



OPEN ACCESS

EDITED AND REVIEWED BY
Giorgio Treglia,
Ente Ospedaliero Cantonale
(EOC), Switzerland

*CORRESPONDENCE
Nicolas Lepareur
✉ n.lepareur@rennes.unicancer.fr

RECEIVED 05 April 2024
ACCEPTED 08 April 2024
PUBLISHED 23 April 2024

CITATION
Lepareur N (2024) Editorial: Recent advances
in nanoradiopharmaceuticals for molecular
imaging and radiotherapy.
Front. Med. 11:1412600.
doi: 10.3389/fmed.2024.1412600

COPYRIGHT
© 2024 Lepareur. This is an open-access
article distributed under the terms of the
[Creative Commons Attribution License \(CC
BY\)](https://creativecommons.org/licenses/by/4.0/). The use, distribution or reproduction in
other forums is permitted, provided the
original author(s) and the copyright owner(s)
are credited and that the original publication
in this journal is cited, in accordance with
accepted academic practice. No use,
distribution or reproduction is permitted
which does not comply with these terms.

Editorial: Recent advances in nanoradiopharmaceuticals for molecular imaging and radiotherapy

Nicolas Lepareur^{1,2*}

¹Comprehensive Cancer Center Eugène Marquis, Pharmacy Department, Rennes, France, ²University of Rennes, Inrae, Inserm, Institut NUMECAN (Nutrition, Métabolismes et Cancer) – UMR_A 1341, UMR_S 1317, Rennes, France

KEYWORDS

drug delivery, molecular imaging, multimodality, nanomedicine, nuclear medicine, radiolabeled nanomaterials, radionuclide therapy, radiopharmaceuticals

Editorial on the Research Topic

Recent advances in nanoradiopharmaceuticals for molecular imaging and radiotherapy

The combination of nanotechnology with nuclear medicine offers attractive diagnostic and therapeutic opportunities for the management of various conditions, notably cancer. Radiolabeled nanoparticles represent an innovative class of radiopharmaceutical agents holding great promises, by exploiting the intrinsic advantages of nanoparticles, such as increased surface area-to-volume ratio, targeting ability, high payload, and the potential for multiplexing several functionalities within one construct (multimodal imaging, combination therapies, or a mixture of both for theranostics), to provide groundbreaking medical solutions to address unmet medical needs.

This Research Topic for Frontiers in Medicine seeks to provide an overview of recent progresses in the field of nanomedicine and radiopharmaceuticals, with new approaches to the design and formulation of innovative radiolabeled nanoconstructs and their applications, advantages, limitations and future prospects, and challenges. Research on the combination of different radionuclides or radiopharmaceuticals with passively or actively targeted nanoparticles offers the possibility to increase personalized diagnostic efficacy and radiotherapeutic index.

Rare earth elements, i.e., scandium, yttrium and the 15 lanthanoids, are a family of elements which has proven to be particularly useful for cancer management. Wang and Li performed an extensive analysis of the literature dealing with the application of rare earth elements in cancer diagnosis and treatment. It ranged from lanthanide-doped nanomaterials to therapeutic radiopharmaceuticals, using especially yttrium-90, an electron-emitting nuclide particularly suited for radioembolization of liver cancers.

Another lanthanide that emerged as particularly attractive for cancer treatment is lutetium-177. Encapsulating both this nuclide and a drug, regorafenib, in PLGA nanoparticles, moreover decorated with receptor-specific ligands, targeting the cancer-overexpressed CXCR4 chemokine receptor, Cruz-Nova et al. demonstrated the interest of the combination of chemotherapy and radiopharmaceutical therapy in a colorectal cancer model.

^{99m}Tc-sulfur colloids are a routinely used type of radiolabeled nanoparticles, valuable for a variety of indications, such as gastric emptying, sentinel lymph node scintigraphy, or assessment of functional liver reserve. [Klinkert et al.](#) presented us a case report of a patient initially diagnosed with a pancreatic tumor. Using both this agent and a radiolabel somatostatin analog, the authors could conclude it was in fact an intrapancreatic accessory spleen, thus highlighting the clinical usefulness of this diagnostic radiotracer.

Finally, a mini-review by [Dixit et al.](#) reported the different types of nanoconstructs and targeting strategies currently employed for nanoradiopharmaceuticals, to take advantage of both medical technologies, emphasizing the diversity of investigated approaches.

Author contributions

NL: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing.

Funding

The author(s) declare financial support was received for the research, authorship, and/or publication of this article. This work

has been supported in part by a grant from the French National Agency for Research called Investissements d'Avenir Labex IRON No. ANR-11-LABX-0018-01.

Acknowledgments

The invited editors acknowledge all the authors who participated to this Research Topic for submitting high quality manuscript.

Conflict of interest

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.