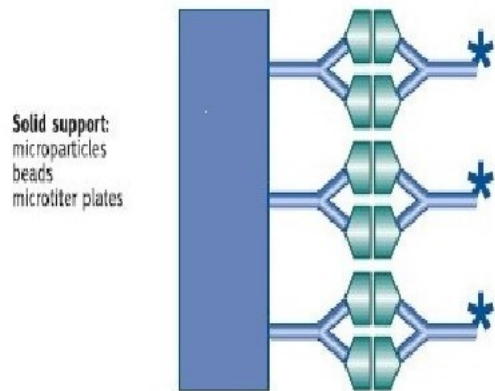


➤ **Treatment effective for
more than an year**

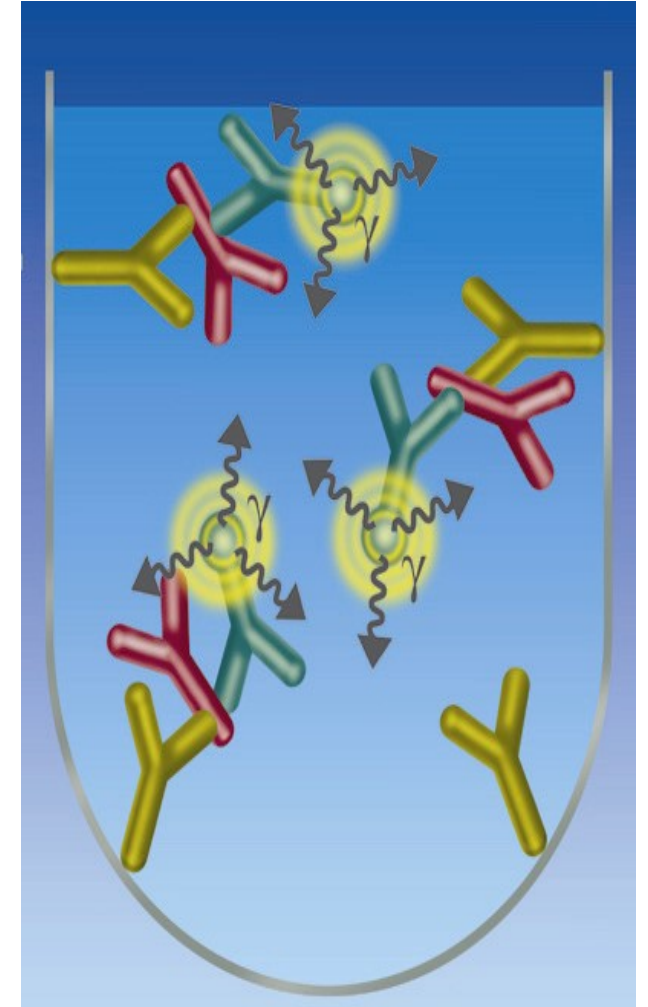
In-vitro Diagnostic Kits RIA and IRMA



Sandwich Assays: Antibodies bind to two sites on analyte

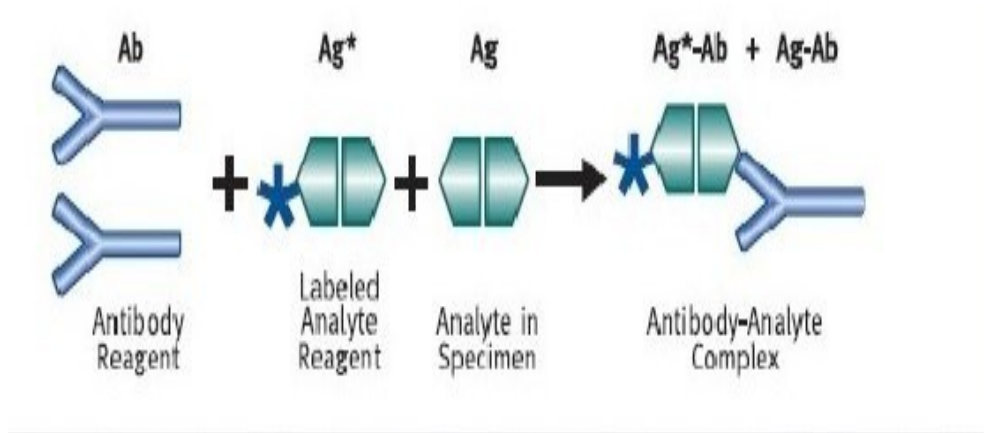


- ❖ RIA & IRMA are very sensitive, specific, in-vitro radioanalytical techniques
- ❖ Used for the quantitative estimation of hormones, vitamins, drugs, tumour markers in complex biological matrix
- ❖ Gold standard technology is robust, offers consistently reliable results at low cost per test.



In-vitro Diagnostic Kits

Thyroid Function Test Kits [ISO 9001:2008 and ISO 13485: 2012 certified]

