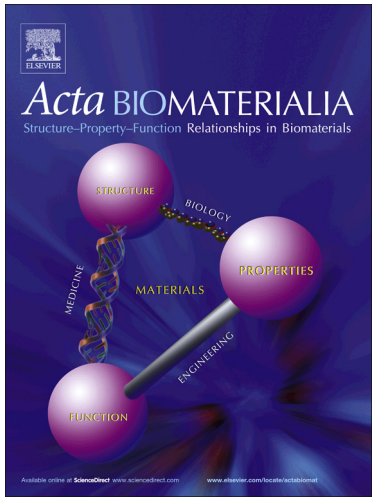
Accepted Manuscript



Review article

Towards tailored management of malignant brain tumors with nanotheranostics

Juan Aparicio-Blanco, Ana-Isabel Torres-Suárez

PII: S1742-7061(18)30232-0
DOI: https://doi.org/10.1016/j.actbio.2018.04.029
Reference: ACTBIO 5429

To appear in: *Acta Biomaterialia*

Received Date: 21 December 2017
Revised Date: 16 April 2018
Accepted Date: 16 April 2018

Please cite this article as: Aparicio-Blanco, J., Torres-Suárez, A-I., Towards tailored management of malignant brain tumors with nanotheranostics, *Acta Biomaterialia* (2018), doi: https://doi.org/10.1016/j.actbio.2018.04.029

Towards tailored management of malignant brain tumors with nanotheranostics

Juan Aparicio-Blanco [a], Ana-Isabel Torres-Suárez [a, b,*]

[a] Department of Pharmaceutical Technology and Food Engineering, Complutense University, 28040, Madrid, Spain

[b] University Institute of Industrial Pharmacy, Complutense University, Madrid, Spain

[*]Corresponding author: Prof. Ana I. Torres-Suárez

Department of Pharmaceutical Technology and Food Engineering, Complutense University, 28040, Madrid, Spain

Telephone: +34 91 394 1735; e-mail: galaaaa@ucm.es

Abstract

Malignant brain tumors still represent an unmet medical need given their rapid progression and often fatal outcome within months of diagnosis. Given their extremely heterogeneous nature, the assumption that a single therapy could be beneficial for all patients is no longer plausible. Hence, early feedback on drug accumulation at the tumor site and on tumor response to treatment would help tailor therapies to each patient's individual needs for personalized medicine. In this context, at the intersection between imaging and therapy, theranostic nanomedicine is a promising new technique for individualized management of malignant brain tumors. Although brain nanotheranostics has yet to be translated into clinical practice, this field is now a research hotspot due to the growing demand for personalized therapies. In this review, the barriers to the clinical implementation of theranostic nanomedicine for tracking tumor responses to treatment and for guiding stimulus-activated therapies and surgical resection of malignant brain tumors are discussed. Likewise, the criteria that nanotheranostic systems need to fulfil to become clinically relevant formulations are analyzed in depth, focusing on theranostic agents already tested *in vivo*. Currently, magnetic nanoparticles exploiting brain targeting strategies represent the first generation of preclinical theranostic nanomedicines for the management of malignant brain tumors.

Statement of significance

The development of nanocarriers that can be used both in imaging studies and the treatment of brain tumors could help identify which patients are most and least likely to respond to a given treatment. This will enable clinicians to adapt the therapy to the needs of the patient and avoid overdosing non-responders. Given the many different approaches to non-invasive techniques for imaging and treating brain tumors, it is important to focus on the strategies most likely to be implemented and to design the most feasible theranostic biomaterials that will bring nanotheranostics one step closer to clinical practice.

Keywords

Brain theranostics, brain targeting, blood-brain barrier, nanoimaging, nanomedicine