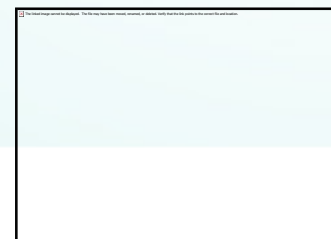


# Professional Development: The Radiopharmacy Perspective

5 October 2019

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# What is Nuclear Medicine?

- **Nuclear**
  - Use of radioactivity
- **Medicine**
  - To diagnose and treat a wide variety of diseases



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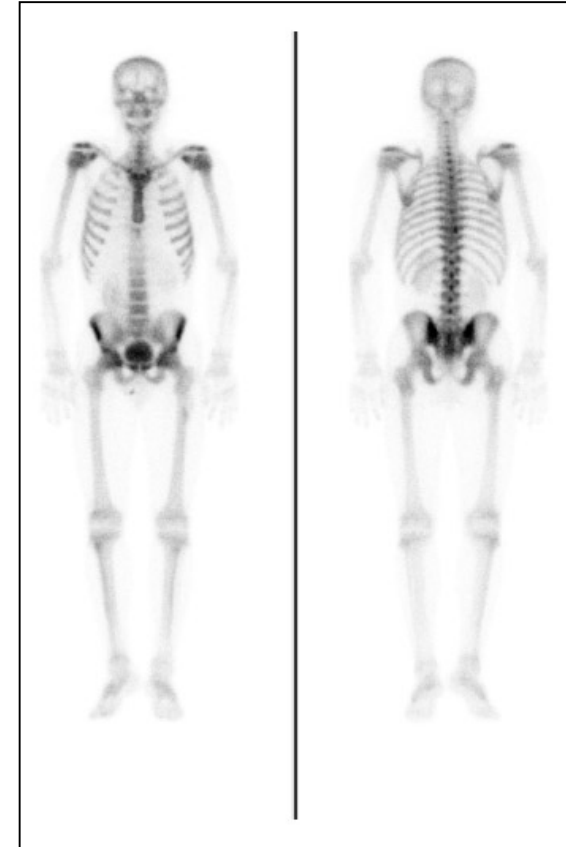


# Nuclear Medicine vs. Radiology

- Radiology = Anatomy/Structure
- NM = Imaging of Function/Physiology



**DIAGNOSE DISEASE WHEN THERE IS AN ALTERATION IN STRUCTURE**



**DIAGNOSE DISEASE WHEN THERE IS AN ALTERATION IN FUNCTION**



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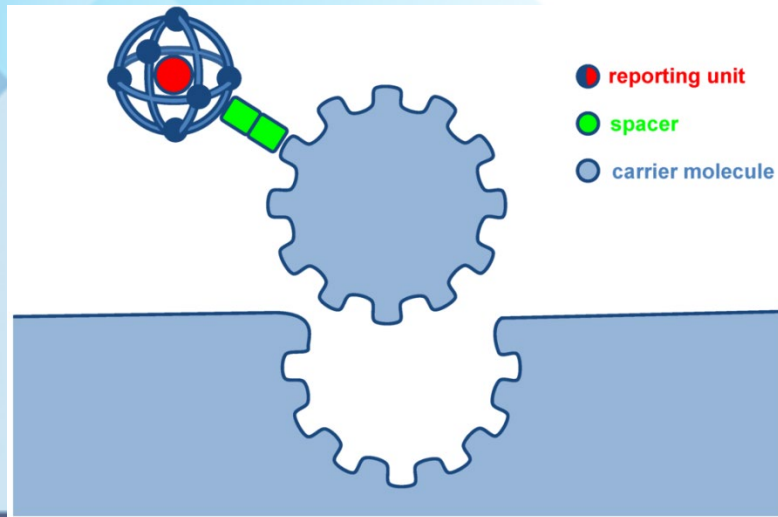
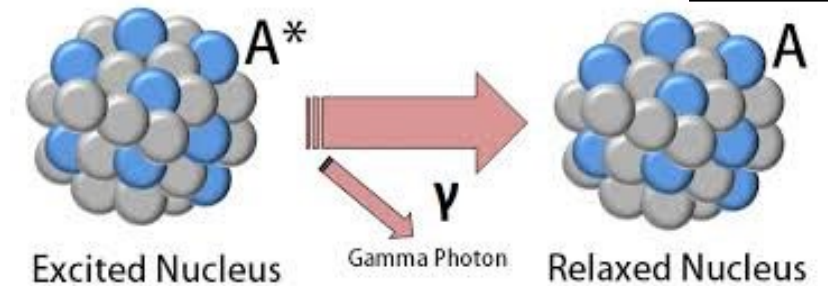
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# Radiopharmaceuticals

