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Non-invasive longitduinal approaches to asses the effectivity of immunotherapy on cancer patients

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Immunotherapies have emerged as the most effective treatments for immune system-related diseases, such as cancer. Unfortunately, immunotherapeutics are not effective for all patients and require a personalised medicine approach. The effectiveness of immunotherapies depends on drug responses, which are dynamic, systemic and spatial. Therefore accurate monitoring and careful selection of therapy are predominant. Optimal treatment outcome mainly depends on successful activation of the immune system, expression levels and localisation of immunotherapeutic drug targets, as well as its relevance to the specific pathology in the individual patient. Therefore, detailed knowledge about these dynamic processes is crucial to improve the potential of immunotherapy, leading to potentially curative and long-lasting treatment. The applicability of immunotherapy may be limited due to the disease characteristics and the variations between patients. Hence, to improve the responses, the mode of treatment should be chosen on a personal basis, and continuously guided to adapt to changes in those as mentioned earlier dynamic key factors. Therefore, the immune status of each individual patient needs to be evaluated at both on a systemic level and the disease site, either by blood markers or tissue biopsies. Unfortunately, tissue biopsies do not always provide information over the immune status of a patient, but only represents part of a heterogeneous tumour that is not always easily accessible, which leads to a restriction of longitudinal monitoring. Nevertheless, blood-based biomarkers have the potential to provide insights into the immunological/systemic status of a patient; however, they do not provide spatial information. Therefore it should ideally be combined with non-invasive imaging (PET, MRI, CT, Optical Imaging) to detect the presence of relevant cell populations or biomarkers. Ideally, the immune status of a patient should be assessed longitudinally and whole-body in a non-inavsive manner. This will benefit not only the patient, but also the clinician in terms of monitoring and selection of treatment as well as improved understanding of the disease state.