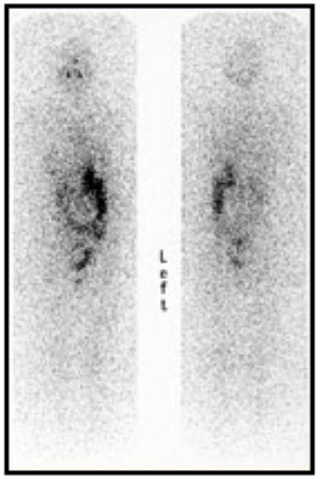
Bone Scan

^{99m}Tc-MDP

- **Physics**
  - Energy: 140 keV
  - T1/2: 6 hrs
  - Dose: 25 mCi
- **Physiology**
  - Diphosphonate
  - Normal biodistribution: bone, kidney, bladder
- **Uses: infection, trauma, tumor**

I-131

^{131}I



- **Physics**
  - Energy: 364 (81%), 637 (7%), 284 (6%) keV
  - $T_{1/2}$: 8.1 days
  - Dose: 2 - 10 mCi
- **Physiology**
  - Trapped and organified
  - Normal biodistribution: thyroid, bowel, nasopharynx
- **Uses: cancer follow up**
- **Comments: Also labels MIBG and NP-59**

Poor vs Good Quality

- **^{131}I**
  - Free ^{131}I
  - ^{131}I-MIBG
  - ^{131}I-NP59
- **^{67}Gallium**
- **Low dose ^{111}In**
  - ^{111}In-WBC
  - ^{111}In-DTPA
- **^{99m}Tc Agents**
- **High dose ^{111}In**
  - Hormonal agents
    - Octreoscan
  - Antibody agents
    - Oncoscint
    - Prostascint
- **^{123}I**
- **^{201}Tl**

DDX: Bone Uptake

- **^{99m}Tc-MDP**
  - Delayed
  - Blood pool
- **^{99m}Tc Sulfur Colloid**
- **^{67}Gallium Citrate**
- **^{111}Indium WBC**
- **^{99m}Tc-HMPAO WBC**

Thallium

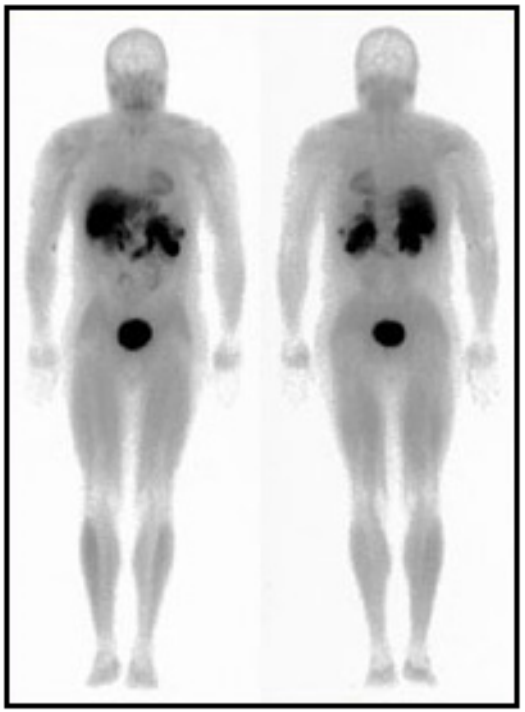
- **Physics**
  - Energy
    - X-ray: 69 - 83 keV (93%)
    - Gamma: 167 keV (9.4%)
  - $T_{1/2}$: 73 hrs.
  - Dose: 3 mCi
- **Physiology**
  - K^+ analogue
  - Normal biodistribution: heart, liver, spleen, skeletal muscles, kidney, brain
- **Uses**
  - Cardiac: MPS
  - Tumors: Osteosarcoma, thyroid, KS, glioma, Lung, breast, low grade NH

DDX: For Myocardial Uptake

- ^{201}Tl
- ^{99m}Tc agents
  - Sestamibi
  - Tetrafosmin
  - Teboroxime
- ^{131}I-MIBG
- ^{18}FDG
- **Beware of**
  - abnormal ^{67}Ga with myocarditis
  - cardiac blood pool