**Radioisotope** → When the nucleus of an atom possesses excess **energy**, such an atom is said to be instable and thus radioactive and it is called a radioisotope/radionuclide → decays or loses its excess energy by emitting electromagnetic waves (gamma rays)



**Ligand** → organ specific, handled by the body in a physiological way → after administration, the **ligand** portion will “**target**” a specific organ (physiological mechanism) and, because the **radioisotope** is bound to it, will “**drag**” the radioisotope along with it to that **specific target organ**.



# Imaging (Diagnosis)

## Gamma Camera



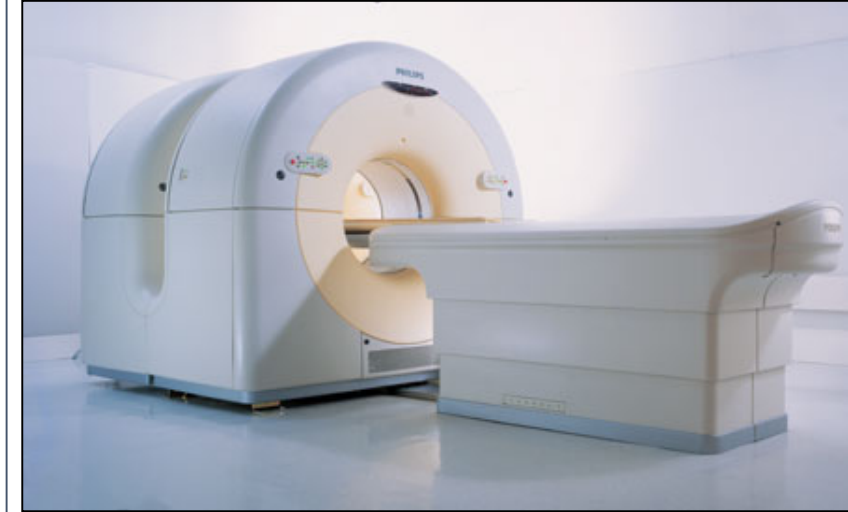
Radioisotope decays by emission of gamma rays → these gamma rays are detected by a gamma camera.

## SPECT



Also makes use of gamma rays, but unlike the gamma camera which produces planar images, 3D information is obtained.

## PET



Makes use of positron emitting RPs. Positron → A particle with approximately the same mass as an electron, but oppositely charged.



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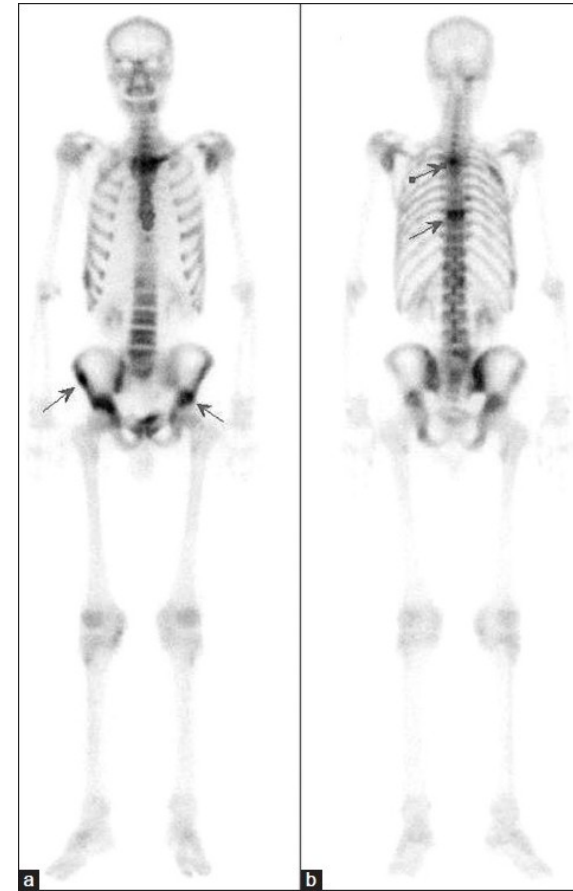




