Scaffolding nanomaterials for stem cell proliferation, migration and neural differentiation

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Title of project or programme

Scaffolding nanomaterials for stem cell proliferation, migration and neural differentiation

Principal Investigators of project/programme grant

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Source of funding information

VINNOVA

Total sum awarded (Euro)

560000

Start date of award

01-04-2009

Total duration of award in months

36

The project/programme is most relevant to

- Alzheimer’s disease and other dementias
- Parkinson’s disease
- Huntington’s disease

Keywords

Stem cells, nanofibers, neuroregeneration

Research abstract in English

The project explores the possibility to create a regenerative milieu for the adult human brain using biocompatible nanofibers. We investigate how nanofibers, modified by surface nanostructuring and linkage of different cell adhesion molecules and neurotrophic factors, can influence stem cell adhesion, proliferation, migration and differentiation in vitro. Human embryonic stem cells and adult human brain stem cells to develop novel in vitro assays. Ultimately, the biofunctionalized nanofibers will form the technology platform for the development of injectable nanofiber materials that will provide artificial niches for brain tissue regeneration from endogenous neural stem cells in vivo.

We see a two-fold impact ofthe project. The biotechnology sector will benefit from the development of novel in vitro assay systems where nanofiber matrices are combined with human stem cells to form a complete assay kit, which required minimal handling and manipulation. Such assays could be used for drug screening purposes to develop novel neuroregenerative drugs. In regenerative medicine, the nanofiber concept is particularly applicable to neurodegenerative diseases such as Parkinsons or Huntingtons disease, where no structural restoration therapies exist and where specific neuronal cell types are lost. Due to the rising costs for long-term care and rehabilitation, the development of successful regenerative therapies could have an enormous socioeconomic impact.

The project consists of five distinct tasks, each connected with a subset of milestones: (1) Optimization of nanofabrication techniques for biological mimicries, (2) Functionalization of nanofibers, (3) Development of an artificial stem cell proliferation niche, (4) Development of artificial radial glia-like nanofibers for cell migration and (5) Development of artificial nanofiber network for stem cell differentiation.

Lay Summary