Sestamibi

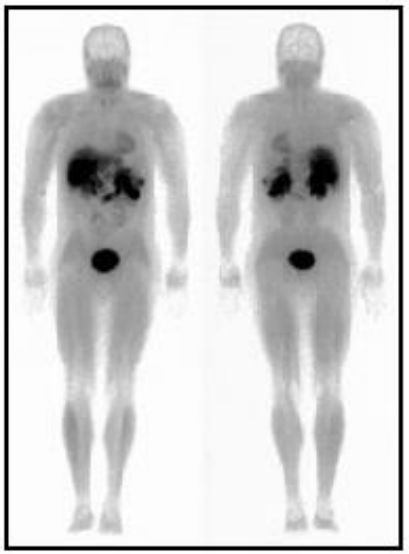
^{99m}Tc-Sestamibi



- **Physics**
  - Energy: 140 keV
  - $T_{1/2}$: 6 hrs
  - Dose: 25 mCi
- **Physiology**
  - Mitochondrial metabolism
  - Normal biodistribution: heart, skeletal muscle, liver, GB, bowel, kidney, bladder
- **Uses: MPS, tumor, parathyroid**

Thalium Vs Sestamibi

^{201}Tl vs. ^{99m}Tc-Sestamibi



- **Poorer images**
- **Kidneys seen well**
- **Good muscle definition**
- **Liver seen well**

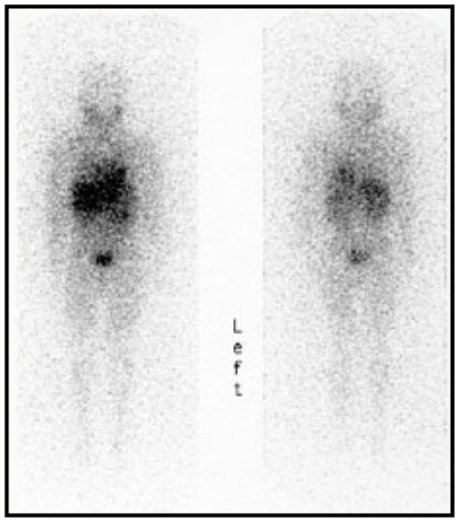
MAA

^{99m}Tc-MAA

- **Physics**
  - Energy: 140 keV
  - $T_{1/2}$: 6 hrs
  - Dose: 5 mCi
- **Physiology**
  - End arteriole occlusion
  - Normal biodistribution: lung
- **Uses: V/Q, R to L shunt**

MIBG -I-131

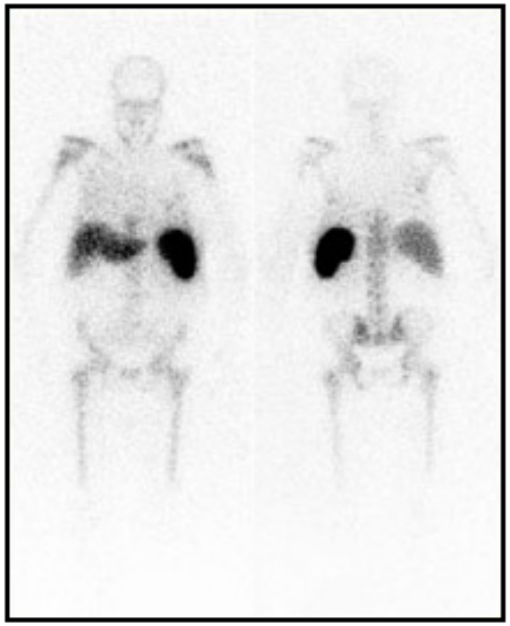
^{131}I-MIBG



- **Physics**
  - Energy: 364 (81%), 637 (7%), 284 (6%) keV
  - $T_{1/2}$: 8.1 days
  - Dose: 0.5 mCi
- **Physiology**
  - Norephinephrine analogue
  - Normal biodistribution: heart, liver, spleen, parotid, salivary, bladder, kidney, thyroid (abnormal, should be blocked)
- **Uses: pheochromocytoma, neuroblastoma, medullary thyroid carcinoma**