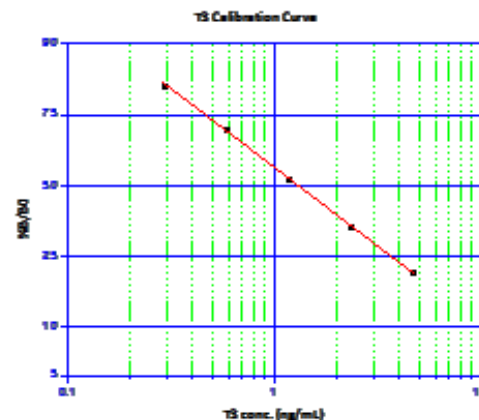


➤ IRMA kit for [hTSH]
Human Thyroid Stimulating Hormone

➤ RIA kit for Thyroxine [T4]

➤ RIA kit for Triiodothyronine [T3]

➤ RIA kit for Free Thyroxine [FT4]



New Products / Services

- ✓ ^{153}Sm -EDTMP available weekly
- ✓ ^{131}I -MIBG available weekly
- ✓ Autosolex ^{99}Mo – $^{99\text{m}}\text{Tc}$ Generator
 - ❖ Useful for Indigenous low specific activity ^{99}Mo
 - ❖ Available shortly for institutes using ^{99}Mo 1Ci and above
- ✓ Door to door delivery from RC, Delhi & Bangalore
- ✓ Ready to use $^{99\text{m}}\text{Tc}$ Radiopharmaceuticals will be available shortly from Regional Centre of BRIT at Hyderabad & RMC, Mumbai