# Example: Skeletal Scintigraphy

## $^{99m}\text{Tc}$ – MDP

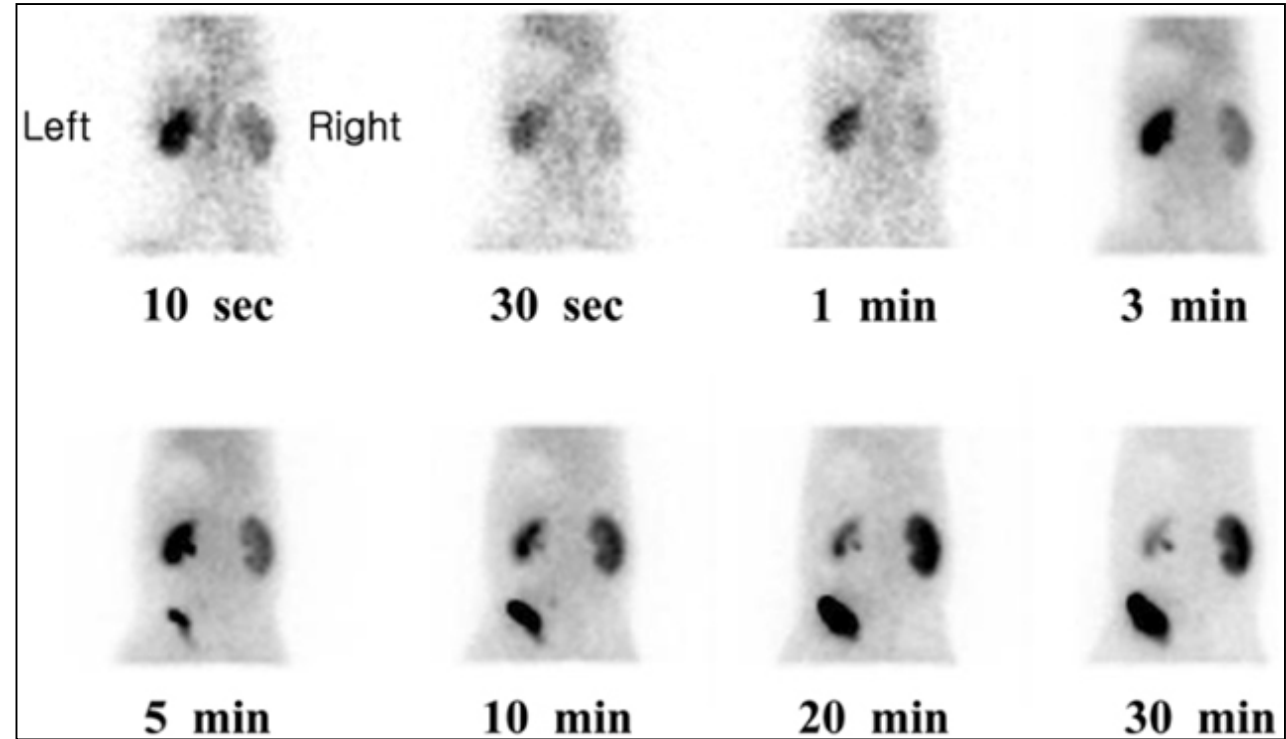
- Technetium-99m labelled methylene diphosphonate
- A bone tracer