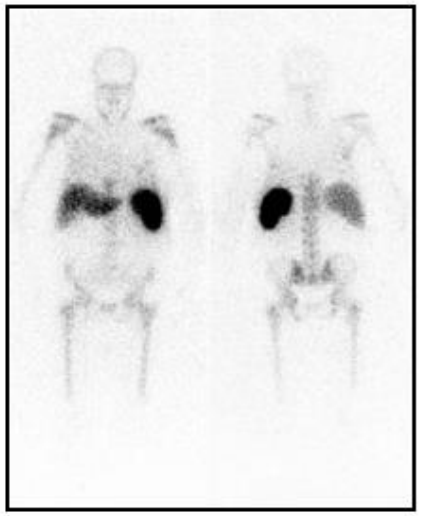
In WBC

^{111}In-WBC



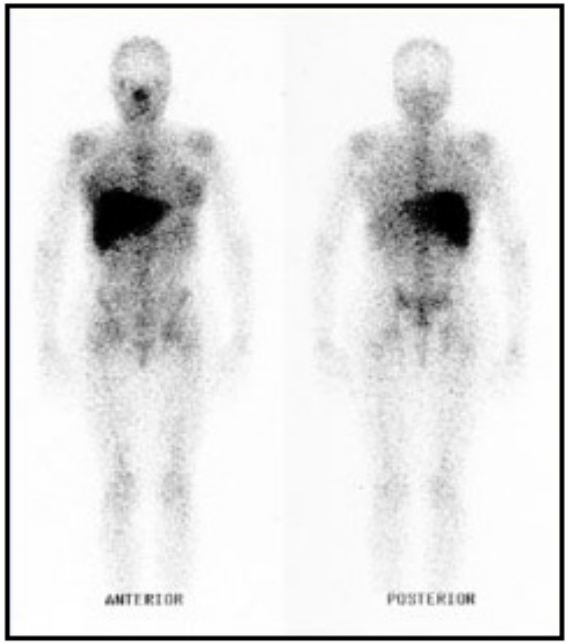
- **Physics**
  - Energy: 172 (90%), 245 (94%) keV
  - $T_{1/2}$: 2.8 days
  - Dose: 500 uCi
- **Physiology**
  - Migration of WBC
  - Normal biodistribution: liver, spleen, bone marrow, +/- lung
- **Uses: Infection**

DDX: Bone, Liver and Spleen



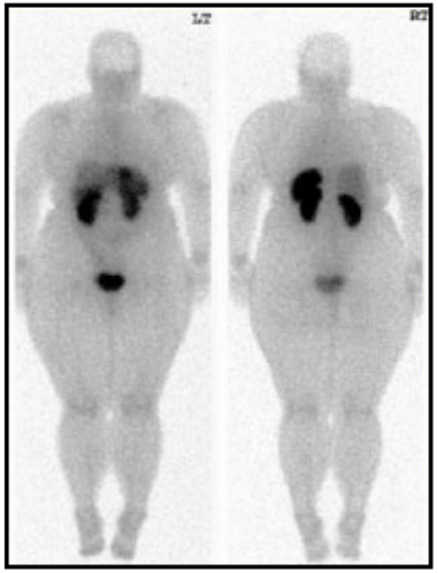
- **^{67}Gallium Citrate**
- **^{111}In-WBC**
- **^{99m}Tc-Sulfur Colloid**
- **^{99m}Tc-HMPAO WBC**

Ga Citrate



- **Physics**
  - Energy: 93 (40%), 184 (20%), 300 (17%), 393 (20%) keV
  - $T_{1/2}$: 78 hrs
  - Dose
    - Infection: 5 mCi
    - Tumor: 10 mCi
- **Physiology**
  - Iron analogue
  - Normal biodistribution: liver, spleen, bone, bone marrow, nasopharynx, lacrimal, salivary, GI, (kidney/bladder 1st 24hrs)
- **Uses: Infection, tumor**

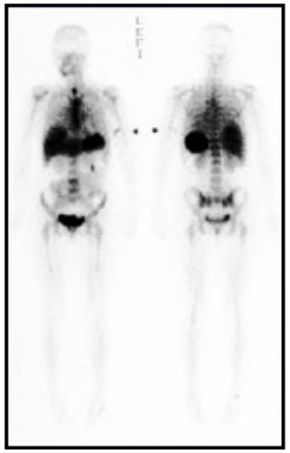
In (111)-Octreoscan



- **Physics**
  - Energy: 172 (90%), 245 (94%) keV
  - $T_{1/2}$: 2.8 days
  - Dose: 3 - 6 mCi
- **Physiology**
  - somatostatin receptor binding
  - Normal biodistribution: spleen, liver, kidneys, bladder, +/- thyroid
- **Uses: neuroendocrine tumors**
- **Comments: not a screening test, need history**

