Toulouse, June 11, 2025.

FAPESP France Week 2025

Cancer Theranostics: Integrating Diagnostics and Targeted Treatment

UNICAMP

CancerThera

FAPESP

Celso Dario Ramos, M.D., Ph.D.

Cancer Theranostics Innovation Center (CancerThera - Fapesp)
University of Campinas (Unicamp), Campinas, Brazil

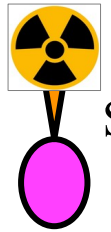
Nuclear Medicine

Theranostics

(Diagnosis + Therapy)

The use of the same molecule labeled with different radioisotopes for diagnostic imaging or treatment.

Radiopharmaceutical



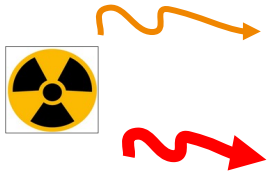
Radioisotope

Spacer

Biomolecule

Tumor target



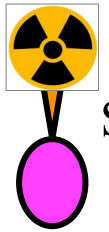


Gamma or positron radiation

Alpha or beta radiation

Theranostics

Radiopharmaceutical



Radioisotope

Spacer

Biomolecule

Tumor target

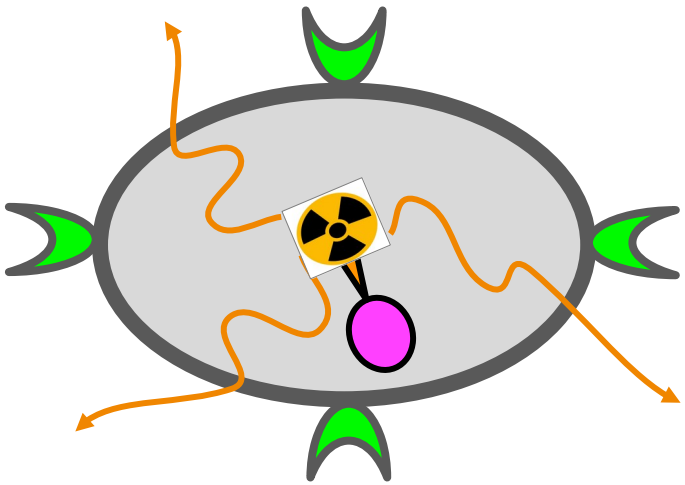


Gamma or positron radiation

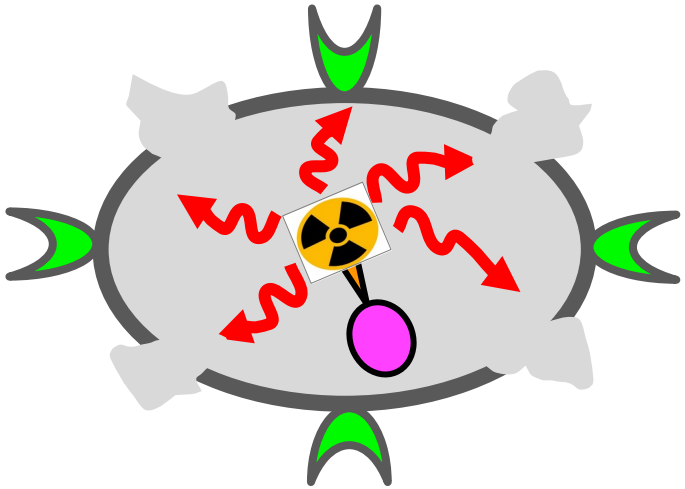
Alpha or beta radiation

Theranostics

Diagnostic Imaging



Therapy



Cancer Theranostics Innovation Center (CancerThera)



- It is a major project focused on research, innovation, and knowledge dissemination activities.
- Objective: to become a reference center in the translational study of theranostics in cancer.

www.cancerthera.org.br

Cancer Theranostics Innovation Center (CancerThera)

Responsible Investigator (Director): Carmino Antonio De Souza **(Hematologist)**

Principal Investigators

Celso Dario Ramos **(Nuclear Physician)**
Carmen Silvia Passos Lima **(Oncologist)**
Elba C.S.C. Etchebehere **(Nuclear Physician)**
Luciana Malavolta Quaglio **(Chemist)**
Jose Barreto C Carvalheira **(Oncologist)**
Pedro Paulo Corbi **(Chemist)**
Victor Marcelo Deflon **(Chemist)**

Associate Researchers: chemists, pharmacists, physicists, biologists, oncologists, hematologists, pathologists, radiologists, epidemiologists and others.

International Advisory Committee: renowned scientists.

Cancer Theranostics Innovation Center (CancerThera)

Two Arms:

- **Basic Research**
- **Clinical Research**

Cancer Theranostics Innovation Center (CancerThera)

Basic Research

- Chemists, pharmacists and biologists are working on radiometal chelators and peptide labeling.

Bioinorganic and Medicinal Chemistry Research Laboratory

Prof. Dr. Pedro Paulo Corbi, Associate Professor (IQ-UNICAMP)

Bioinorganic Chemistry: synthesis of metalopharmaceuticals for human health.