# Example: Dynamic Renal Scintigraphy

## $^{99m}\text{Tc}$ – DTPA

- Technetium-99m labelled diethyltriamine-pentaacetic acid
- A renal tracer



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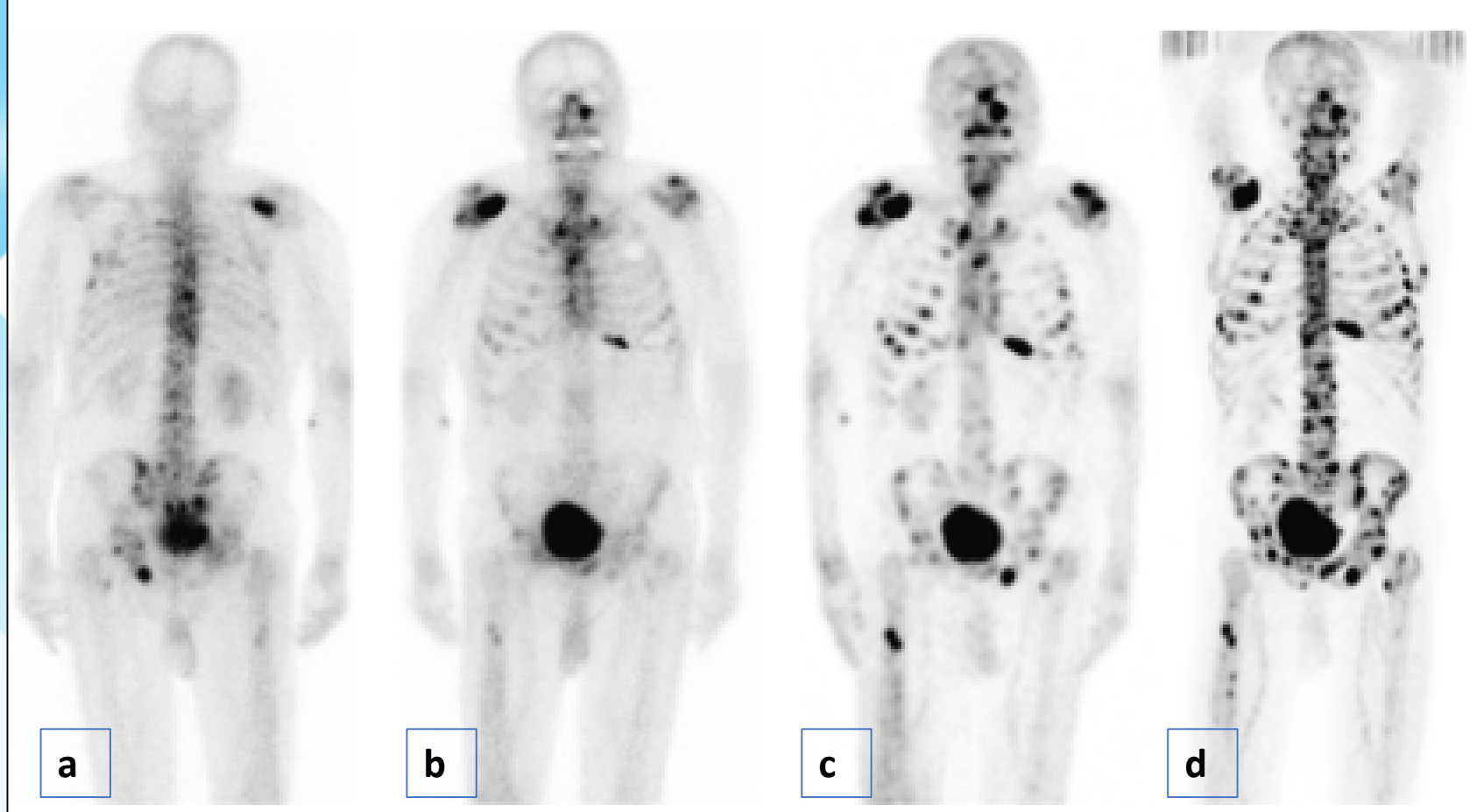


