Researchers engineer a hybrid five times more effective in delivering genetic material into cells

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Researchers at the Polytechnic Institute of New York University (NYU-Poly) and the NYU College of Dentistry (NYUCD) have developed a carrier in their lab that is five times more efficient in delivering DNA into cells than today's commercial delivery methods—reagent vectors. This novel complex is a peptide-polymer hybrid, assembled from two separate, less effective vectors that are used to carry DNA into cells.

Results of their study, "Long Term Efficient Gene Delivery Using Polyethylenimine with Modified Tat Peptide," were published in *Biomaterials*. The findings were the result of a collaborative research project conducted by Dr. Seiichi Yamano at NYUCD and Dr. Jin Montclare at NYU-Poly. The outcome of the study could help researchers better understand gene function and ultimately improve gene therapy.

Non-viral vectors such as those engineered in this study are used for transfection—the process of introducing foreign genetic material (in this case, DNA called a plasmid) into a cell. The vectors are essentially vehicles that carry the genetic matter into the cell. But transfection is not as easy. Cells are set up to keep things out of the nucleus. Even if the transported plasmid manages to permeate the cellular membrane, the cytoplasm within the cell has safeguards to stop anything from getting into the nucleus.

Traditionally, scientists have engineered viruses to carry out transfection, but viruses are problematic because cells recognize them as foreign and trigger the immune response. Virus transfection is extremely costly and presents numerous difficulties for mass processing. On the other hand, non-viral vectors do not trigger the immune system and are easily manufactured and modified for safe, more effective delivery. Their shortcoming is that they generally are effective only for short periods in transfection, as well as other forms of gene expression.

For this project, Yamano and Montclare paired a modified version of CPP HIV-1 (mTat) with PEI – a non-viral vector particularly effective for delivering oligonucleotides. In combining mTat and PEI, they built a new non-viral vector, more effective than mTat or PEI individually. They tested their reagent vector both in vitro—grown in a Petri dish—as well as for approximately seven months in a living organism—in vivo.

The vector may be used in the future for targeted gene therapy.

More information: www.sciencedirect.com/science/ … ii/S0142961213013501

Provided by New York University

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