# Chitosan-DNA complexes: charge inversion and DNA condensation

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Keywords: chitosan, DNA, polyelectrolyte complexes, drug delivery

The design of biocompatible polyelectrolytes complexes (PECs) is a promising strategy for in vivo delivery of biological macromolecules, such as proteins and DNA. Particularly, the condensation of DNA by polycations (with the formation of the so called "polyplexes") received considerable attention for its potential in gene delivery applications, where the development of safe and effective non-viral vectors remains a central challenge [1]. Among polymeric polycations, chitosan has recently emerged as a suitable material for the preparation of non-viral gene delivery vectors [2]. There has been recently a significant research effort aimed at understanding the general aspects of the PEC formation and the influence of the polycation valence, degree of polymerization and polydispersity, theoretical phase diagrams for polyanion-polycation complexes have been calculated [3]. Despite the significant efforts, a comprehensive theory for the complex phenomenology has not been developed yet, probably due to the fact that most experimental studies focused on empirical attempts to design "optimal" carriers (in terms of some biological effect), paying scant attention to the systematic study of the complexation process and to the comparison with theory. In this study, we investigate the aggregation behavior of Chitosan-DNA complexes in different conditions, by considering Chitosan of different degree of polymerization, by a combined study using Dynamic Light Scattering, Electrophoresis, Atomic Force and Scanning Electron Microscopy [4]. We compare the results with the existing models for the complexation of oppositely charged polyions and show that they represent a consistent "frame" for the different observations reported in the literature that previously appeared uncorrelated, and that they can hence be used as a guide to the rational design of new and more efficient polycation-based vectors, for an effective delivery of genetic material [5].

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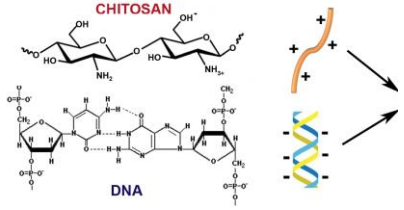


Figure 1. Sketch of complexation process.

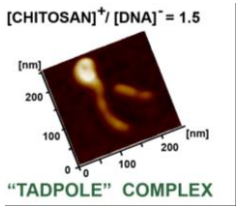


Figure 2. AFM image of the "Tadpole" complex