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**A patient with numerous bone metastases. From left to right: a) Posterior and b) Anterior  $^{99m}\text{Tc}$ -MDP Planar Bone Scintigraphy c) Multi-Field-of-View SPECT and d)  $^{18}\text{F}$ -Fluoride PET**



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# Treatment

- Use of very organ specific radiopharmaceuticals, which produce particles when they decay → this particle possesses kinetic energy → able to “ablate” tissue.
- E.g.
  - $^{131}\text{I}$  for treatment of thyroid cancer
  - $^{89}\text{Sr}$  as palliative therapy in cancer patients with bone metastases
  - $^{177}\text{Lu}$ -PSMA (Prostate Specific Membrane Antigen) for treatment of prostate cancer

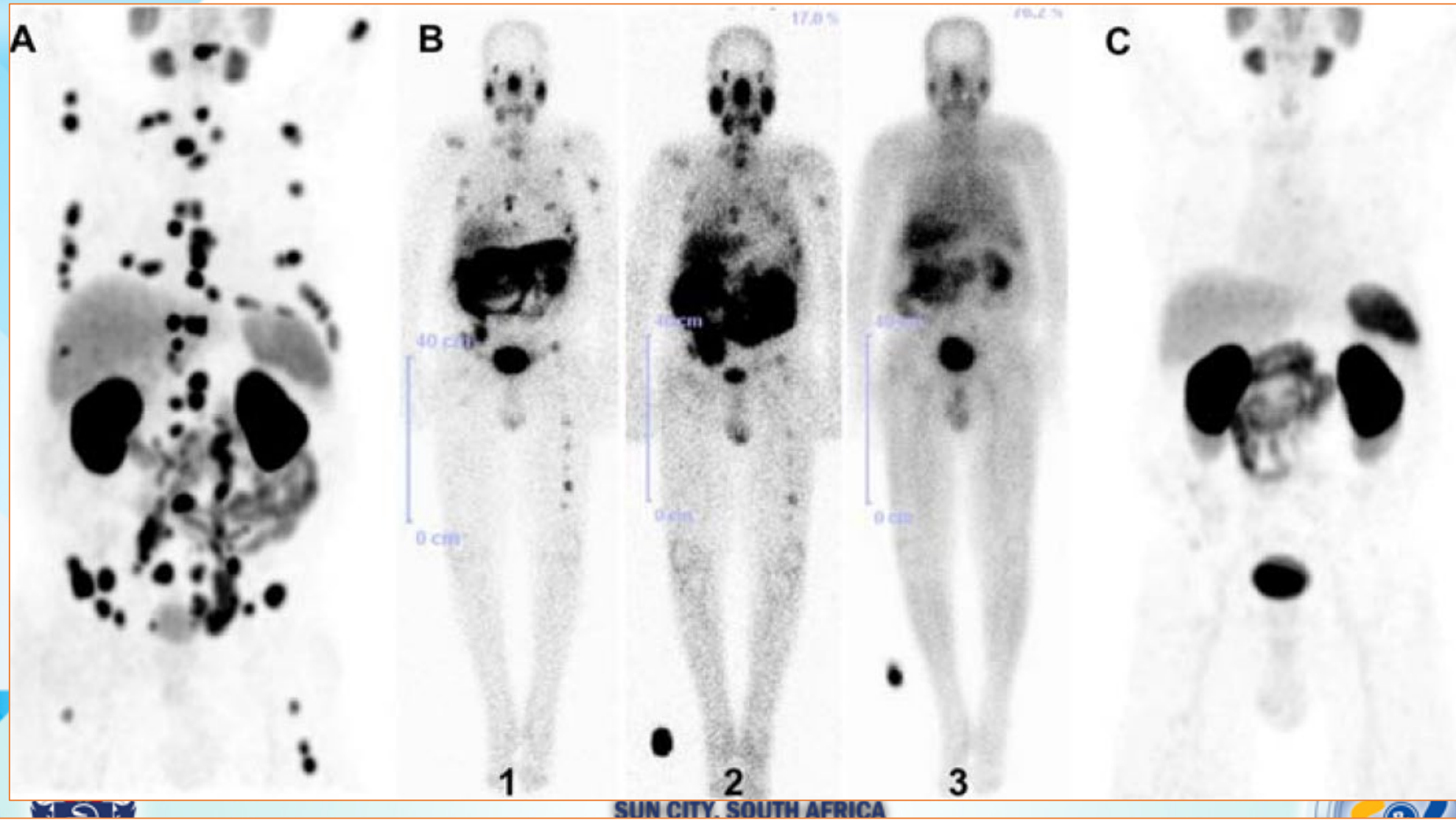


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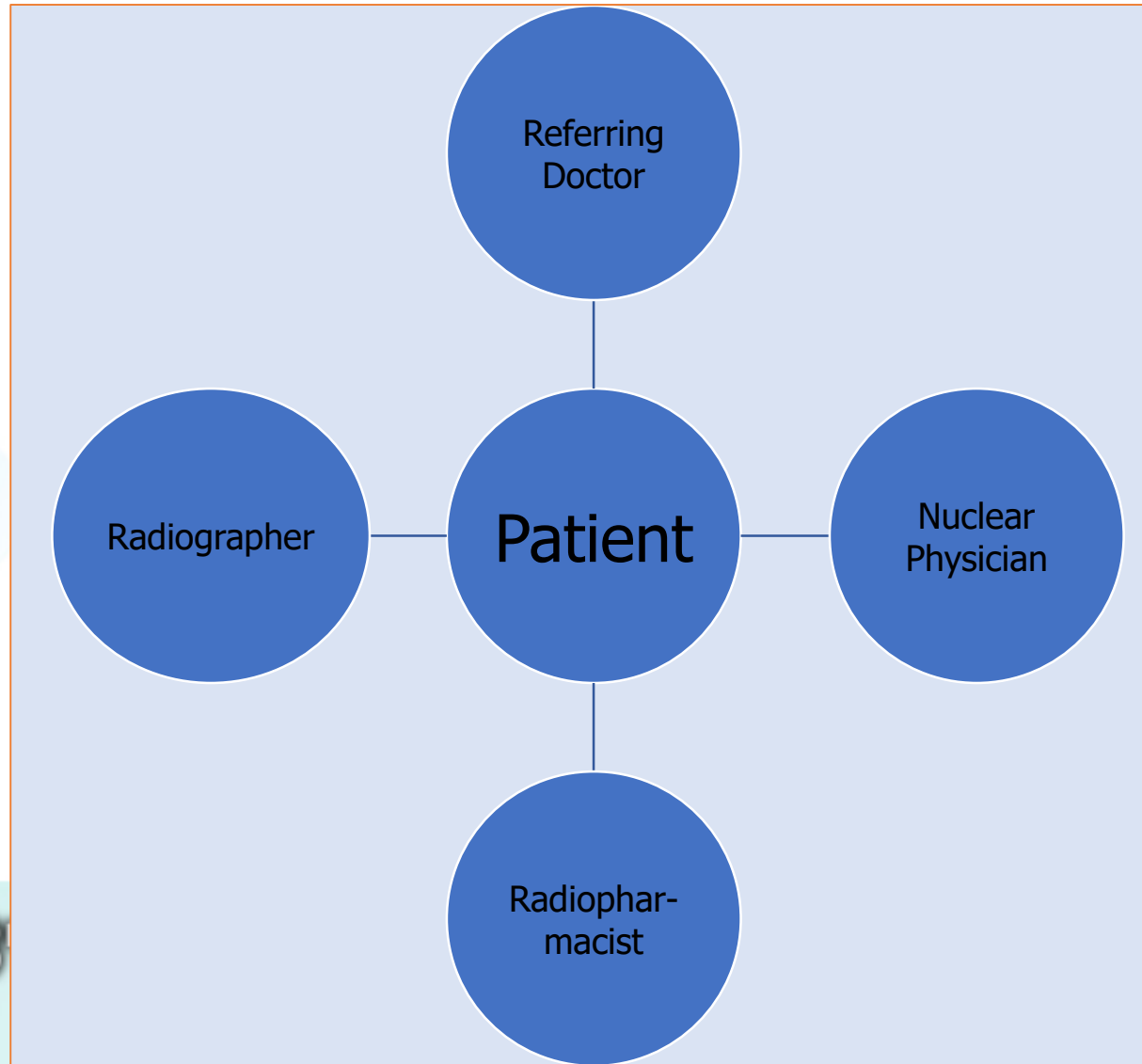