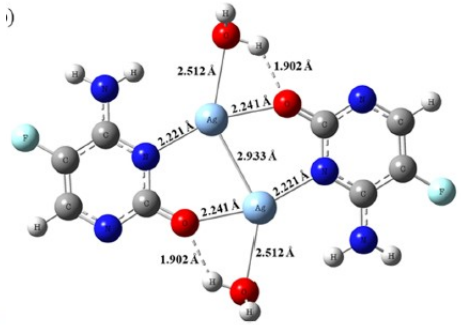
Contents lists available at ScienceDirect

Journal of Fluorine Chemistry

journal homepage: www.elsevier.com/locate/fluor

Synthesis, spectroscopic characterization, antibacterial activity and antiproliferative profile of a new silver(I) complex of 5-fluorocytosine

de Menezes Pereira G et al. *J Fluor Chem*. 2023;266:110096



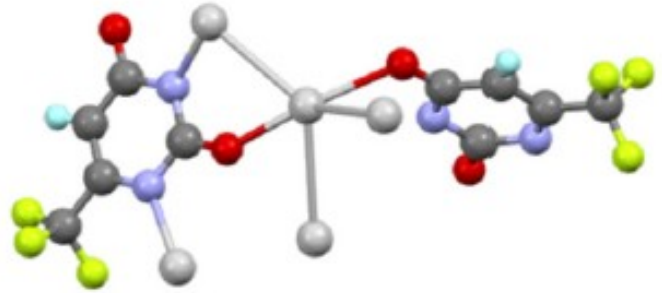
Contents lists available at ScienceDirect

Journal of Inorganic Biochemistry

journal homepage: www.elsevier.com/locate/jinorgbio

Antibacterial profile and antiproliferative activities over human tumor cells of new silver(I) complexes containing two distinct trifluoromethyl uracil isomers

de Menezes Pereira G et al. *J Inorg Biochem*. 2025;262:112752



Chemistry and Molecular Physics Sector

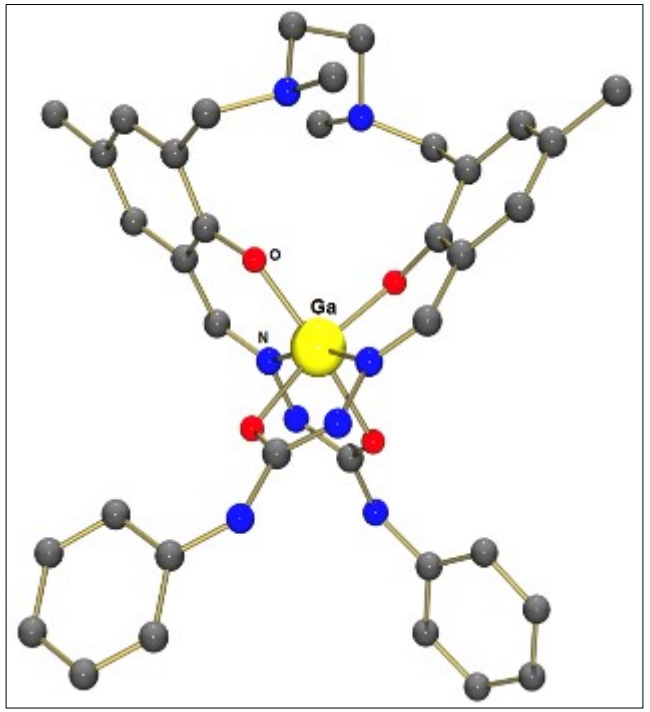
Prof. Dr. Victor Marcelo Deflon, Associate Professor (IQ-USP, Sao Carlos)

Development of bifunctional chelators for gallium and lutetium for theranostic application.

Gallium and indium complexes with new hexadentate bis(semicarbazone) and bis (thiosemicarbazone) chelators†

Viviana S. Prado,[a] Renan C. F. Leitao,[a] Francisco Silva,[b] Lurdes Gano,[b] Isabel C. Santos,[b] Fabio L. N. Marques,[c] António Paulo[b] and Victor M. Deflon[*a]

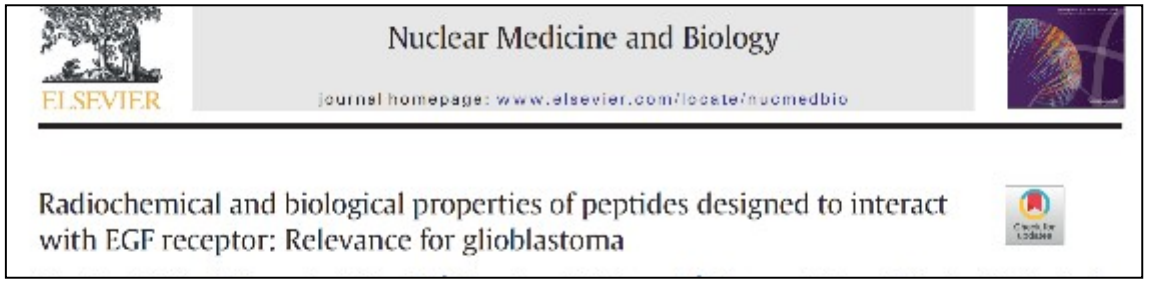
Prado VS, et al. *Dalton Trans.* 2021 Feb 9;50(5):1631



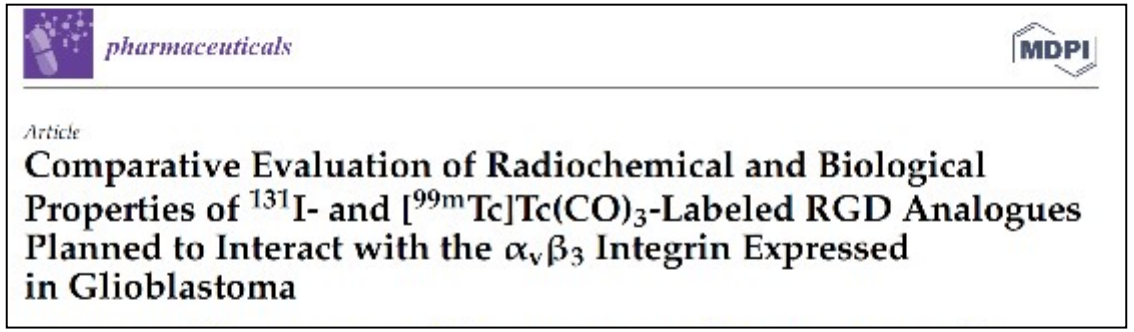
Macromolecule Chemistry

Prof. Dr. Luciana Malavolta, Assistant Professor (Santa Casa, SP)