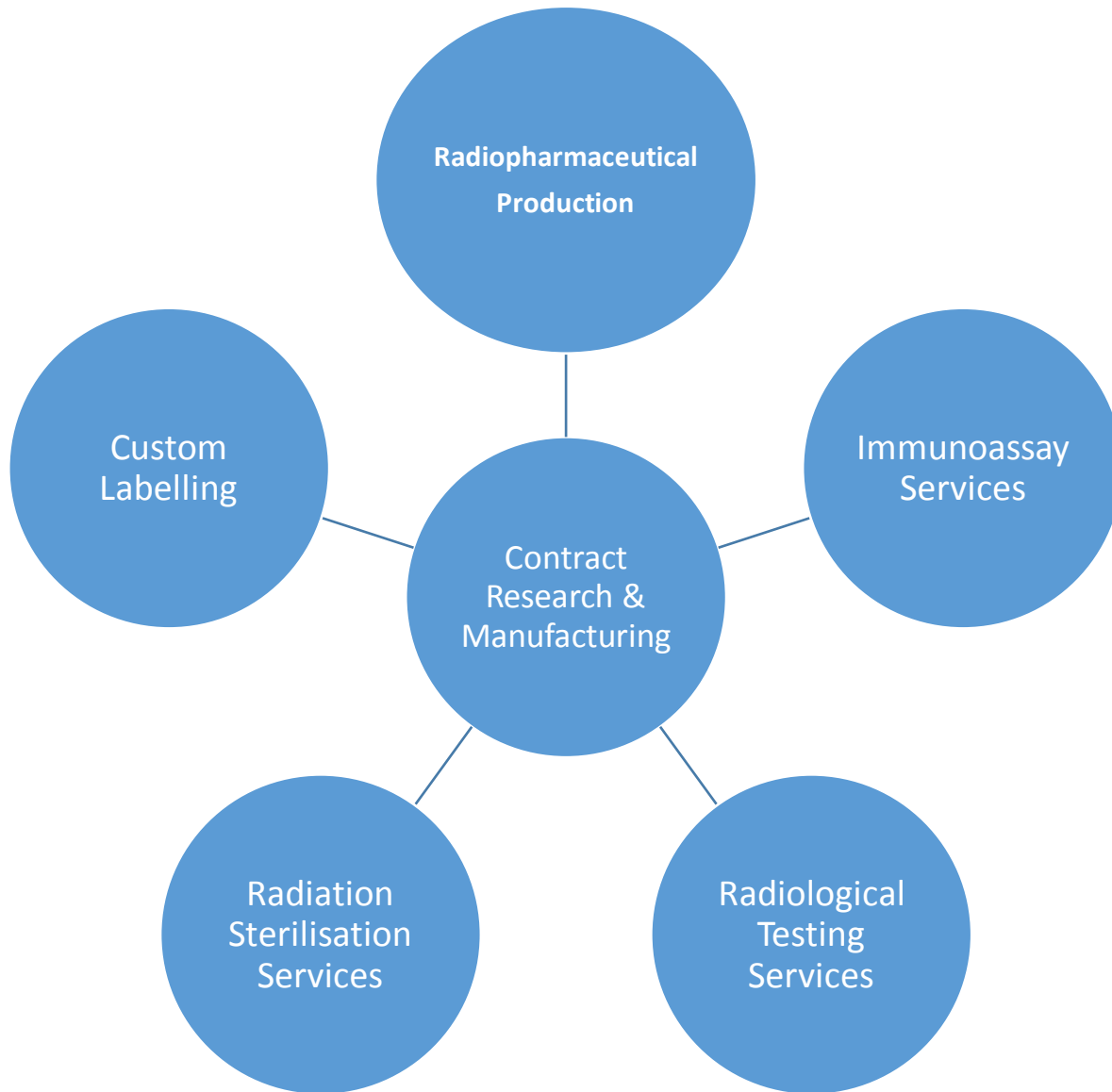
Production Plant for Indigenous High Specific Activity Mo-99 from fission (Under Construction)

Under
Implemen-
-tation



Self reliance, no
need for import of
fission produced
high specific activity
Mo-99 for COLTECH

Services Offered



- ✓ Custom radiolabelling of biomolecules such as monoclonal antibodies with ^{125}I or ^{131}I for clinical, research & other uses
- ✓ **Custom synthesis and manufacturing of ^{131}I , ^{32}P , ^{51}Cr , ^{153}Sm & ^{177}Lu based radiopharmaceuticals for clinical use under GMP conditions.**
- ✓ Formulation of cold kits for $^{99\text{m}}\text{Tc}$ based radiopharmaceuticals
- ✓ **Consultancy service in setting up of RIA lab**
- ✓ Training of man-power in RIA and related techniques on-site and at BRIT Lab
- ✓ **Technology development for RIA/IRMA of Custom antigens & proteins including those for veterinary applications**

Ordering Information



- ❖ SA4 form for standing orders and A1 form for single orders of Radiopharmaceuticals and radiochemicals can be downloaded from BRIT website

www.britatom.gov.in

- ❖ Contact Address:

Customer Relation Cell

RPhP, BRIT Vashi Complex

Sector 20, Vashi, Navi Mumbai, India.

Pin: 400703

Phone: 022-27887254/7201 Mobile: 09869454120

Fax: 022-27887218/7272

Email: rphp@britatom.gov.in