

Summary of the context and overall objectives of the project

PRISMAP – The European medical radionuclide programme, aims at providing emerging and non-conventional radionuclides for scientists across different disciplines in biomedical research.

Radionuclides, since their discovery 125 years ago, have shown their potential for medicine, and have been used in diagnostics and therapeutic applications. They are used either directly or in synthetic compounds and serve as injectable solutions in diagnostics such as PET-CT scan imaging, and therapeutic compounds to treat, e.g., cancers.

Cancer is a major cause of disease and mortality in Europe: in 2022 alone, 2.7 million persons in the European Union were diagnosed with cancer, and 1.3 million persons lost their lives to it. In the past twenty years, new efficient therapeutic drugs based on radionuclides that were previously not available, commercially obtained a marketing authorisation and have been used to treat cancers that were lacking appropriate treatments. However, an imperfect match of the radionuclide properties and the targeted medical applications can lead to reduced efficacy, possible side effects, higher treatment costs, or even the discontinuation of an already marketed drug.

PRISMAP's overarching goal is to eliminate these bottlenecks for the benefit of European citizens and health-care systems. This is achieved by the selection of better radionuclides with appropriate properties, and the development of targeted treatments, notably by combining diagnostic and therapeutic radiopharmaceuticals in so-called theranostic approaches. PRISMAP will support economic growth, as the field is experiencing a double-digit growth and the overall economic impact of cancer in Europe is estimated to exceed €100 billion annually. It can also support other fields of medical research, such as molecular targeted imaging and therapies, treatment of neurological disorders, and new imaging technologies.

Work performed during the second period (Nov 2022-Apr2024)

PRISMAP's access platform, www.prismap.eu, is used to convey information and collect the community's input, alongside a private consortium section for data sharing and communication. Our portfolio covers today 28 different radionuclides, that can be used as active ingredients in diagnostics, treatment, or for theranostics, with the recent addition of four radionuclides requested by the emerging PRISMAP community. Our platform allows scientists interested in biomedical research to easily access synthetic information, such as the type of diagnostic, imaging, or treatment modality, that directly depends on the chemical, physical and nuclear properties of a given radionuclide.

43 Sc Scandium	44 Sc Scandium	47 Sc Scandium	52 Mn Manganese	64 Cu Copper	67 Cu Copper	103 Pd Palladium
111 Ag Silver	128 Ba Barium	128 Cs Caesium	135 La Lanthanum	153 Sm Samarium	149 Tb Terbium	152 Tb Terbium
155 Tb Terbium	161 Tb Terbium	165 Tm Thulium	165 Er Erbium	169 Er Erbium	175 Yb Ytterbium	199 Au Gold
203 Pb Lead	211 At Astatine	213 Bi Bismuth	223 Ra Radium	224 Ra Radium	225 Ac Actinium	
227 Th Thorium	+ Suggest!					

*PRISMAP radionuclide
portfolio period 2 (call-4)*

For each radionuclide we provide general information, together with the mode of production and general applications of the radionuclides in biomedical research with links to published articles when available. We also give full specifications of the quality grades supplied by PRISMAP allowing to clarify if the radionuclide with its properties, and the range of purity grades accessible are appropriate for a given field of biomedical research, including recent data produced in PRISMAP.

New terminologies and standards have been introduced to account for the novel methods of production made available across the PRISMAP consortium, notably combining isotope mass separation with accelerator (cyclotron) or reactor methods, allowing our radionuclides to be supplied in high molar activities. Sometimes the data are insufficiently known or not available at all. The produced new data can be useful in the assessment of the physical and nuclear parameters, purity grades, or their application in biomedical research. A new information portal has been established on our platform to provide everybody access to the accepted data as well as the newly created knowledge. This enables the synthesis and use in radiopharmaceuticals targeting specific tumour receptors, as can be seen in our ongoing research projects (<https://www.prismap.eu/about/outcomes/>).

PRISMAP can provide access, free of charge, to new radionuclides and new grades of these to researchers across Europe and beyond, either directly in their laboratory, or by accessing one of our biomedical research centres licensed to handle these new radionuclides.

After 3 additional calls in period 2, a total of 32 user projects from 33 research groups and 12 countries have been selected to develop their research projects. The selected projects cover a wide range of disciplines in radiochemistry, radiation physics, radiopharmacy, preclinical and translational biomedical research, and target different types of cancer and experimental approaches, as the first publications and reports at conferences have shown, e.g., comparing the emerging Tb-161 radiolanthanide efficacy with the Lu-177 benchmark used for neuroendocrine and advanced prostate cancer treatments.

Targeted alpha therapy, an efficient mode of treatment exploiting alpha emitters, also benefits from research and data produced in PRISMAP. This is particularly true for radionuclides which present short half-lives and require efficient dispatch, such as new schemes tested with private air carriers allowing reaching PRISMAP nodes located 2000 km apart in a 4-hour door-to-door lead time, as demonstrated for the delivery of Er-165.

The radionuclides offered by PRISMAP are beyond the common clinical practice and require particular attention for the users, as well as for the future clinical practice. PRISMAP has thus established a training programme that has attracted many talented young researchers, as well as reaching out to established researchers across the disciplines where the PRISMAP community is represented.

Beyond the state of the art, expected results and potential impact

Our activities have so far allowed PRISMAP to launch various interactions, such as with the European Medicine Agency and the Bureau International des Poids et Mesures. To maximise the output of PRISMAP and prepare for a PRISMAP+ programme, new infrastructures are integrated when they become available, such as SPES and SPIRAL2, which are in the demonstrator and commissioning phases. We also interact with other European infrastructure projects, such as EuroBioimaging to maximise future synergistic actions in the medical field. Input from other programmes, such as those active in Japan and North America, has provided us with important insights and will allow PRISMAP to develop future links with other geographically distributed programmes.

As PRISMAP is delivering its radionuclides to European biomedical researchers, some of them hosted in our biomedical nodes during their projects, the first outcomes are published and presented at international scientific conferences. Alongside we have published or patented technical developments together with position papers and reports, notably on the needs for metrological data on PRISMAP radionuclides together with regulatory frameworks for transport and research with radiopharmaceuticals, in association with the IAEA.

We are confident that these various elements will help unite a currently dispersed PRISMAP community by shaping a more mature PRISMAP+ for a European Medical Radionuclides Programme, a one-stop shop for biomedical researchers who need to develop research activities with non-conventional radionuclides in the years to come.



*Dave Townsend visiting
PRISMAP facility
MEDICIS at CERN*



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