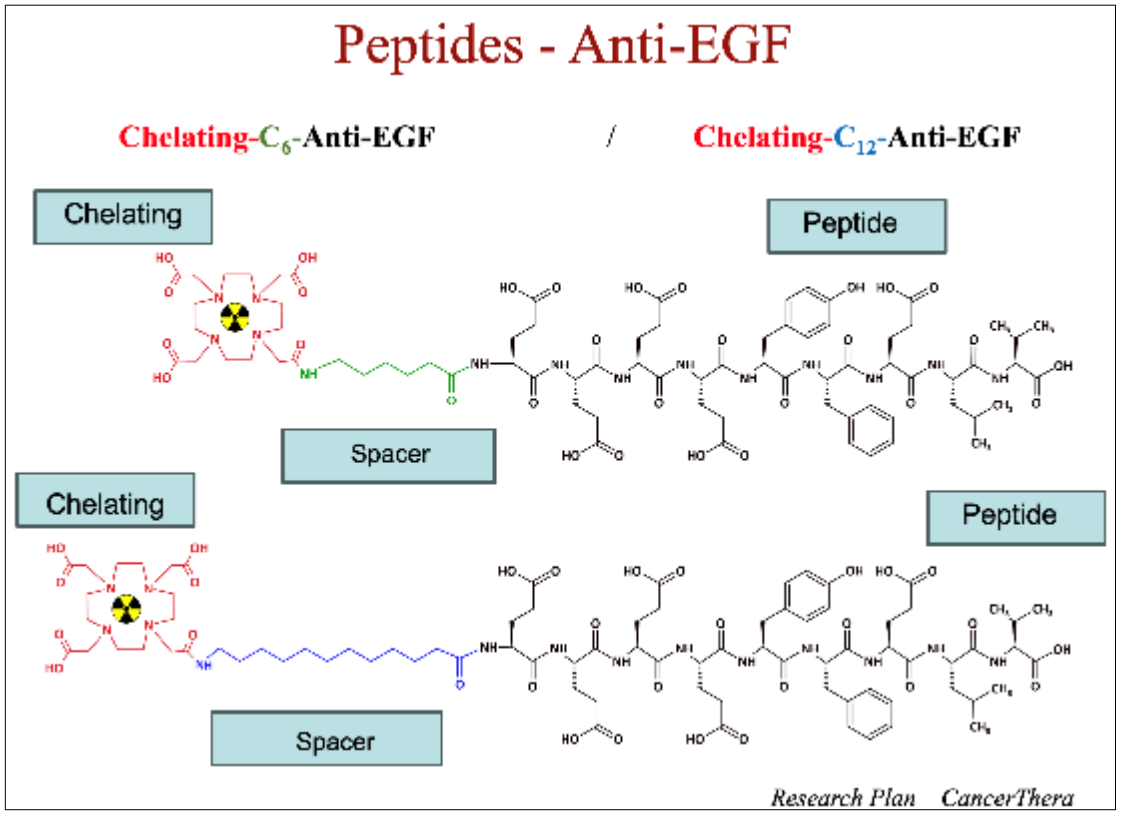
Synthesis and radiolabeling of peptides for radiotracers development.



Sobral DV, et al. *Nucl Med Biol*. 2020;88-89:14-23.



Sobral DV, et al. *Pharmaceuticals (Basel)*. 2022;18;15:116.



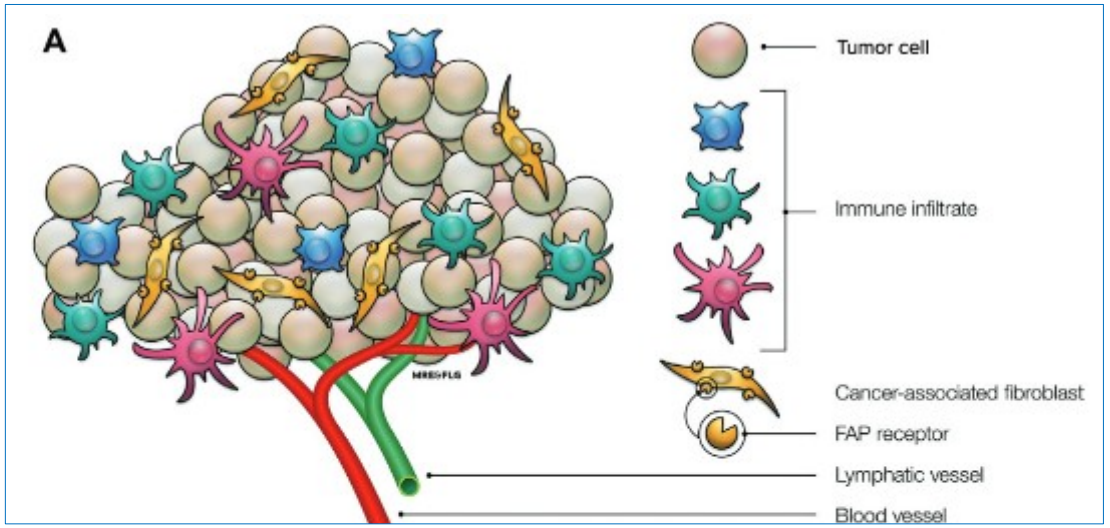
Clinical Research

- It takes a long time for new radiopharmaceuticals to reach clinical research.
- Clinical research needs to work in parallel with basic research.
- We are initially looking for new applications for known molecules: faster clinical results.

