

# Production and Application of Radioisotopes

*Maria dos Anjos Neves*

## Objectives

The main goal is the production of radioisotopes at the Portuguese Nuclear Reactor (RPI) and its application in the field of new radiopharmaceuticals. Also, to collaborate with other research groups interested on R&D actions involving radioisotopes.

The main actions established for 2000 were:

1. R&D actions on new radiopharmaceuticals for systemic therapy, in particular **bisphosphonates with Sm-153**. (1)
2. Collaboration with IBILI and Department of Biochemistry - University of Coimbra, concerning the production of **Sm-153 and the labeling of DTPA derivatives**. (2)
3. **Baboon evaluation of <sup>99m</sup>Tc-biguanide** as a tracer for renal imaging at the Institute of Life Sciences, University of Pretoria. (3)

## Results

1. There are several BPs used in humans for inhibition of bone resorption, but their action mechanism is not yet clear. By molecular mechanics computational studies the molecular structures of alendronate, pamidronate and neridronate (which differs only in the aliphatic chain length) are simulated to interact with hydroxyapatite (HAP), the bone mineral component, using a Silicon Graphics Workstation and Cerius II software. Interactions energies and bone resorption potency were compared with *in vitro* and *in vivo* studies of Sm-153 complexed by the referred BPs. The BPs were synthesized and

characterized by elemental analyses and <sup>1</sup>H-NMR. Radiolabelling with Sm-153, radiochemical characterization, HAP binding, and mice biodistribution studies were performed. <sup>153</sup>Sm-alendronate has shown the highest interaction energy and the highest values of HA binding and bone uptake. Interactions between the electrons donor BPs atoms and Ca ions of HAP are dominant. The knowledge of active groups and interactions (type and energy) involved in binding of BPs to HAP, is very important for the design of new BPs for bone therapy.

2. Our participation was to supply Sm-153 in the appropriated chemical form, and collaboration on labeling procedures and radiochemical control.
3. The baboon scintigraphic and dosimetric studies of <sup>99m</sup>Tc-biguanide as a tracer for renal imaging were performed. Our collaboration was to supply the radiopharmaceutical in a kit form, previous developed.

## Published work

- [1] Neves, M., Dormehl, I., Kilian, E., Low, W.K.A., Lalaoui, K., Pedroso de Lima, J.J., Evaluation in the Baboon Model of <sup>99m</sup>Tc-Biguanide as a Tracer for Renal Imaging, *Nuclear Medicine & Biology* **27** (6) (2000) 593-597.
- [2] Neves, M., Kling, A., Lambrecht, R.M., Utilization of low power reactors for therapeutic radiopharmaceuticals, IAEA-CSP-4/C (2000), ISSN 1562-4153.

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- (1) M.C. Costa, M.R. Costa, INETI (*synthesis and characterization of bisphosphonates*)  
Rui Fausto, Mário Rosado, Dept. Chemistry – Univ. of Coimbra (*computational chemistry*)
  - (2) C. Geraldes, I. Prata, Dept. Biochemistry – Univ. Coimbra  
J. J. Pedroso de Lima, A.C. Santos, IBILI
  - (3) Dormehl, E. Kilian, Institute of Life Sciences, University of Pretoria, South Africa

## Research Team

### Researchers

- Maria dos Anjos Neves (Aux. Researcher)  
(**Group Leader**)
- L. Gano (Aux. Researcher) (5%)
- A. Kling (Aux. Researcher) (5%)

### Students

- Nuno Pereira (Praxis **BSc** student)

### Publications

Journals:	2
Conf. Communications:	2

### Funding

	×10 <sup>3</sup> PTE
<b>Research Projects<sup>(a)</sup>:</b>	6602
<b>Pharmaceutical Industry:</b>	700
<b>TOTAL:</b>	<b>7832</b>

(a)

	×10 <sup>3</sup> PTE
- Syntheses and characterization of Technetium Biguanide Complexes (PRAXIS/2/2.1/SAU/1396/95) – October 1996 - March 2000 (15 000 × 10 <sup>3</sup> PTE → ITN/14 230 × 10 <sup>3</sup> PTE) ITN/Co-ordinator: <b>M. Anjos Neves</b> , Partners, AIBILI (J.J. Pedroso de Lima) .....	2702
- Radiopharmaceuticals for bone therapy (PRAXIS/P/SAU/14036/95) – March 1999 - March 2001 (13 000 × 10 <sup>3</sup> PTE → ITN/10 560 × 10 <sup>3</sup> PTE) ITN/Co-ordinator: <b>M. Anjos Neves</b> , Partners, INETI (M.C. Costa, M.R. Costa) .....	3900
- Bilateral Collaboration between ITN and Nuclear Energy Commission of Chile	
- ITN/Co-ordinator: <b>M. Anjos Neves</b> .....	530