Development of nanosheets film has potential for safe, effective gene transfection into cells

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Japanese scientists from the NIMS International Center for Materials Nanoarchitectonics (MANA) have developed a nanostructured sheets film capable of introducing designated genes into animal cells. The scientists also demonstrated the safety and efficacy of the new nanosheet film as a substrate for reverse gene transfection.

The methods of introducing genes into cells can be performed in liquids (solution-based) or on the surface of a solid substrate (solid phase gene transfection). In the solid phase gene transfection, DNA is fixed on the solid surface and then cells adhere on the DNA-bearing surface. The objective of the present research is to explore new solid substrates for the reverse gene transfection. This solid-mediated transfection has attracted attention due to the higher delivery efficiency of DNA than liquid phase transfection method. Different types of DNA are possible to arrange on a solid surface and introduce into cells. This technology is also effective in systematic analysis and profiling of the effects of genes.

Until now, an extracellular matrix called fibronectin, which is an animal-derived protein, or other similar substances, had been used as an accelerant in solid phase gene transfection. However, this approach had been considered problematic in clinical application situations, where the gene transferred cells are returned to the patient's body. Thus, the use of animal-derived substances has a serious concern from the viewpoint of safety, etc.

In the present research, the MANA researchers prepared a nanosheets

film through a near-infinite number of nanoscale walls protruding from the surface. The film is composed of only inorganic silica without any animal sources. The MANA team found that genes can be introduced into cells with extremely high efficiency when fixing DNA on the nanostructured silica film and contacting with cells. Since an animal-derived supplements is not necessary, this should be a safe and simple solid phase transfection system.

This research result is applicable to gene therapy and offers a revolutionary gene introduction method. It is expected to make a valued contribution to gene therapy for hereditary diseases such as diseases of inborn error of metabolism, hemophilia, etc., and for intractable diseases such as diabetes and the like.

More information: pubs.rsc.org/en/Content/Articl … g/2012/CC/c2cc34289h

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