FAPI

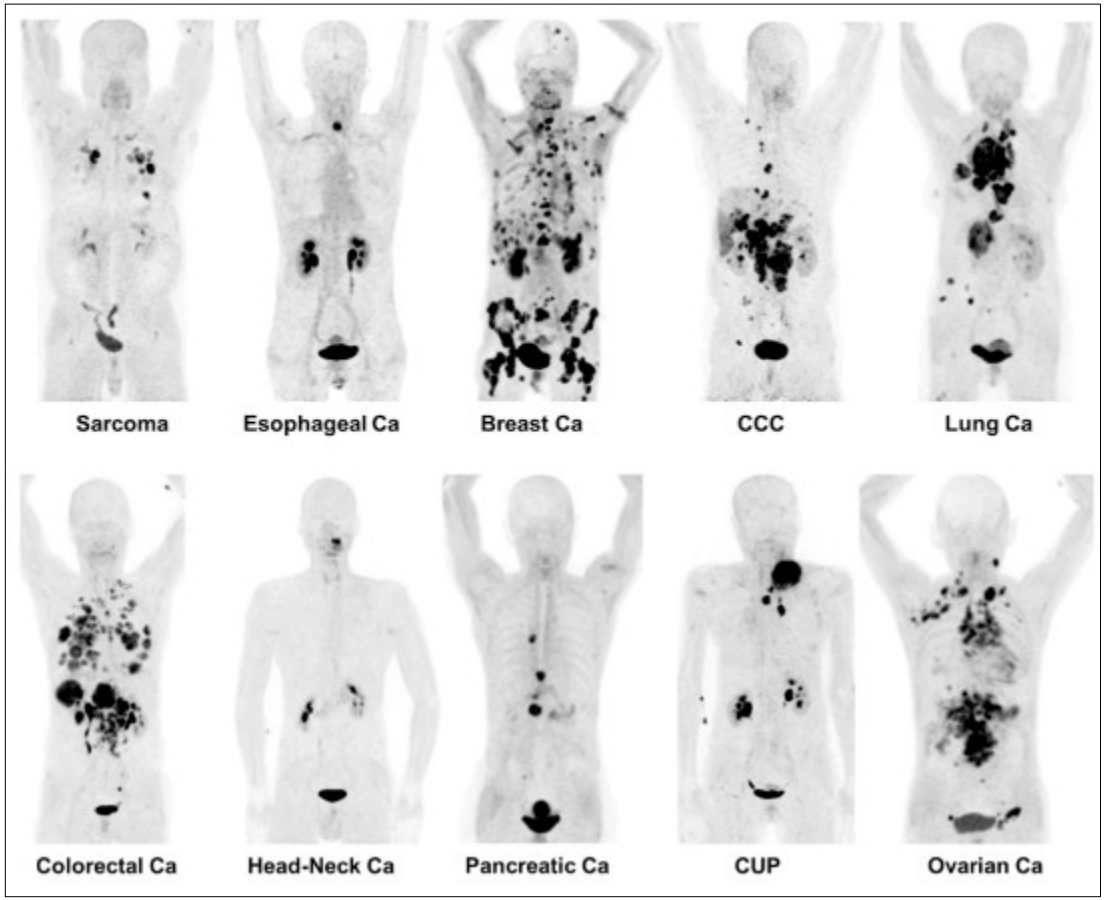
Fibroblast activation protein inhibitor

Image of fibroblasts associated with tumor stroma.



Mori Y et al. *Radiology*. 2023;306(2):e220749.

^{68}Ga-FAPI Uptake in 28 Different Neoplasms

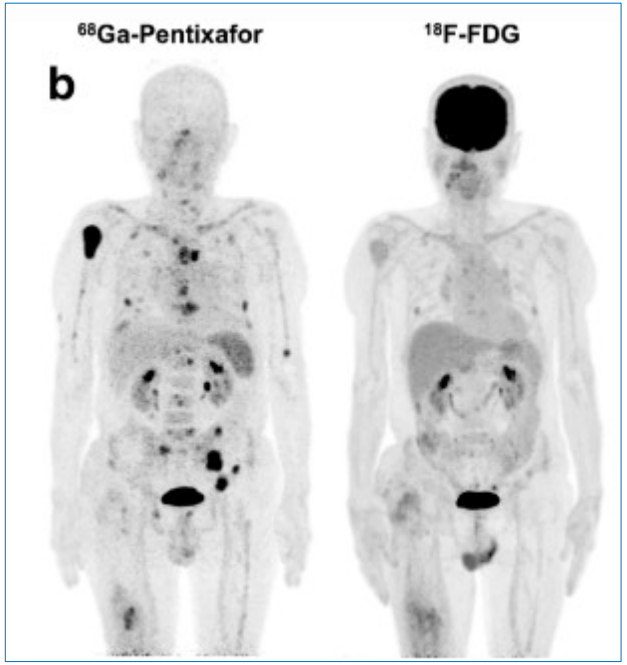


Kratochwil C, et al. *J Nucl Med.* 2019;60(6):801-805.

PentixaFor / PentixaTher

Expression of the Chemokinin-4 receptor ($CXCR_4$)

$CXCR_4$: related to the progression of several neoplasms.



