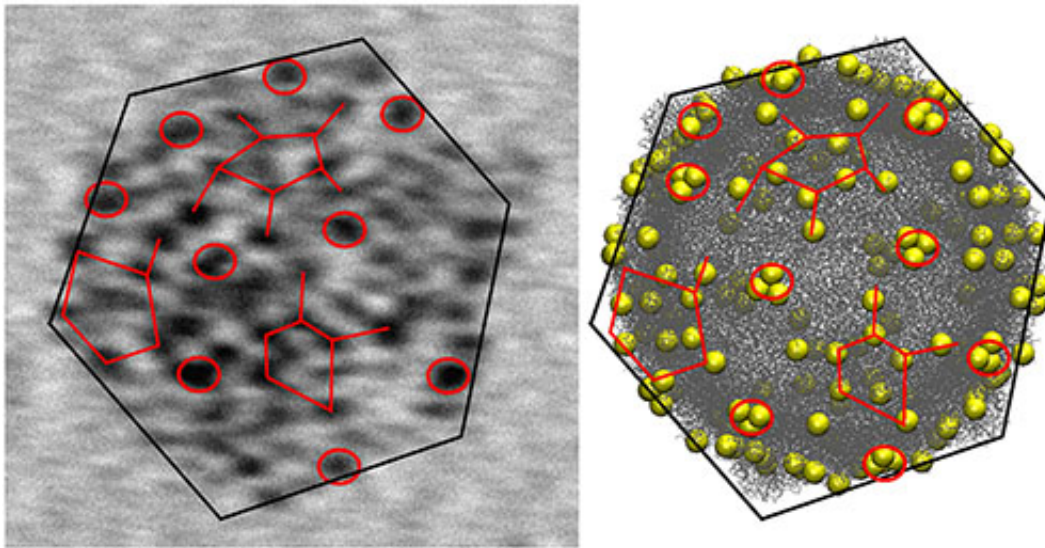


# Gold nanoparticles help to develop a new method for tracking viruses

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Left: transmission electron microscopy (TEM) image of a single CVB3 virus showing tens of gold nanoparticles attached to its surface. The particles form a distinct "tagging pattern" that reflects the shape and the structure of the virus. The TEM image can be correlated to the model of the virus (right), where the yellow spheres mark the possible binding sites of the gold particles. The diameter of the virus is about 35 nanometers (nanometer = one billionth of a millimeter).

Researchers at the Nanoscience Center (NSC) of University of Jyväskylä in Finland have developed a novel method to study enterovirus structures and their functions. The method will help to obtain new information on trafficking of viruses in cells and tissues as well as on the mechanisms of

virus opening inside cells. This new information is important for example for developing new antiviral drugs and vaccines. The study was published in the journal *Proceedings of the National Academy of Sciences* January 13, 2014. (1)

Enteroviruses are [pathogenic viruses](#) infecting humans. This group consists of polioviruses, coxsackieviruses, echoviruses and rhinoviruses. Enteroviruses are the most common causes of flu, but they also cause serious symptoms such as heart muscle infections and paralysis. Recently, enteroviruses have been linked with chronic diseases such as diabetes (2).

The infection mechanisms and infectious pathways of enteroviruses are still rather poorly known. Previous studies in the group of Dr. Varpu Marjomäki at the NSC have focused on the cellular factors that are important for the infection caused by selected enteroviruses (3). The mechanistic understanding of [virus](#) opening and the release of the viral genome in cellular structures for starting new virus production is still largely lacking. Furthermore, the knowledge of infectious processes in tissues is hampered by the lack of reliable tools for detecting virus infection.

The newly developed method involves a chemical modification of a known thiol-stabilized gold nanoparticle, the so-called Au102 cluster that was first synthesized and structurally solved by the group of Roger D Kornberg in 2007 (4) and later characterized at NSC by the groups of prof. Hannu Häkkinen and prof. Mika Pettersson in collaboration with Kornberg. (5) The organic thiol surface of the Au102 particles is modified by attaching linker molecules that make a chemical bond to sulfur-containing cysteine residues that are part of the surface structure of the virus. Several tens of gold particles can bind to a single virus, and the binding pattern shows up as dark tags reflecting the overall shape and structure of the virus (see the figure). The gold particles allow for studies

on the structural changes of the viruses during their lifespan.

The study showed also that the infectivity of the viruses is not compromised by the attached [gold particles](#) which indicates that the labeling method does not interfere with the normal biological functions of viruses inside cells. This facilitates new investigations on the virus structures from samples taken from inside cells during the various phases of the [virus infection](#), and gives possibilities to obtain new information on the mechanisms of virus uncoating (opening and release of the genome). The new method allows also for tracking studies of virus pathways in tissues. This is important for further understanding of acute and chronic symptoms caused by [viruses](#). Finally, the method is expected to be useful for developing of new antiviral vaccines that are based on virus-like particles.

**More information: [References](#):**

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