Nanovaccines: the next frontier in personalised cancer therapy

New research demonstrates how biohybrid and biodegradable nanovaccines can provide effective, personalised cancer treatment.

Nanovaccines, a new generation of vaccines that use nanoparticles as carriers, have been heralded as the most successful advancement in using nanotechnology for disease prevention. In particular, biohybrid and biodegradable nanovaccines have demonstrated great potential for treating several types of cancers.

They have also been shown to prolong survival rate, increase the amount of complete tumour remission, and boost tumour-specific immune responses.

“Biohybrid and biodegradable nanovaccines are a novel, patient-focused nanomaterial-based immunotherapy platform that represents the next frontier in personalised cancer therapy,” says Hélder Santos, a professor of pharmaceutical nanotechnology at the University of Helsinki.
With the support of the EU-funded iNANOVAC4CANCER project, Santos and his team of researchers have established the technical and commercial viability of a personalised biohybrid and biodegradable nanovaccine platform.

**Nanovaccines as a cancer immunotherapy**

The main goal of the project, which was supported by the European Research Council, was to develop a biohybrid nanovaccine formulation and evaluate its anticancer efficacy in cancer tumour models. To do this, the project used advanced nanotechnologies that have been tailored for personalised medicine.

“These technologies allow us to precisely engineer materials at the nanoscale for the development of novel therapeutic formulations,” explains Santos.

From this work, the project successfully determined both the most relevant parameters affecting the formulation of the biohybrid nanovaccines and their efficacy as both combined and monotherapies. Furthermore, researchers evaluated the influence that the cell membrane coating has on the stability and biocompatibility of the nanovaccines being produced. They also validated the technical translatability of the nanovaccines and demonstrated their preventative and therapeutic effect on different cancer tumour models.

“We demonstrated the advantages of using such biological elements as cancer cell membranes and viruses as nanovaccine platforms to address some of the current issues related to cancer immunotherapy,” adds Santos. “Most importantly, we showed the potential of using biohybrid nanovaccines as a cancer immunotherapy.”

**Competitive analysis and continued research**

In addition to the research itself, Santos and his team also conducted a thorough competitive analysis and explored the possibility of marketing the iNANOVAC4CANCER-based findings via a start-up company or through licensing agreements. However, in the end, the team determined that the best route for the time being was to focus their efforts on developing nanovaccines for breast and melanoma cancers only.

“Based on all the preclinical data generated during this project, it was decided that before we start talking about commercialisation, we needed to conduct human feasibility studies to test the technology in potential cancer patients,” notes Santos.

In light of this, Santos is currently working to extend the generalisability and translatability of the iNANOVAC4CANCER techniques. He is also assessing the
preventative and therapeutic efficacy of the two nanovaccine platforms in poorly immunogenic cancer types, for example triple negative breast cancer.

“We would also like to analyse the exact composition of the isolated cancer cell membranes to evaluate which proteins, glycoproteins and glycans are still present after the formulation process,” concludes Santos.

“Further studies will be required to evaluate the influence of heterologous cancer cell membranes on the cellular uptake, together with studies evaluating differences in the composition of the protein corona between the coated and uncoated nanovaccines.”

Keywords

iNANOVAC4CANCER, nanovaccines, cancer, cancer therapy, nanoparticles, nanotechnology, immunotherapy

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