Oslo Cancer Cluster
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OSLO CANCER CLUSTER

THE NORWEGIAN RADIUM HOSPITAL RESEARCH FOUNDATION

The Oslo Cancer Cluster: a collaborating ecosystem

Norway's ambitious oncology cluster is dedicated to accelerating the development of new cancer immuno-therapies through collaboration and new partnerships.

A new wave of immuno-oncology innovation is arising from the Oslo Cancer Cluster (OCC). The cluster's 75 members range from first-rate academic laboratories and clinical centers to startups, small and medium enterprises (SMEs) and global pharmaceutical companies, all focused on translating new immunological advances into a pipeline of preclinical and clinical projects, in a collaboration-focused ecosystem.

The oncology research and industry cluster was the vision of former CEO Jónas Einarsson. Einarsson is now the CEO of the Radium Hospital Research Foundation (RadForsk) in Oslo, which was established in 1987 to translate the Norwegian Radium Hospital's cancer research into commercial innovations that provide real benefit to patients. With 13 companies in its portfolio, it is now one of the most successful pre-seed investors in Europe, focused on Norwegian immuno-oncology startups.

Dedicated to strengthening Norway's innovative capacity in the field, the OCC, founded in 2006, subsequently attracted government funding and Norwegian Center of Expertise status. Since then the OCC has matured into an integrated innovation ecosystem, with additional capabilities provided by the OCC Innovation Park and the OCC Incubator, both launched in 2015. This has allowed the co-location of academic labs, technology-transfer activities and larger industry all on the same campus near the Norwegian Radium Hospital in Oslo (**Fig. 1**). The incubator currently supports over 30 companies, with OCC's managing director Ketil Widerberg actively working to attract more, particularly companies exploiting IT and big data solutions for precision medicine.

The OCC is well positioned to make a global contribution to the rapidly developing area of cancer immunotherapy, building on strong science and productive relationships between Norway's top cancer hospitals and academic centers. One example is University of Oslo's K.G. Jebsen Centre for Cancer Immunotherapy. Its pioneering work in the generation of tumor-specific T cell immune responses, from the laboratory of Johanna Olweus, was recently published in *Science*[1].

Scientific expertise is complemented by the cluster's clinical capabilities, with early clinical trials performed at the Oslo and Haukeland University Hospitals. Oslo University Hospital's Department of Cellular Therapy is part of a 20,000m^2 research facility that opened in 2009. It contains the largest academic good manufacturing practice (GMP) facility in Europe for the clinical production of cell products and stem cell cultivation. A number of OCC industry partners are collaborating closely with the facility to produce cell-based cancer vaccines for clinical trials.

Figure 1: Aerial view of the Oslo Cancer Cluster campus with completed planned construction.

Cluster companies and therapies

The OCC boasts an exciting pipeline of novel cancer immunotherapies in preclinical and clinical development. University of Oslo spin-out company Nextera, for example, is using a new approach to immunotherapy, built around a proprietary 'Phagemer' platform that enables combinatorial engineering of both T cell receptors and MHC class II molecules. Nextera's approach allows for highly disease-specific targeting, in addition to offering improved patient stratification and monitoring.

Nextera CEO Thomas Andersen explained that the cluster gives them "access and exposure to new knowledge and information within the oncology field." The company has an ongoing hematological cancer collaboration with the groups of Ludvig A. Munthe and Geir Tjønnfjord at University of Oslo and Oslo University Hospital. The company recently announced a research agreement with Janssen Biotech to explore the use of the Phagemer platform for rheumatoid arthritis.

Clinical-stage companies are also well represented in the OCC, such as Targovax, a company with a broad immuno-oncology pipeline that arose from a 2015 merger with Finnish biotech Oncos Therapeutics. Its pipeline is based on two approaches: the first, a peptide-based platform, targets cancers with mutations in the *RAS* family of genes, which cause disruption of normal cell division. The second is based on engineered oncolytic viruses armed with potent immune-stimulating transgenes.

Targovax's lead peptide-based immunotherapy, TG01, is in phase 2 clinical trials for pancreatic cancer, and is currently showing encouraging improvement on historical 1-year overall survival. Its lead adenoviral product, ONCOS-102, is in early-phase clinical studies for the treatment of melanoma and mesothelioma. According to Peter Skorpil, VP of business development at Targovax, a goal for the company is to find partners to develop combinations of immunotherapies. "We believe that combination treatments will prove more successful than monotherapies, the most obvious combinations being with the immune-checkpoint inhibitors," he said. The cluster also includes many other clinical-stage companies advancing novel cancer immunotherapies, which are profiled on the OCC website.

Diagnostics and technology

Diagnostics and technology ventures are also supported by the OCC; one such company, the bioinformatics-focused OncoImmunity, develops software able to identify immunogenic mutated tumor peptides from next-generation sequencing data using machine-learning methods. The technology offers the potential for improved patient diagnostics, clinical monitoring and neoantigen target selection, which will be essential for personalized cancer vaccines and T cell therapies.

OncoImmunity, founded in 2014, has recently completed a successful funding round, attracting both life science and software investors. The company is already collaborating with several other cluster members and international partners on applications ranging from patient stratification for novel drug combinations to the intelligent design of personalized vaccines.

"The OCC has been very proactive in helping connect us to valuable contacts," said OncoImmunity's CEO Richard Stratford. Targovax's Skorpil also emphasized the cluster's role in the development of collaborations: "For a small startup like ourselves, being part of the OCC amplifies our resources and our visibility."

Widerberg said that for those looking to connect to the next generation of Nordic immuno-oncology innovators, the OCC can provide tailored opportunities. "With a strong focus on immuno-oncology and precision medicine, our goal is to be a leading oncology innovation center in Europe and to maximize collaborative opportunities with global partners," he added.

1. Strønen, E. *et al. Science* **352**, 1337–1341 (2016).

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