Tc-HMPAO-WBC

^{99m}Tc-HMPAO-WBC



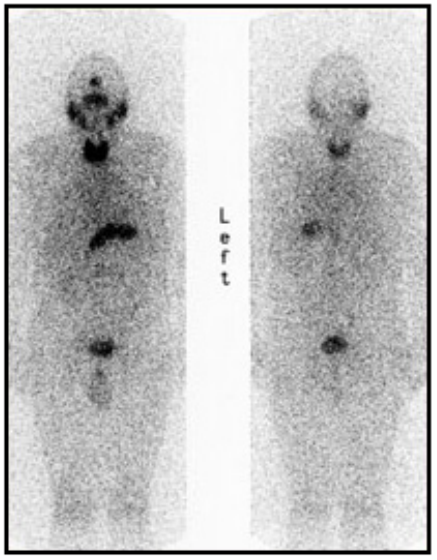
- **Physics**
  - Energy: 140 keV
  - $T_{1/2}$: 6 hrs
  - Dose: 6 - 20 mCi (dep on tag)
- **Physiology**
  - Migration of WBC
  - Normal biodistribution: liver, spleen, bone marrow, GI, GU, lung
- **Uses: Infection**
- **Comments: done w/in 2 hrs**
- **Learning point: "dirty" In-WBC study = HMPAO WBC**

gallium vs. indium

- Advantages:
- Ga-67 citrate
  - readily available
  - no preparation
  - bone + soft-tissue infections
  - chronic inflammatory processes
- In-111 WBCs
  - no bowel uptake
  - minimal or no uptake in healing wounds
  - images easier to interpret
  - high specificity for inflammatory process

I - 123

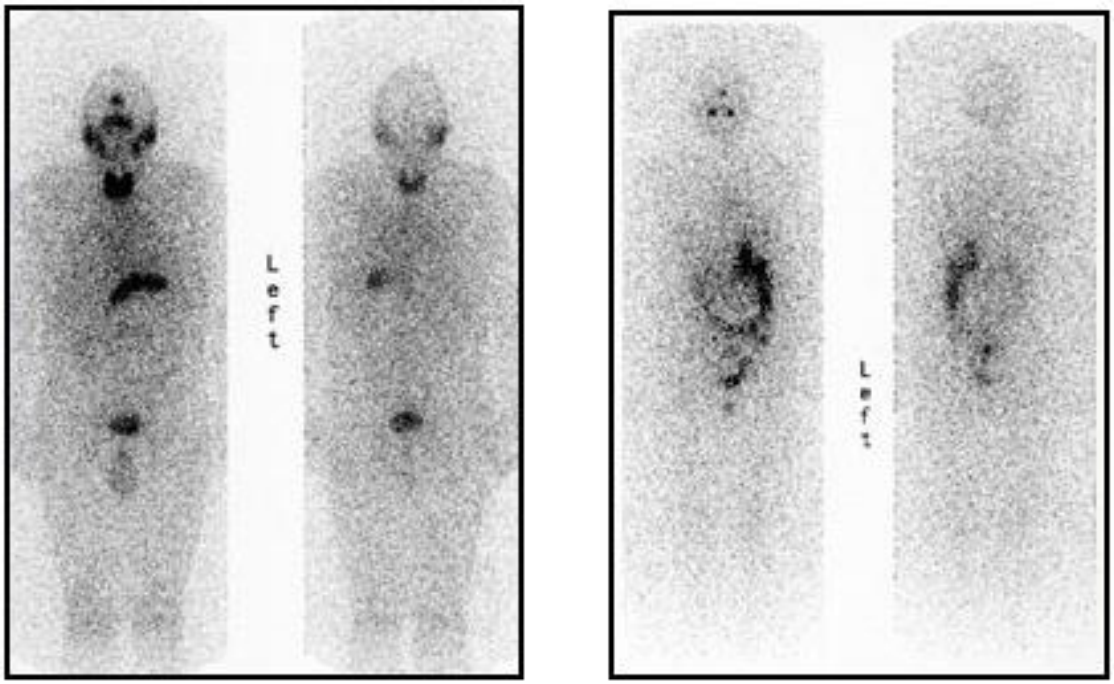
^{123}I



- **Physics**
  - Energy: 159 keV
  - $T_{1/2}$: 13.2 hrs
  - Dose: 200 - 400 mCi
- **Physiology**
  - Trapped and organified
  - Normal biodistribution: thyroid, bowel, nasopharynx, bladder
- **Uses: thyroid**
- **Comments: uptake & scan, substernal goiter**