# Treatment of mCRPC with $^{177}\text{Lu}$ -PSMA



Baum RP, Kulkarni HR, Schuchardt C, Singh A, Wirtz M, Wiessalla S, Schottelius M, Mueller D, Klette I & Wester HJ.  $^{177}\text{Lu}$ -Labeled Prostate-Specific Membrane Antigen Radioligand Therapy of Metastatic Castration-Resistant Prostate Cancer: Safety and Efficacy. *Journal of Nuclear Medicine*. 2016 Jul;57(7):1006-13. doi: 10.2967/jnumed.115.168443.

# Role of the Radiopharmacist?



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# SAPC Scope of Practice for Radiopharmacy

1. Perform acts and services specially pertaining to the profession of a pharmacist.
2. Take a leading pharmaceutical role in protocol and guideline development in radiopharmacy and nuclear medicine.
3. Take a leading pharmaceutical role in compounding and/or manufacturing radiopharmaceuticals
4. Act as a leading pharmaceutical partner within a multi-professional healthcare team in nuclear medicine departments and in industry.
5. Develop, implement, evaluate and provide strategic leadership for radiopharmacy services.
6. Appraise information, make informed decisions regarding supply and use of radiopharmaceuticals with the evidence available and be able to justify/defend the decisions.
7. Develop policies and procedures specifically for the specialty area.
8. Develop a quality and an evaluative culture within radiopharmaceutical services.
9. Perform pharmaceutical risk management.
10. Provide education and training related to radiopharmacy.
11. Research, teach and publish in the field of radiopharmacy.



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# Radiopharmacy in South Africa

- **In South Africa, Radiopharmacy is a specialisation** recognised by the SAPC (requirement: “appropriate postgraduate pharmacy degree” + 2 years experience in a specialised unit).
- A new **curriculum outline has been developed** for the SAPC and the revised registration requirements have been gazetted (Dec, 2014).
- The School of Pharmacy, SMU, is the only **pharmacy school in SA to offer RP at a postgraduate level and the MPharm course has been recently accredited by the Council on Higher Education.**
- RP is classified as a scarce skill by the Department of Health.
- There are currently only two SAPC-registered Radiopharmacy Specialists in the country with three additional registrations pending.
- **Radiopharmacists are needed** in public and private sector hospital Nuclear Medicine Departments, as well as industry.



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# Radiopharmacy in SA (continued)



- 19 graduates from the course and 7 current students
- Only 5 working in the Radiopharmacy field
- From a previous study done in 2016, it was concluded that post availability in SA is the largest obstacle in following a career in radiopharmacy (70%), followed by the compulsory year of community service and bursary repayment years (50% combined).
- There has been a lot of role substitution with radiographers performing the admixing of radiopharmaceuticals, but with the progression to more complex radiopharmaceuticals, pharmacists should assume their true role in radiopharmaceutical preparation.
- It is therefore crucial that radiopharmacist posts are created in Nuclear Medicine Departments in SA.
- It would also be ideal for Radiopharmacy Master's graduates to be allowed community service in Nuclear Medicine Departments in academic hospitals. SAPC need to take into account the special expertise that the academic interns come out with and pressure needs to be put on DOH to create posts.



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# DGMAH PET Radiopharmacy





# DGMAH PET: Uptake rooms and Camera





# DGMAH SPECT RP



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