

**United Immunity, Co., Ltd.**
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# Uniting nanotechnology and immunity in cancer treatment

By harnessing its proprietary nanotechnology 'pullulan nanogel', United Immunity is creating a generation of novel immunotherapies for cancer and infectious diseases such as COVID-19.

Advances in immuno-oncology have progressed significantly in recent years, with innovative therapies such as immune checkpoint inhibitors and T cell therapies increasingly becoming a standard part of cancer treatment. However, the clinical efficacy of these therapies is still limited, mainly owing to the hostile tumor immune microenvironment seen in resistant cases.

United Immunity, based in Kobe and Mie, Japan, is utilizing its proprietary nanotechnology pullulan nanogel to develop novel nano-immunotherapies against hard-to-treat cancers and infectious diseases such as COVID-19. The technology is designed for immune modulation and could also have the potential to significantly increase the efficacy of existing immunotherapies.

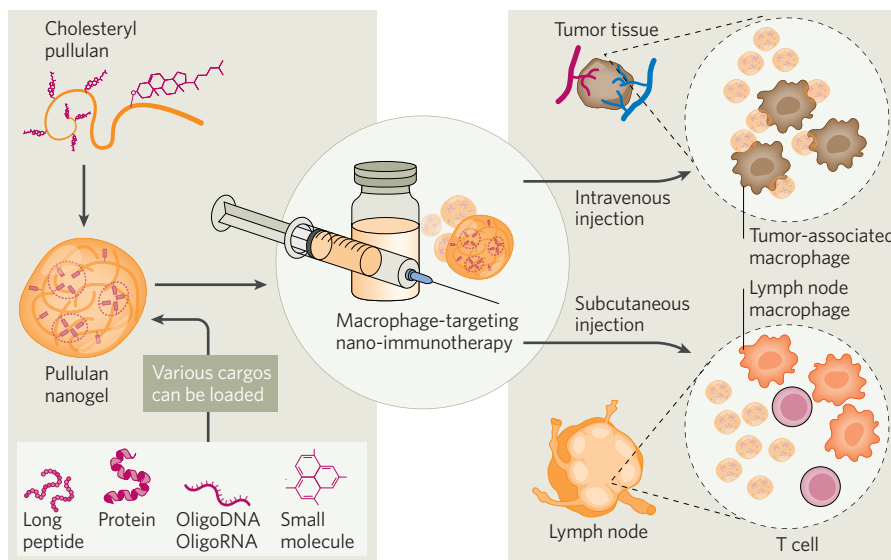
## Nanoparticulate immuno-delivery system

Pullulan nanogel, United Immunity's nanoparticulate immuno-delivery system technology targets macrophages—a key component of innate immunity that have emerged as a novel drug target in immuno-oncology and other diseases, leading to the development of a variety of macrophage-targeted drugs and delivery systems.

The unique pullulan nanogel is highly selective to disease-related macrophages and is also capable of delivering a wide variety of cargos to modulate the functions of these cells (Fig. 1). It offers advantages over some existing delivery systems that lack specificity, which limits their clinical usefulness in terms of safety or efficacy. "Our pullulan nanogel immuno-delivery system selectively binds to certain subsets of disease-related macrophages by binding to a macrophage-specific C-type lectin DC-SIGN, making it highly effective and safe," said Naozumi Harada, CEO and CTO of United Immunity.

The company is developing a series of programs driven by its technology. The first is UI-101, a pre-clinical tumor-associated macrophage-targeted drug that can transform an immune-resistant cold tumor into an immune-sensitive hot tumor. Cold tumor is highly resistant to immunotherapy and accounts for more than 70% of cancer types. Its second, UI-201, is an in vivo booster for T cell receptor (TCR)-engineered T cell therapy that supports proliferation and tumor-homing of TCR-T cells. This program has recently completed a phase 1 trial with promising results including remarkable regression of refractory advanced solid tumors. The results are being prepared for publication.

The third program, still in development, is a next-generation vaccine developed against COVID-19. This preclinical-stage vaccine is a recombinant



**Fig. 1 | United Immunity's pullulan nanogel technology.** The technology creates macrophage-targeting nano-immunotherapies that are able to deliver various cargos either to tumor tissues or lymph nodes.

protein vaccine, enhanced by the company's pullulan nanogel delivery system for the simultaneous induction of robust T cell response as well as humoral response against SARS-CoV-2, including the Delta variant of concern. Pullulan nanogel also helps to stabilize the protein antigen, enabling easy use and transport of the vaccine.

United Immunity was established only a few years ago in 2017 as a private company, built upon a 30-year-long academic collaboration between a nanotechnology research team at Kyoto University and a cancer immunology team based at Mie University in Japan. The company has successfully grown since then, thanks to this strong academic partnership and vital investor support.

## Looking ahead

Over the next few years, United Immunity aims to focus on the early development of its novel nano-immunotherapy UI-101 program, as well as the development of its next-generation COVID-19 vaccine, supported by the Japan Agency for Medical Research and Development (AMED), a governmental medical funding organization in Japan. "We look forward to seeing the signs of clinical efficacy of these products. To further support the R&D, we will have a fundraising this summer aiming to raise \$5 million and will expand our management and R&D team," Harada explained.

The company already has a key partnership with Astellas Pharma/Xyphos for the discovery of a novel cancer immunotherapy. It is now interested in establishing further partnerships, with deals covering out-licensing, co-development, or joint research with pharma and biotech companies worldwide.

The immuno-oncology field remains fiercely competitive, particularly the volume of T cell-dependent drugs in development. However, considerable opportunities still exist to develop innate immune-modulating drugs, especially macrophage-targeted drugs, and this is where United Immunity could make its mark. "Fortunately, our macrophage-selective pullulan nanogel immuno-delivery system enables us to generate highly useful, competitive products that can dominate in this area," Harada concluded.

**CONTACT**

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