Virus scaffolds as Enzyme Nano-Carriers (ENCs).

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Nature offers to the nanotechnologist exquisite precisely defined nanometer-sized objects. Viruses are well-ordered structures formed by a self-association of capsid proteins monomers that can be easily modified by genetic engineering or by chemistry. Engineered bacterial, animal and plant viruses have been already used for instance as biosensors, nanoreactors or high throughput screening tools. Our aim is to use plant viruses as enzymes supports to create a new experimental tool mimicking *in vivo* enzymatic cascade reactions at the nanoscale level.

The association of collaborating enzymes in supramolecular structures enables metabolic processes to be performed more efficiently, accelerating reactions rates and preventing the diffusion of intermediates in the cell medium. The project's outcomes will serve the technology of enzymatically assisted catalysis in organic synthesis with potential applications for the technology of microreactors and biosensors.

Viruses applied as Enzyme's NanoCarriers (ENCs) will also offer the opportunity to study enzymatic processes at the level of one single or few molecules. Thanks to an innovative AFM/SECM technique, that plans to fabricate a "nanocavity" microelectrode at the tip of an AFM probe, it will be possible to confine clustered enzymes and to measure de final activity of few enzymes molecules. Two model enzymes will be used to build artificial redox cascades: the lipase B (CalB) from *Candida antarctica* and the glucose oxidase (GOX) from *Penicillum amagasakiense*. In order to interface virus and enzymes we selected 3 peptides which bind specifically to one end of PVA (Potato virus A) our model virus. These peptides were cloned at the N-terminus of CalB (lipase B from *Candida Antarctica*). AFM and TEM images show clustering of the modified enzymes to the extremity of the virus.