CIC biomaGUNE
CENTER FOR COOPERATIVE RESEARCH IN BIOMATERIALS

PRESS RELEASE

Efficient, stable and self-standing: new carbon nanotubes to make neurons grow

The research, a joint work between CIC biomaGUNE, the University of Trieste and SISSA, and financed by AXA Research Foundation, is published in the journal ACS Nano

(Donostia-San Sebastián, 9 August 2019). Through targeted chemical modification of carbon nanotubes, innovative materials are obtained that are able to modulate the activity of nerve cells, opening up interesting application horizons for the repair of damaged nerve tissues. The research, a joint work between CIC biomaGUNE, the University of Trieste and SISSA, and financed by AXA Research Foundation, is published in the journal ACS Nano.

Self-supporting carbon nanotubes, able to assume the desired shapes thanks to a special chemical treatment, called crosslinking are, at the same time, able to function as a substrate for the growth of nerve cells, finely modulating growth and activity. It is a new and important step towards the construction of neuronal interfaces for the repair of spinal cord injuries, a result just published in ACS Nano, a prestigious international scientific journal. The study is the new goal of a multi-year project and, in terms of results, a very important collaboration between scientists Laura Ballerini of SISSA and Maurizio Prato, AXA Chair and Ikerbasque Research Proffesor in CIC biomaGUNE.

Self-supporting nanotubes

The carbon nanotubes used in the research have been modified through appropriate chemical treatments: "For many years in our laboratories we have been working on the chemical reactivity of carbon nanotubes, a fascinating material that is very difficult to work with. Thanks to our experience, in this work we have crosslinked them or, to put it more clearly, we have treated nanotubes so that they could bind to each other thanks to specific chemical reactions. We have found that this procedure gives the material some very interesting features. For example, the material is organized in a stable manner according to a precise form, chosen by us: that of a fabric where nerve cells can be implanted, for example.

Or around the electrodes, explains Professor Prato. "We know from previous research that nerve cells grow well on carbon nanotubes and therefore could be used as a surface to build hybrid devices for nerve tissue regeneration. However, we had to make sure that

this chemical modification does not compromise the constructive interaction with neurons ". Towards biosynthetic hybrids Professor Prato continues: "We have thus discovered that chemical processing has important effects because through this treatment we can modulate the activity of neurons, in terms of growth, adhesion and survival. Not only that, even the communication between neurons can be regulated by these materials. In short, we can say that the carpet of crosslinked carbon nanotubes interacts very intensively and constructively with nerve cells ".

This interaction depends on how the different carbon nanotutubes are linked to each other, ie crosslinked. The lower is the number of bonds between the nanotubes, the higher is the activity of the neurons growing on their surface. Through the chemical control of their properties, and of the bonds between them, the response of neurons can therefore be regulated. Together Ballerini and Prato explain: "This is an intriguing result, the result of a refined research in the approach that ranges from chemistry to nanosciences to biology and an important and fruitful collaboration between our research groups. This study also provides a further step in the conception of possible biosynthetic hybrids for restoring the functions of injured nerve tissues".

About CIC biomaGUNE

The Center for Cooperative Research in Biomaterials (CIC biomaGUNE), located in the Gipuzkoa Science and Technology Park, conducts cutting-edge research at the interface between Chemistry, Biology and Physics, and particularly on the properties of molecular level biological nanostructures and their biomedical applications.

CIC biomaGUNE was accredited in 2018 as a "María de Maeztu" Unit of Excellence after assessment of its compliance with a series of excellence requirements characterised by a high impact and level of competitiveness in its particular field of activity and in the scientific arena worldwide. The center's research activities are not only regularly subjected to scientific assessment processes conducted by an external and independent committee of scientists, but are frontier research actions developed in line with a strategic program. Furthermore, the centre also selects, trains and attracts talent on an international level, has active partnership and exchange agreements on an institutional level with other top-level research centers and promotes activities for the transfer and dissemination of knowledge to society at large.

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