2. Scientific goal

The scientific goal of this thesis was the synthesis of dendritic core-multishell architectures in order to go beyond the existing core-singleshell architectures (see chapter 1.5.4.). Starting from easily accessible commercial products as building blocks hyperbranched PEI and PG should be used as core structures. The resulting architectures shall be designed to mimic the polarity gradient of liposomes and therefore can be described in analogy to unimolecular micelles as unimolecular liposome-like architecture. The obtained polymers should be investigated in the following fields:

1. Investigation of structural modifications that influence the encapsulation capacity of the polymers for polar and nonpolar molecules. The study will include modification of core type and size, “thickness” of the inner hydrophobic shell, “thickness” of the outer polar shell, and density of the shells
2. Investigation of transport phenomenon and its dependency from type of guest molecules and concentration of core-shell architecture. Additionally the location of guest molecules in the polymer structure should be checked.
3. Tailoring of dendritic structures for universal transport abilities and applications of these polymer architectures.

First a simple procedure for the synthesis of core-multishell architectures should be developed in order to obtain these dendritic structures in multigram quantities. Additionally, the synthetic procedure should be designed in a modular way to allow an easy scale-up of the synthesis and be flexible for the modification of the product composition. This will allow for the creation of a library of core-shell structures with different building blocks. As a core hyperbranched PEI and PG with different molecular weights should be studied and compared with polymers based on dendritic PAMAM core. As inner shell an aliphatic, linear dicarboxylic acid with various chain lengths should be used. mPEGs with different number of monomer units should be investigated as an outer shell. Additionally, the influence of the density of the shells should be determined. The encapsulation capabilities of the liposome-like polymers depending on the molecular weight and topology of the polymer core and length of the attached amphiphilic chains should be revealed. The encapsulation capacities for different polar and nonpolar guest molecules should be investigated. Furthermore, the solubility of the core-multishell architectures in various types of polar and nonpolar solvents should be determined.

Second, various publications report the encapsulation of guest molecules inside the core of a single core-shell architecture. In this thesis transport properties and transport

mechanism for nanotransporters should be revealed. The various techniques such as dynamic light scattering (DLS), transmission electron microscopy (TEM), CryoTEM, and atomic force microscopy (AFM) should be used to determine guest molecules localization inside the polymeric architectures as well as to described the behavior of the nanotransporters in the solution.

Finally, the biocompatibility of the obtained polymers and possible biomedical applications of these newly developed core-multishell architectures should be investigated. Drug, dye, metal ion and metal nanoparticle stabilization with focus on the fields of drug delivery, *in vivo* and *in vitro* imaging, and antibacterial and fungicidal activity should be studied.