

Development of directed immunotherapy against cancer

Imagine that the patients of ovarian cancer or other types of cancer have an effective and reliable therapy without suffering from variety of side effects caused by the chemotherapy or after going into a deep surgery. In our project we intend to invent a novel therapy which could target the site of the tumor and that prevents the off-target effects caused by the conventional chemotherapy, and at the same time create a sustainable cure for the cancer after the application of the treatment. All of that might be the reality in the future by exploiting our immune system by only delivering the drug to the tumor microenvironment and triggering the immunity there.

Particles from gold with the scale of nanometer are so small in comparison the used scale we use, it correlates to one-billionth of the meter. Imagine the diameter of a marble was one nanometer, then the diameter of the Earth would be about one meter.

These particles can be decorated with protein molecules with specific targeting against receptors on the cancer cell's surface. So, the gold particles work as a vehicle to transfer the protein molecules to the target in the tumor. This leads to minimize the side effects caused by the so called off-target effect when the protein molecules bind to their related receptors on the healthy cells.

These protein molecules are called antibodies, that they can bind to specific sites on the cells. This binding might activate signaling pathways and stimulate the cells to produce other types of proteins, called cytokines, which in their turns activate other cells like T cells or pathways and activate the immune response locally.

However, these antibodies can be lazy molecules and cannot activate the related receptors even if they bind to them if they bind individually in the soluble and free phase. So, they need to be encouraged by their comrades, guided, and transported by vehicles.

Gold nanoparticles play the role of the transporter and the guider of the antibodies which gather them and localize them narrowly.

The gold nanoparticles can be tracked as well using their optical properties which work as navigation system that help us to track their motion and location.

In total, the gold nano particles can be used as drug delivery system to localize and to transfer the antibodies specifically to the site of tumor in an efficient pattern by oligomerizing these molecules to acquire their agonistic activity. Later, this system can be protected by encapsulation with a sensitive polymer which can be released only in the microenvironment of the tumor.