Acta Chimica and Pharmaceutica Indica
ISSN: 2277-288X

Acta Chimica and Pharmaceutica Indica

Exploring the boron chemical space towards new BNCT agents

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Abstract

Boron Neutron Capture Therapy (BNCT) is a binary therapy that employs neutron irradiation on the boron agents to release high-energy helium and alpha particles able to kill cancer cells. This technique is used for cancer treatment by a selective accumulation of 10B-containing compounds in tumor cells and is limited to tumors not responding to conventional therapies, such as glioblastoma multiforme, melanoma, and head, and neck tumors. Optimal response to BNCT depends critically on the maximal 10B accumulation in tumor cells when performing the neutron irradiation. Until recently, the use of nuclear reactors as a primary source of neutrons has limited BNCT application in a hospital setting. Moreover, the only two compounds clinically used, boronophenylalanine (BPA) and sodium borocaptate (BSH), have shown significant limitations. The development of accelerators as neutron sources has sparked new interest in BNCT, stimulating the research towards the design of new boronated molecules. We herein present the synthesis of new compounds containing boron moieties linked to saccharidic structures as potential agents for BNCT. We will focalize on the development of new theranostic agents containing a trifluoroborate moiety that can furnish at the same time the boron atom required for BNCT, while the fluorine atoms can be exchanged by an 18F isotope which can be exploited as a positron emitter, guiding BNCT in an orthogonal modality. To ensure a higher tumor affinity vs normal cells, trifluoroborate will be conjugated to molecules able to selectively target cancer cells. In our compounds, sugars represent the substructures of choice exploiting their higher consumption by malignant cells and their selective uptake thanks to GLUT transporters.

Biography

Daniela Imperio graduated in Medicinal Chemistry with 110 magna cum laude and completed her PhD in Pharmaceutical and Food Biotechnology in 2011 at the University of Eastern Piedmont, Italy. After a few years as a R&D researcher in a pharmaceutical industry, she is currently a post- doctoral researcher in organic chemistry and adjunct professor of organic chemistry at the degree course in Biological Sciences, University of Eastern Piedmont. She has 16 publications, 1 patent, 2 book chapters, and her H-index publication is 7. Her research is focused on the synthesis of new glycolipid molecules for synthetic vaccines and on saccharide structures containing boronic clusters that can be used for Neutron Boron Capture Therapy.

Publications

1.Life Theranostics in Boron Neutron Capture Therapy

2.Synthesis and Characterisation of a Boron-Rich Symmetric Triazine Bearing a Hypoxia-Targeting Nitroimidazole Moiety

3.A Short Method for the Synthesis of Hydroxyoleic Acids

4.Gentianose: Purification and structural determination of an unknown oligosaccharide in grape seeds

5.An Efficient and Concise Synthesis of α-Galactosylceramide

4th International Conference on Pharmaceutics & Advanced Drug Delivery Systems | Berlin, Germany | April 05, 2021

Citation: Daniela Imperio, Exploring the boron chemical space towards new BNCT agents, Pharmaceutical Science 2021, 4th International Conference on Pharmaceutics & Advanced Drug Delivery Systems, Berlin, Germany, April 05, 2021