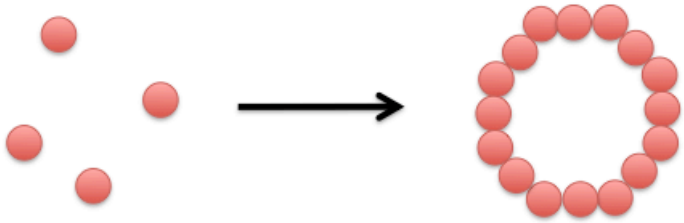
Examensarbete

Virus capsids as nanoscale chemical reactors and containers for protein delivery

Virus capsids, filaments, flagella, and other large protein complexes that are central to many biological processes are generated by protein self-assembly, whereby protein subunits spontaneously organize to form functional complexes. In this project we will rebuild one of these amazing protein assemblies, spherical virus capsids, to function as nanoscale chemical reactors and containers for gene delivery of proteins into human cells.

In Nature the genome of viruses are protected by protein capsids. The capsid serves two purposes: to protect the genome from the outside and to trick cells into incorporating the virus. In spherical viruses capsid proteins forms icosahedral shells with hundreds of subunits. The shells of many viruses are made up by only a single type of subunit and can often form from a solution of purified protein subunits (they self-assemble).



Virus particles and purified capsids have found many applications in nanotechnology, biotechnology and medicine. Of particular importance is their use in vaccines. In gene therapy viruses are used to deliver genes into cells by swapping out the virus genome with human DNA. The outside and inside of capsids have been modified to attach functional molecules, such as quantum dots.

All previous work in this area has relied on the properties of existing natural virus capsids. In this project we will use molecular engineering to custom-make virus capsids and going beyond the confines of Natures natural variety. Our goal is to develop a protein based nanocontainer for use as small chemical reactors and vehicles for protein delivery into cells.

In this thesis project you will work on characterizing a synthetic variant of a capsid protein from a natural virus that has been designed using computational structural modeling. Initial work has indicated that this protein has the potential to function as a nanocontainer.

You will study the self-assembly properties of the capsid protein and demonstrate that a fluorescent protein, GFP, can be selectively be encapsulated into synthetic virus capsids.

In this master thesis project you will learn:

I) Expression and purification of proteins.
II) How to make novel synthetic proteins
III) Biophysical characterization of proteins using a variety of techniques
IV) State-of-the-art structural modeling using computational tools

Don't hesitate to contact me, ingemar.andre@biochemistry.lu.se, for further information about the project!