MULTIFUNCTIONAL PORPHYRIN-LIPID NANOPARTICLES FOR CANCER THERANOSTICS: FROM DISCOVERY TO FIRST-IN-HUMAN AND BEYOND

Brian C Wilson, Princess Margaret Cancer Centre/University of Toronto Author
brian.wilson@uhnresearch.ca
Gang Zheng, Princess Margaret Cancer Centre/University of Toronto

Key Words: nanoparticles, multifunctionality, cancer, theranostics

Porphysomes (PS) are self-assembled porphyrin-lipid nanoparticles that have a unique range of intrinsic optical and radiological properties and which have potential for new approaches to cancer theranostics, i.e. image-guided therapeutics. Which properties are “expressed” differs between intact and, after cell uptake, dissociated states. The properties include contrast for optical imaging and/or spectroscopy (photoacoustic, fluorescence, diffuse), light-based therapeutics (photothermal, photodynamic, photochemical immune stimulation) and, by incorporation of suitable isotopes into the porphyrin structure, radiological imaging (PET, MRI) and radiation therapy (radioisotope, radiodynamic).

This paper will comprise four main sections. Firstly, we summarize the preclinical studies in multiple tumor types *in vitro* and *in vivo* that have confirmed the various functional capabilities [1,2]. Secondly, the >10-year journey from discovery of the “parental” PS in 2010 [3] towards first clinical studies planned for 2024 will be outlined to illustrate the many translational hurdles in this process that will apply to any optically-active agent intended for human use. Thirdly, some of the additional properties of “next-gen” PS are presented as “teasers” for possible future developments and, lastly, new challenges and opportunities in optical techniques and technologies in using PS in patients with different tumors are considered.

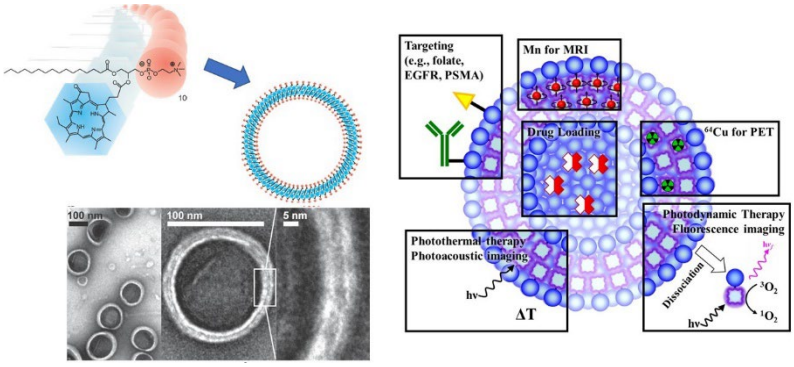

Figure 1. Porphysome self-assembly (left) and multifunctionality (right)

References

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2. Overchuk M et al., ACS Nano 2023, 17, 7979–8003
3. Lovell JF et al., Nature Materials 2011, 10: 324-332

Acknowledgements. This work was supported primarily by the Terry Fox Research Institute, the Canadian Cancer Society, the Canadian Institutes of Health Research and the Princess Margaret Foundation.