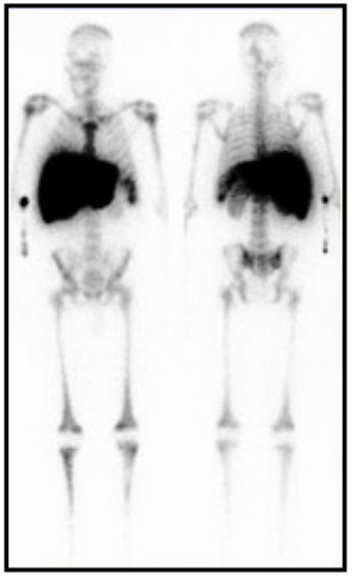
I-123 vs 131

^{123}I vs. ^{131}I



Sulfer Colloid

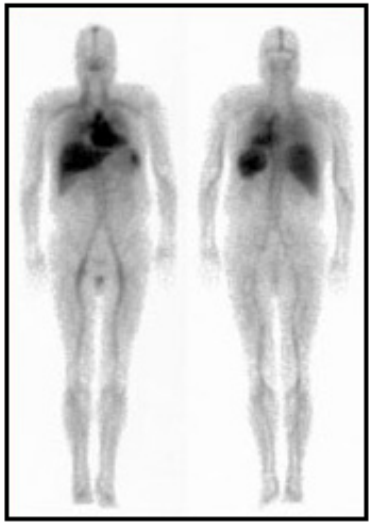
^{99m}Tc-Sulfur Colloid



- **Physics**
  - Energy: 140 keV
  - $T_{1/2}$: 6 hrs
  - Dose: 25 mCi
- **Physiology**
  - Reticuloendothelial cell activity (bone marrow, liver, spleen)
  - Normal biodistribution: liver, spleen, bone marrow
- **Uses: liver/spleen & bone marrow imaging**

Prostascint

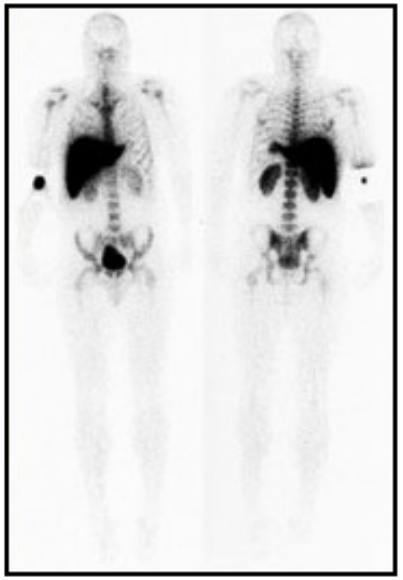
^{111}In-Prostascint



- **Physics**
  - Energy: 172 (90%), 245 (94%) keV
  - $T_{1/2}$: 2.8 days
  - Dose: 5 mCi (0.5 mg Ab)
- **Physiology**
  - Ab binding to glycoprotein PSMA on prostatic epithelium
  - Normal biodistribution: liver, spleen, bone marrow, (+/- bowel, blood pool, GU, genitalia)
- **Uses: Prostate Cancer**

Damaged Red Blood Cells

^{99m}Tc Damaged RBC



- **Physics**
  - Energy: 140 keV
  - $T_{1/2}$: 6 hrs
  - Dose: 3 - 5 mCi
- **Physiology**
  - Phagocytosis
  - Normal biodistribution: spleen, liver, bone marrow, blood pool
- **Uses:**
  - Ectopic/Accessory spelenic tissue

Co-57

- energy: 122 keV (near Tc-99m)
- half-life: 270 days
- used as standard to check dose calibrator

Meckel scan

- agent: Tc-99m pertechnetate
- prep:
  - pentagastrin -- increase acid production
  - cimetidine -- block secretion of acid
  - glucagon -- decrease bowel activity

Molybdenum breakthrough

- 0.15 uCi Mo-99 / mCi Tc-99m
- must check EVERY elution of generator
  - use dose calibrator + lead shield
- Mo-99 emits beta particles, has 67-hr half-life
  - it's taken up by liver

Technetium 99m

- Tc-99m
- half-life: 6.03 hr
- decay: isomeric transition
- radiation: gamma, 140 keV (98%)

xenon 133

- Xe-133
- half-life: 5.2 days
- 80 keV photon
- dose for V/Q imaging = 20 mCi