ARGETING NEURONS OVERCOMING EXTRA AND INTRACELLULAR BARRIERS WITH BIOMATERIAL-BASED VECTORS TO PROMOTE NEUROPROTECTION AND NEUROREGENERATION

ANA PAULA PÊGO*

INEB - INSTITUTO DE ENGENHARIA BIOMÉDICA, UNIVERSIDADE DO PORTO, PORTUGAL
I3S – INSTITUTO DE INVESTIGAÇÃO E INOVAÇÃO EM SAÚDE, UNIVERSIDADE DO PORTO, PORTUGAL
ICBAS - INSTITUTO DE CIÊNCIAS BIOMÉDICA ABEL SALAZAR, UNIVERSIDADE DO PORTO, PORTUGAL
FEUP - FACULDADE DE ENGENHARIA, UNIVERSIDADE DO PORTO, PORTUGAL
*E-MAIL: APEGO@I3S.UP.PT

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Nervous system problems are common and encompass a large spectrum of traumatic injuries, diseases or iatrogenic lesions. The poor regenerative capacity, particularly in the case of the central nervous system (CNS), cannot be attributed to an intrinsic inability of neurons to sprout and re-grow after injury, as axons are able to regenerate in the presence of a permissive growth environment. One of the challenges facing the neuroscience field is the development of effective therapies that can enhance the regenerative capacity of the nervous system based on the advances achieved in basic research.
We have been dedicated to using nano-enabled solutions to the design of new therapeutic approaches towards the enhancement of the process of nerve regeneration. In this talk, particular emphasis will be given to the design of biomaterial-based nanoparticles for targeted nucleic acid delivery to neurons to promote neuroprotection and neuroregeneration.

Two biomaterial-based vectors will be discussed:
- polymeric nanoparticles based on thiolated trimethyl chitosan to mediate targeted gene delivery to peripheral neurons upon a peripheral and minimally invasive intramuscular administration [1];
- dendrimer based vectors [2] for brain delivery in the aftermath of stroke.

Emphasis will be given to the application of novel strategies proposed to assess the potential of the developed systems and contribute to the design of more efficient nucleic acid delivery vectors. Namely, the use of:
- imaging flow cytometry - a high throughput technique with unique features that combines the statistical strength of flow cytometry with image acquisition of every event - to unravel some critical aspects for vector formulation [3];
- atomic force microscopy as a tool to assess the specificity of targeted nanoparticles in biological models of high complexity [4];
- microfluidic-based platforms to mimic the in vivo administration of neurotropic nanoparticles [5].

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