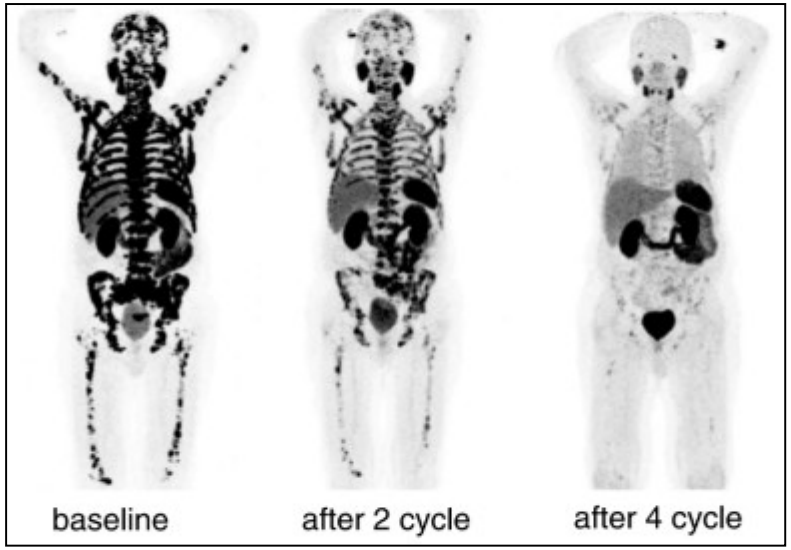
Pan Q, et al. *Eur J Nucl Med Mol Imaging*. 2020;47(3):537

PSMA

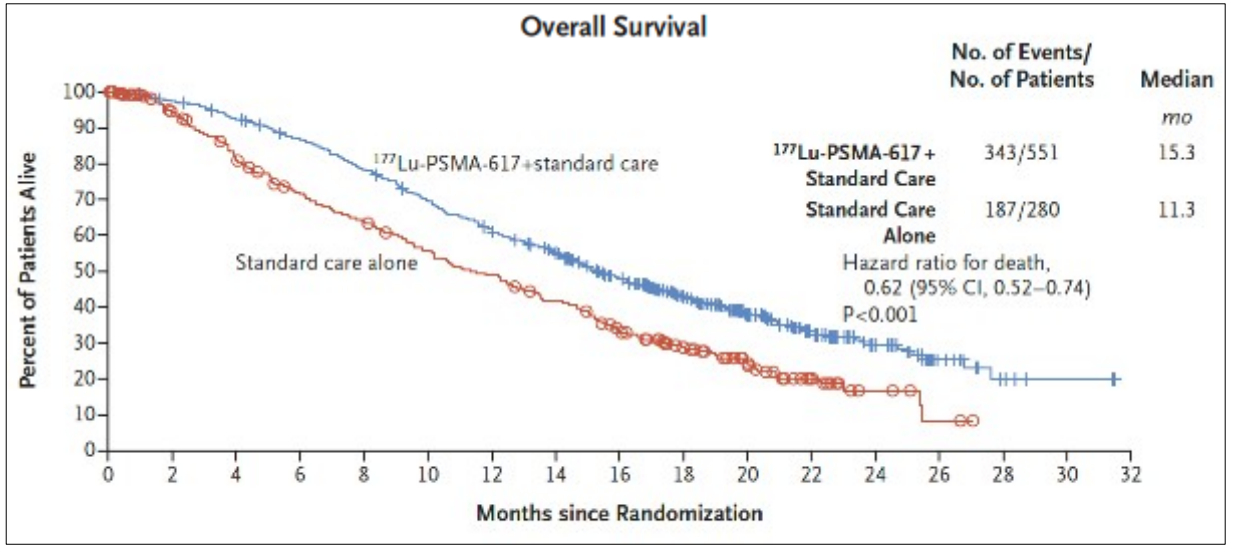
Prostate-Specific Membrane Antigen

- Transmembrane glycoprotein
- Expressed in secretory cells of normal prostatic epithelium.
- Overexpressed in prostate cancer.

Treatment of Prostate Cancer with ^{177}Lu-PSMA



Clinical Nuclear Medicine • Volume 42, Number 2, February 2017



N Engl J Med 2021;385:1091-103.

PSMA

Prostate-Specific Membrane Antigen

- Not prostate-specific! Also a marker of tumor neoangiogenesis.
- First molecule used in the context of CancerThera clinical research.

PSMA

Prostate-Specific Membrane Antigen

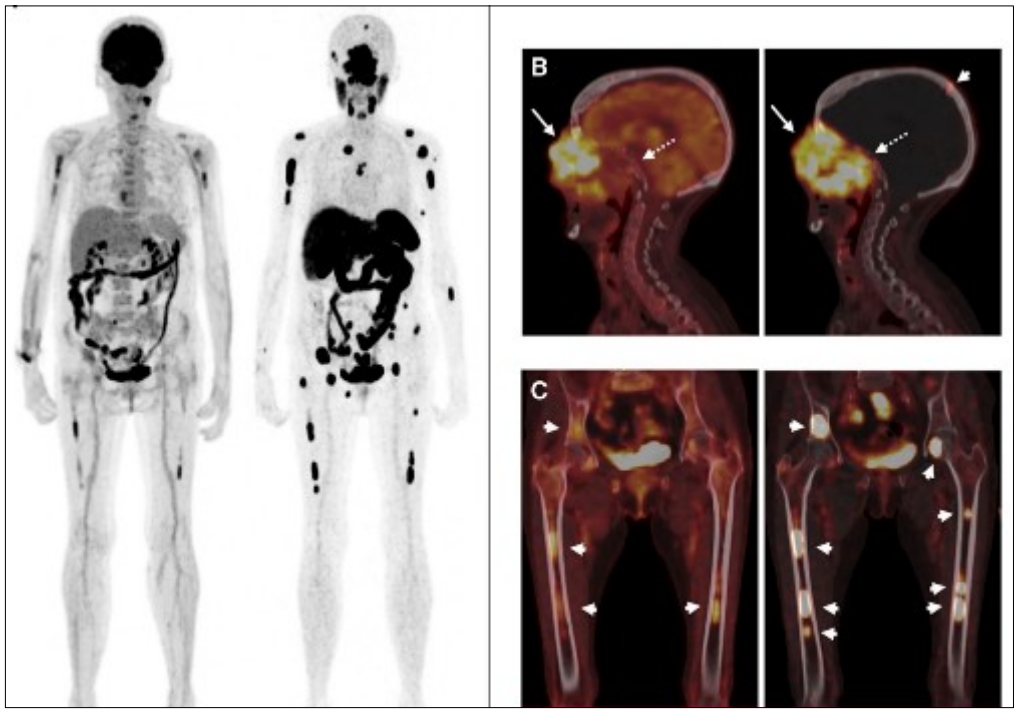
Different neoplasms are being studied with PSMA imaging (115 patients):

