

Computing and probing cancer immunity

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Recent breakthroughs in cancer immunotherapy and decreasing costs of high-throughput technologies sparked intensive research into tumour-immune cell interactions using genomic tools. However, the wealth of the generated data and the added complexity pose considerable challenges and require computational tools to process, analyse and visualise the data. Recently, a number of tools have been developed and used to effectively mine tumour immunologic and genomic data and provide novel mechanistic insights. In this talk I will first review discuss computational genomics tools for mining cancer genomic data and extracting immunological parameters. I will focus on higher-level analyses of NGS data including quantification of tumour-infiltrating lymphocytes (TILs), identification of tumour antigens and T cell receptor (TCR) profiling. Additionally, I will address the major challenges in the field and ongoing efforts to tackle them.

In the second part I will show results generated using state-of-the-art computational tools addressing several prevailing questions in cancer immunology including: estimation of the TIL landscape, identification of determinants of tumor immunogenicity, and immunoediting that tumors undergo during progression or as a consequence of targeting the PD-1/PD-L1 axis. Finally, I will propose a novel approach based on perturbation biology of patient-derived organoids and mathematical modeling for the identification of a mechanistic rationale for combination immunotherapies in colorectal cancer