

# Chemical and Radiopharmaceutical Sciences

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The **Chemical and Radiopharmaceutical Sciences Unit** (CRSU, formerly Chemistry Sector) reinforced its competence skills and pursued its activities in the synthesis and characterization of inactive and radioactive compounds with relevance in Health, Materials and Nuclear Sciences and Catalysis, and in the implementation and use of nuclear-based and related analytical techniques in Environmental and Earth Sciences and Cultural Heritage. The activities are developed by five research teams:

**Applied Geochemistry & Luminescence on Cultural Heritage (GeoLuC)** – dedicated to the study of the Portuguese cultural heritage materials and environmental contexts, through the application of nuclear methods, geochemistry and mineralogy. The main techniques used comprise INAA, XRD and luminescence (TL and OSL) and are applied to archaeometry, environmental geology and palaeoenvironmental reconstruction studies. Investigations of the composition and internal dosimetry of natural quartz grains with relevance for luminescence dating were newly performed.

**Environmental and Analytical Chemistry** – committed to elemental and isotopic analysis as applied to the research fields of environmental geochemistry, isotope hydrology, oceanography and archaeometry. ED-XRF, light isotope MS, HPLC-ICP/QMS, radiocarbon dating and tritium determinations are the main techniques used in sedimentary geochemistry, geochronology, absolute dating, palaeoecology, meteorology, water resources, and archaeometallurgical studies. Research was focused on coastal palaeoenvironmental evolution, upwelling, gas-phase composition in thermomineral waters and metallurgical processes in the Bronze Age.

**Inorganic and Organometallic Chemistry** – devoted to the synthesis, characterization and reactivity studies of actinide and lanthanide compounds. Catalytic studies, advanced MS techniques and calorimetry are used with the aim of understanding the influence of the electronic structure of the elements in the chemical

properties of the compounds. Studies were pursued on the activation and valorisation of C1 feedstocks, namely the catalytic partial oxidation of CH<sub>4</sub> using lanthanide and actinide intermetallics and the electrochemical treatment of CO<sub>2</sub>.

**Radiopharmaceutical Sciences** – involved in basic/applied-oriented research and technology transfer on nuclear tools for molecular imaging and/or targeted radiotherapy. The multidisciplinary research is based on innovative organic and coordination chemistry, bioconjugation, radiochemistry, animal and cell studies and cellular and molecular biology. A myocardial imaging probe prepared in the Group is now being developed in GMP conditions for human evaluation by a pharmaceutical company.

**Solid State** – centred in the study of new materials with unconventional electrical and magnetic properties. It combines a high expertise on preparative chemistry of molecule based conducting and magnetic materials and of *f*-element intermetallic compounds with a wide range of specialized solid state physics techniques. The elucidation of the structural details of a Co chain compound with dimerised anions and the discovery of superconductivity in a Au chain compound sharing a borderline with a non-magnetic CDW phase were recent achievements.

New **facilities/equipments** installed in the CRSU during 2008 included a HPLC-ICP/QMS with collision/reaction cell, under the National Program for Scientific Hardware Renewal, and a Microwave Peptide Synthesizer, under a ITN-ITQB partnership.

Researchers at the CRSU maintained their renowned practice of high level **training** of students at the MSc, PhD and Post-doc levels, and of participation in advanced **education** activities in the universities. National and international **projects** financed by the FCT, the EC and Pharmaceutical Companies, most with the scientific coordination of the Unit, are in progress. Further funds were obtained by Protocols, Contracts and Services with different Institutions and Industries.

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