- multiple myeloma*
- lymphomas
- myelofibrosis*
- urothelial carcinoma
- head and neck cancer
- sarcomas*
- thyroid cancer*
- desmoid tumor
- colorectal cancer
- hepatocellular carcinoma
- melanoma

* Total of 9 patients treated with 1 or 2 cycles of ^{177}Lu-PSMA (compassionate)

Head-to-head comparison of [^{68}Ga]Ga-PSMA-11 and [^{18}F]FDG PET/CT in multiple myeloma

Stephan P. M. Souza[1] · Fernanda C. Frasson[1] · Maria Emilia S. Takahashi[2] · Gislaine B. O. Duarte[3] · Vania P. Castro[1] · Fernando V. Pericole[3] · Licio A. Velloso[4,5] · Carmino A. De Souza[3,5] · Irene Lorand-Metze[5] Allan O. Santos[1] · Celso D. Ramos[1,4]



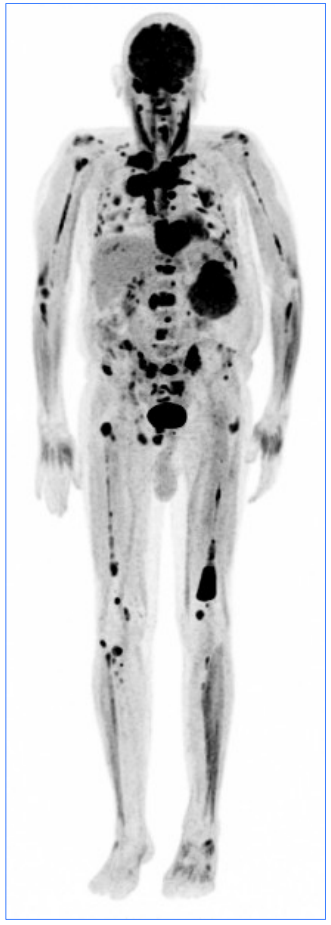
- The marked PSMA uptake in some cases raises the possibility of a theranostic approach in selected patients.

Eur J Nucl Med Mol Imaging. 2023 Jul;50(8):2432-2440.

Treatment of Multiple Myeloma with ^{177}Lu-PSMA

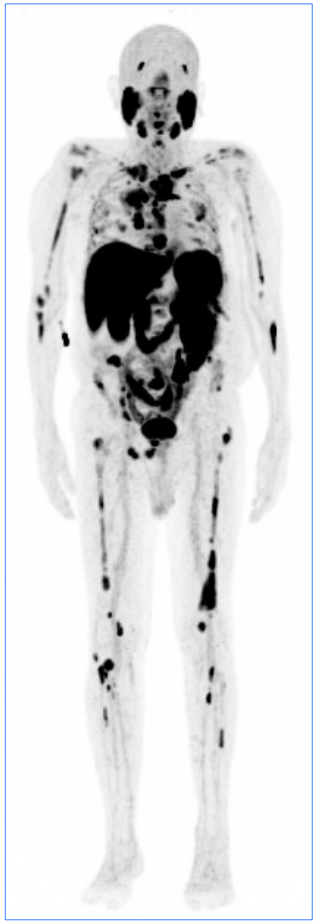
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^{18}F-FDG



pre dose

^{18}F-PSMA

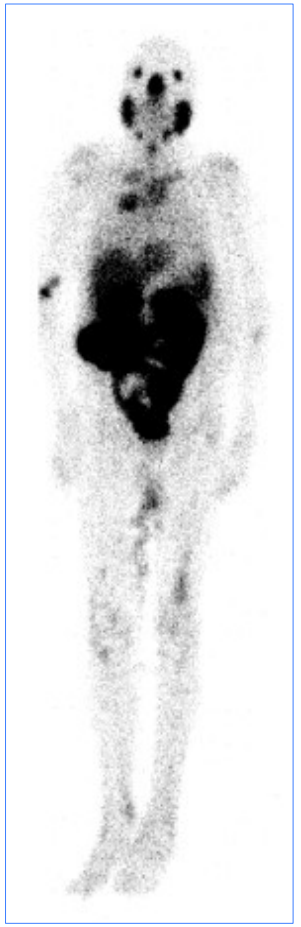


pre dose

^{177}Lu-PSMA (200 mCi)



