Anna Gerdtsson: Harnessing AI and Spatial Omics to Transform Ovarian Cancer Treatment

Immunotherapy has offered new hope in cancer treatment, since it can stimulate the patient's own immune system to broadly target the tumor and thereby has the potential to cure even advanced cancers. But for ovarian cancer, results so far have been disappointing. Few patients respond, largely due to the highly complex and heterogeneous tumor–immune microenvironment (TIME). At the same time, clinicians lack reliable tools to predict which patients are likely to benefit.

Anna Gerdtsson's research addresses this challenge by combining recent breakthroughs in Spatial Omics with artificial intelligence to map the TIME at an unprecedented level. Her aim is to uncover how tumor and immune cells interact, and to use this knowledge to make better patient classifications already at diagnosis, when tumor tissue becomes available after surgery. These classifications will help doctors decide which patients may benefit from immunotherapy and guide the development of new treatment strategies.

Anna Gerdtsson holds a Ph.D. in Immunotechnology from Lund University and has completed postdoctoral training at The Scripps Research Institute in La Jolla and at the University of Southern California, Los Angeles. Since 2020 she has been Associate Senior Lecturer in Immunotechnology at Lund University, where she also earned her appointment as Associate Professor (Docent).

Her research focuses on the tumor microenvironment of solid tumors and on developing computational tools for spatial and multiomic analysis. With expertise spanning biology, technology, and machine learning, Gerdtsson is well-prepared to contribute to new approaches in precision cancer care.

> *"Ovarian cancer urgently needs better ways to guide treatment. By combining advanced imaging and molecular profiling with AI, we can reveal how tumor and immune cells interact, and translate this knowledge into tools that truly benefit patients."*
> — **Anna Gerdtsson**

In earlier studies, Gerdtsson and colleagues observed that protein profiles vary across distinct TIME niches. These spatial structures, and their influence on survival, remain poorly understood. At the same time, advances in AI, particularly Graph Neural Networks, have shown that tissue images can be used to robustly predict molecular and clinical features.

Gerdtsson's project leverages these innovations through a two-tier design:

1. Multiplex immunofluorescence imaging of 140 high-grade serous ovarian tumors, analyzed with AI to identify TIME niches associated with prognosis.
2. Spatial transcriptomics of the identified niches to uncover molecular interactions driving their formation and their links to patient outcome.

The ultimate goal is to create image-based tools that can:

- Classify ovarian cancer patients more accurately already at the time of diagnosis (surgery).
- Guide treatment decisions, particularly in predicting who may benefit from immunotherapy.
- Reveal new molecular targets for future therapies.

Because the project uses formalin-fixed paraffin-embedded samples, the current gold standard in pathology, the findings can be translated into clinical settings with relative ease.

This research has the potential to fundamentally change how ovarian cancer is treated. By combining advanced imaging with deep learning, Gerdtsson's work will support a more precise, patient-centered approach: where each patient receives the most effective therapy, with the highest likelihood of long-term benefit.

Her vision is clear: to unlock immunotherapy's potential in ovarian cancer and provide new hope for women facing one of the most challenging gynecological cancers.