

The art of stabilizing entangled spaghetti-like materials

November 28 2011

Gene therapy can only be effective if delivered by a stable complex molecule. Now, scientists have determined the conditions that would stabilise complex molecular structures that are subject to inherent attractions and repulsions triggered by electric charges at the surfaces of the molecules, in a study about to be published in *European Physical Journal E*, by Valentina Mengarelli and her colleagues from the Solid State Physics Laboratory at the Paris-Sud University in Orsay, France, in collaboration with Paris 7 and Evry Universities scientists.

The authors studied soluble complexes made of negatively charged DNA or another negatively charged polymer – polystyrene-sulfonate (PSSNa) – and a so-called condensation agent, which is a negatively charged polymer, known as linear polyethyleneimine (PEI). PEI participates in the condensation process by tying onto a molecule such as DNA, like tangled hair, to form an overall positively charged DNA/polymer complex structure.

Previous research focused mainly on non-soluble complexes, while the few attempts at focusing on soluble complexes dealt either with smaller polymers or those with a weaker electric charge, which may therefore be easier to stabilise.

The French team thus confirmed experimentally that the complexation process does not depend on the rigidity of the original molecule, be it DNA or PSSNa, but on the positive/negative electric charge ratio and on the polymer concentrations. It is the interactions between electrically

charged parts within the complex that govern its properties. When the condensation agent is in excess, the positively charged complex is then attracted to negatively charged biological cell membranes. This could be used to deliver the DNA into a targeted cell nucleus as part of [gene therapy](#) treatment.

Future work will focus on using long DNA molecules and novel polymers to form complexes of controlled size and [electric charge](#) for gene therapy.

More information: Charge inversion, condensation and decondensation of DNA and Polystyrene sulfonate by polyethylenimine, Mengarelli V, Auvray L, Pastré D, and Zeghal M, *European Physical Journal E* (EPJE) 34, 127, [DOI 10.1140/epje/i2011/11127-3](https://doi.org/10.1140/epje/i2011/11127-3)

Provided by Springer

Citation: The art of stabilizing entangled spaghetti-like materials (2011, November 28) retrieved 25 April 2024 from <https://phys.org/news/2011-11-art-stabilizing-entangled-spaghetti-like-materials.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.