21h after



30h after



7dias after

Treatment of Multiple Myeloma with ^{177}Lu-PSMA

Before

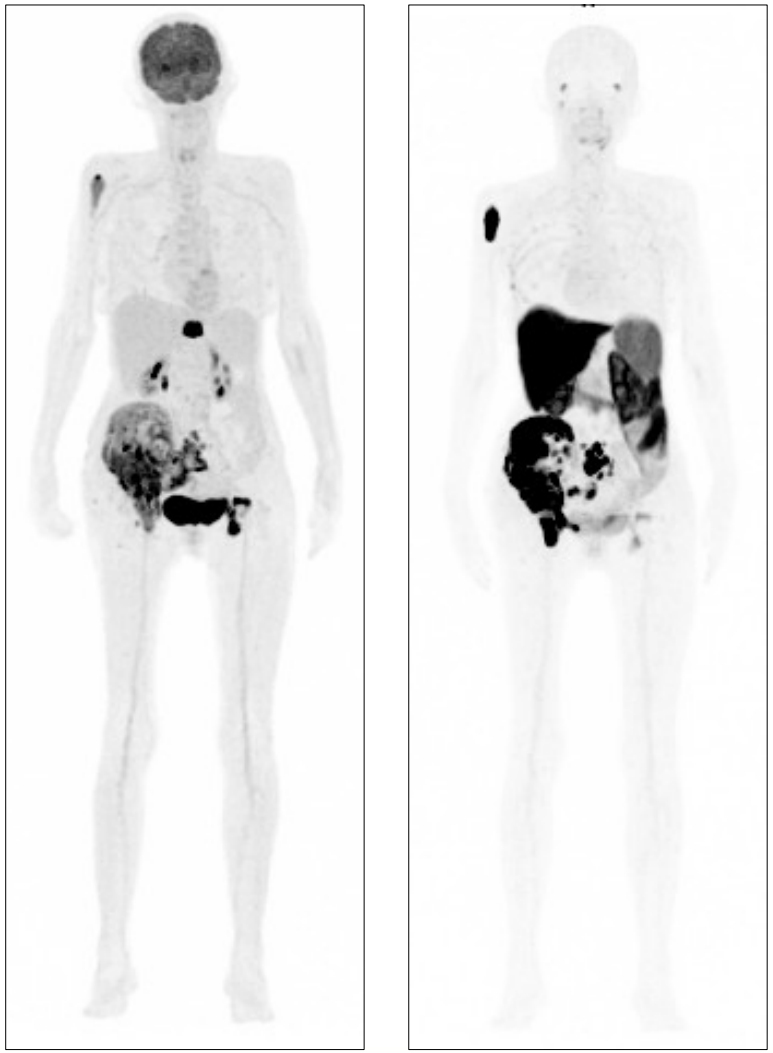


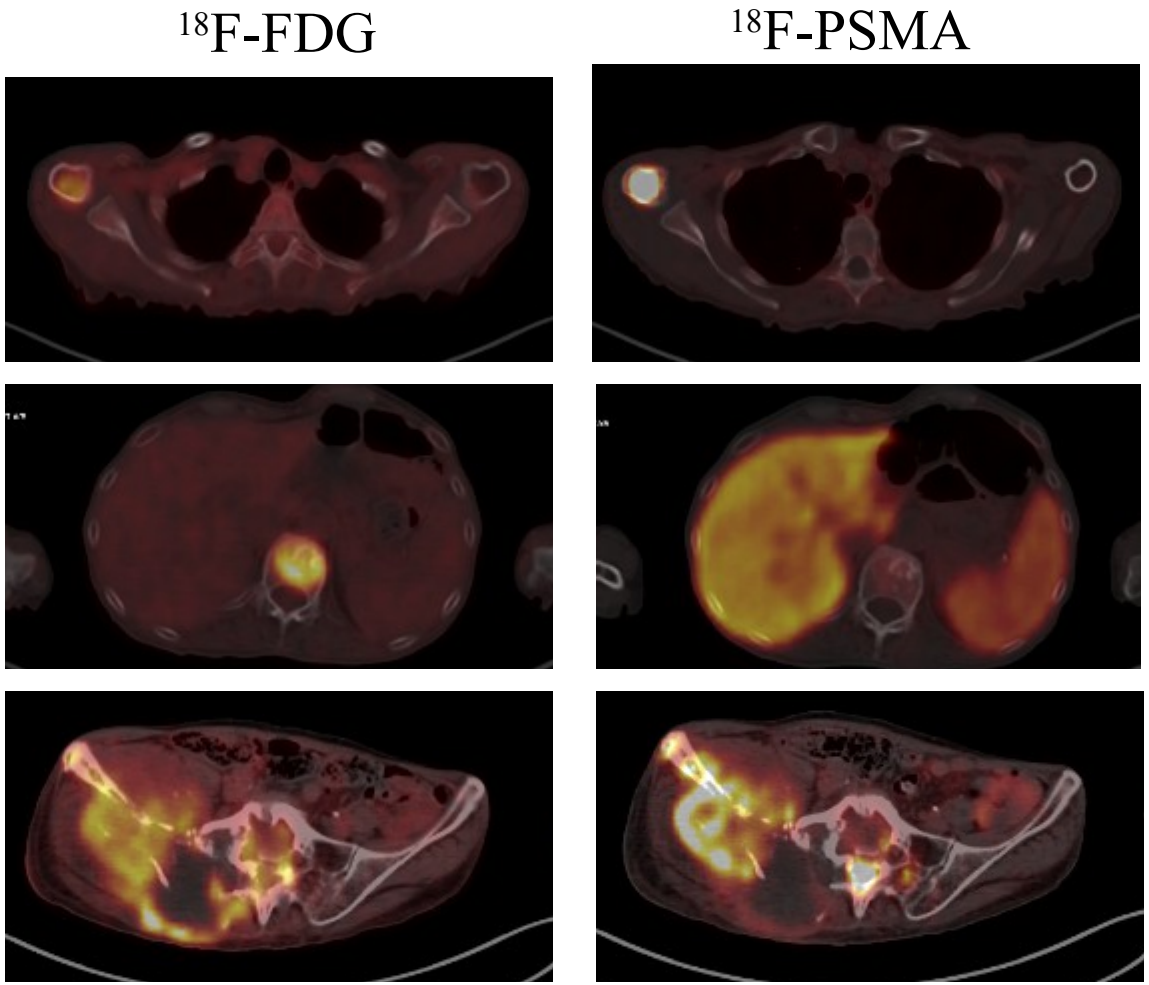
7 days after



- pain reduction;
- softening of the lesion, suggesting necrosis.

