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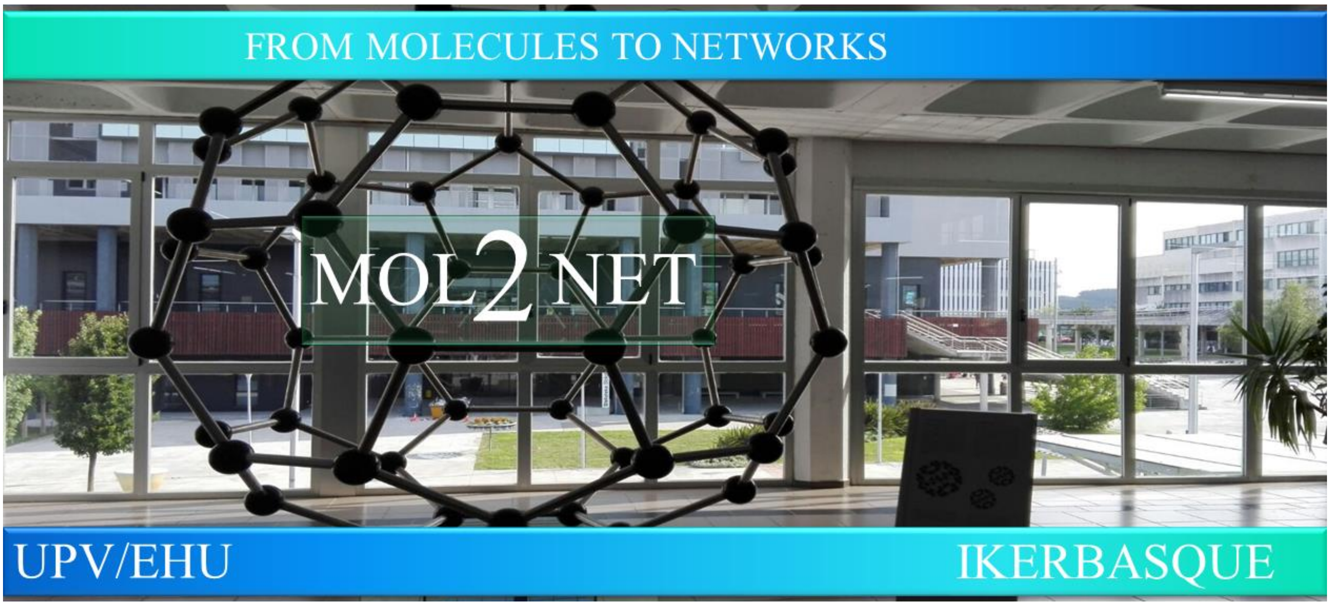

Cancer treatment and nanotechnology

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Abstract.

Nanotechnology is gaining significant attention worldwide for cancer treatment. Nanoparticles are being used as Nanomedicine which participates in diagnosis and treatment of various diseases including cancer. Nanobiotechnology encourages the combination of diagnostics with therapeutics, which is a vital component of a customized way to deal with the malignancy. In this review, the use of nanotechnology on the treatment and diagnosis of cancer will be discussed.

The microbiome is emerging as a key player and driver of cancer. Traditional modalities to manipulate the microbiome (for example, antibiotics, probiotics and microbiota transplants) have been shown to improve efficacy of cancer therapies in some cases, but issues such as collateral damage to the commensal microbiota and consistency of these approaches motivates efforts towards developing new technologies specifically designed for the microbiome-cancer interface. Nanobiotechnology encourages the combination of diagnostics with therapeutics, which is a vital component of a customized way to deal with the malignancy. In this review, the use of nanotechnology on the treatment and diagnosis of cancer will be discussed.

The unique characteristic of Nanomedicine i.e. their high surface to volume ratio enables them to tie, absorb, and convey small biomolecule like DNA, RNA, drugs, proteins, and other molecules to targeted site and thus enhances the efficacy of therapeutic agents. In particular, the applications of nanoparticles for treatment and diagnostics of cancer reached such a precision that it can detect a single cancer cell and target it to deliver a payload for the treatment of that cancerous cell. Conventional cancer therapy methods have side effects, and diagnostics techniques are time-consuming and expensive [1].

Besides, nanoparticles such as polymeric nanoparticles (nanogels, nanofibers, liposomes), metallic nanoparticles such as gold nanoparticles, sliver nanoparticles, calcium nanoparticles, carbon nanotubes, graphene, and quantum dots have revolutionized cancer diagnostics and treatments due to their high surface charge, size, and morphology. Functionalization of these nanoparticles with different biological molecules, such as antibodies, helps them to target delivery and early detection of cancer cells through their plasmon resonance properties. While some of the magnetic properties of nanoparticles such as iron, copper, and carbon nanotubes were also evaluated for detection and treatments of cancer cells. An advanced type of nanoparticles, such as nanobubbles and oxygen-releasing polymers, are helping to address the hypoxia conditions in the cancer microenvironment, while others are employed in photodynamic therapy and photothermal therapy due to their intrinsic theranostic properties. The green synthesis of nanoparticles has further increased biocompatibility and broadened their applications [2].

Chaturvedi *et al.* [3] performed an extensive search on bibliographic database for research articleon nanotechnology and cancer therapeutics and further compiled the necessary information from various articles. They noticed that cancer nanotechnology confers a unique technology against cancer through early diagnosis, prevention, personalized therapy by utilizing nanoparticles and quantum dots. Moreover, nanoparticle assisted cancer detection and monitoring involves biomolecules like proteins, antibody fragments, DNA fragments, and RNA fragments as the base of cancer biomarkers.

To conclude nanotechnology has shown promising advancements in the field of drug development and its delivery. In fact, nano-biotechnology plays an important role in the discovery of cancer biomarkers. The opportunities at the intersection of nanotechnology, the microbiome and cancer are massive. Last but not least, nanotechnologies capable of manipulating interactions that occur across microscopic and molecular length scales in the microbiome and the tumour microenvironment have the potential to provide innovative strategies for cancer treatment.

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