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Sommario/riassunto	In the past decade, significant progresses have taken place in the field of cancer immunotherapeutics. Tumor-targeting or adjuvant immunotherapies are being developed for most human cancers including melanoma, prostate cancer, glioblastoma, sarcoma, lung carcinoma and hepatocellular carcinoma. New immunotherapeutics, such as Ipilimumab (anti-CTLA-4), have finished human trials and are approved by the US Food and Drug Administration (FDA) for clinical treatment; cell-based immunotherapies such as adoptive cell transfer (ACT) have either been approved (i.e., sipuleucel-T) for the treatment of selected neoplastic malignancies or reached the stage of phase II/III clinical trials. Immunotherapeutics has become a sophisticated field. Multimodal therapeutic regimens comprising several functional modules (up to 5 in the case of ACT) have been developed to provide more focused therapeutic responses with improved efficacy and reduced side effects. Despite the tremendous developments, a major challenge mains: the lack of effective and clinically-applicable methods. Due to the complex immunological responses of patients that involve both the organs with neoplastic lesion and the whole immune system,

it is difficult to provide comprehensive assessment of therapeutic efficacy and mechanism in patients. Despite the rapid adaptation of advanced medical imaging modalities such as MRI and PET/CT scan and the gold standard pathological examination, there is still unmet demand in the clinic to best evaluate cancer-specific cellular immunity and functions. Flow cytometry analysis has modernized hematology and immunology, and is currently being adapted to clinical immune monitoring through a multi-center endeavour in the US. The study aims to normalize, standardize, and implement flow cytometry-based cellular immunity assay in routine clinical tests. In parallel, new technologies including single cell polyfunctional analysis and immunophenotyping microchip are being developed for rapid, informative, and longitudinal monitoring of immune response to anti-cancer treatment in the clinical settings, shedding new light to future clinical trials of cancer immunotherapies. These technologies were designed to address the major challenges caused by the complexity and functional heterogeneity of cancer biology and cellular immunity, and allow for comprehensive survey of both tumor and the immune system to identify their mechanistic interplay in response to cancer immunotherapy. In addition, new computational tools are required to integrate high dimensional data sets from comprehensive, single-cell level measurements of patient's immune responses and render most accurate and definitive diagnostic decision facilitated by new immune monitoring tools. This new generation of informative, personalized clinical diagnostic tools will likely contribute to new understanding of therapy mechanism, pre-treatment stratification of patients, ongoing therapeutic monitoring and assessment.