Radioiodine Resistant Thyroid Cancer



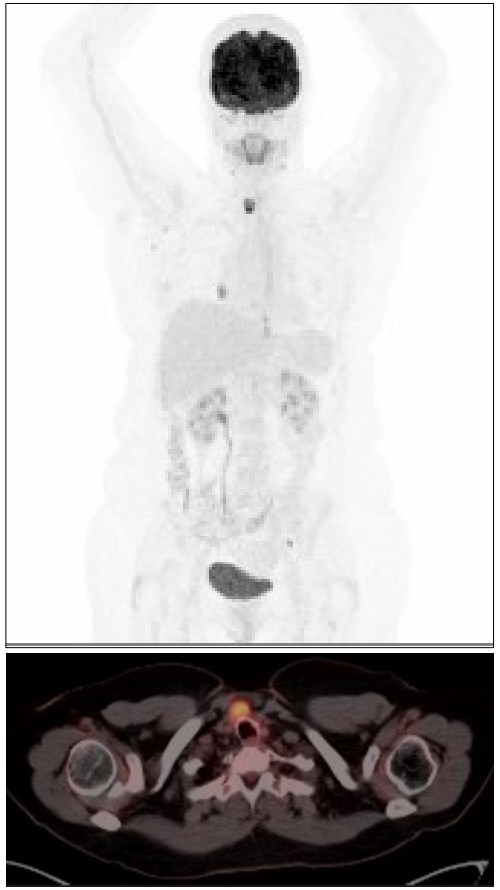


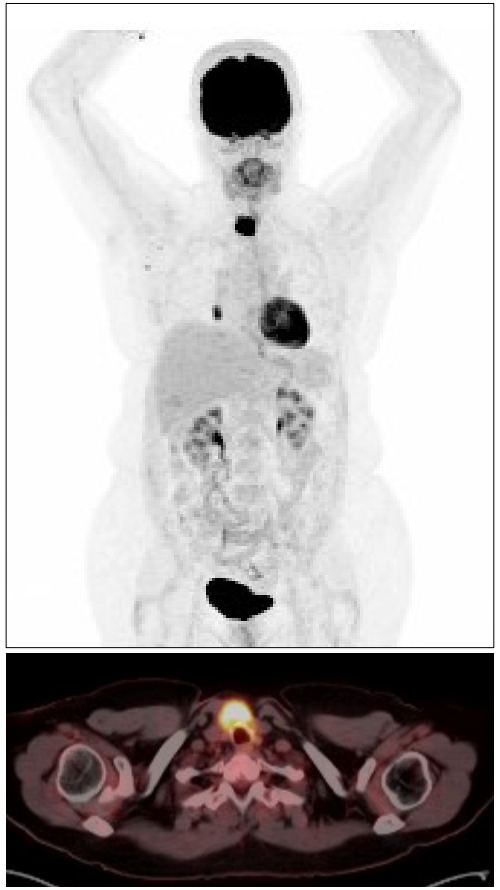
Radioiodine Resistant Thyroid Cancer

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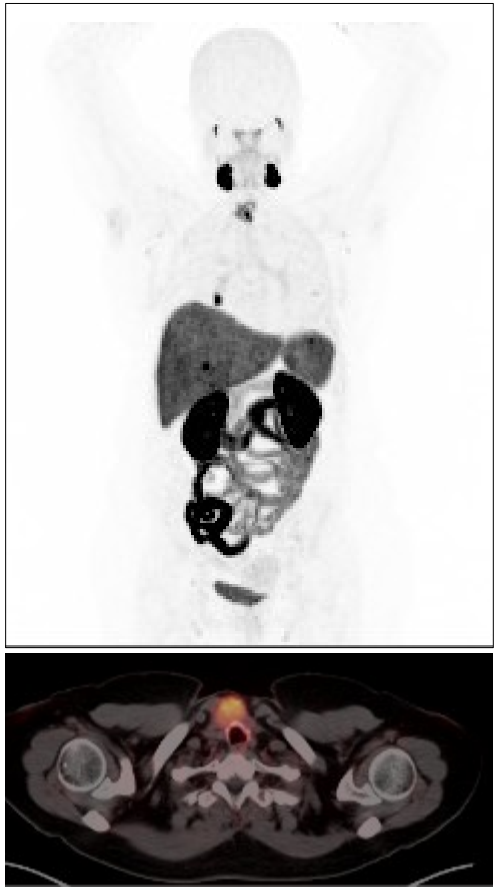
Treatment with 2 cycles of ^{177}Lu-PSMA

^{18}F-FDG Before	^{18}F-FDG 6 mo. after 2 cycles	^{18}F-PSMA Before	^{18}F-PSMA 6 mo. after 2 cycles









Strengths of Our Research Group

- **Multidisciplinary Team and Cutting-Edge Infrastructure**

- **Strategic Collaborations:** Strong links with leading national institutions.
  – IPEN (nuclear research reactor)
  – AMAZUL (architectural and engineering support for nuclear facilities)

- **Clinical Research Potential:** Located within a large general hospital: access to a high patient volume for clinical trials and translational studies.

Current Limitations

Limited Access to Key Radioisotopes for Therapy.

- **Lutetium-177** ($T_{1/2}$ = 6.7 days)
  - High import costs and bureaucratic barriers
  - Supply chain instability

- **Actinium-225** ($T_{1/2}$ = 10 days)
  - Currently unavailable in Brazil

Possible Alternatives

- **Renium-188:** $^{188}W/^{188}Re$ generator system.
- Advantage: Long parent half-life (^{88}W, $t_{1/2}$= 69 days) → Extended usability

^{67}Ga as a Practical Alternative to ^{68}Ga

- Longer half-life (78h vs. 68min) → Nationwide distribution
- Pre-treatment dosimetry → Optimized efficacy

Cancer Theranostics Innovation Center (CancerThera)

Cooperation

CancerThera is fully open to collaborations with universities and companies from Brazil and around the world.

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Merci!

cdramos@unicamp.br

UNICAMP

CancerThera
centro de inovação teranóstica em câncer

FAPESP