Immunome Research
ISSN: 1745-7580
OPEN ACCESS Freely available online
Perspective

Immunological Tools and Techniques for Precision Medicine

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ABOUT THE STUDY

Precision medicine is an approach to healthcare that takes into account individual variability in genes, environment, and lifestyle for each person. It aims to provide targeted therapies and treatments based on specific characteristics of patients, including their immune system. Immunological tools and techniques play a crucial role in precision medicine by enabling the identification, characterization, and monitoring of immune responses.

Tools and techniques

- Flow cytometry is a powerful tool used to analyze and quantify various characteristics of individual cells in a heterogeneous population [1]. It is widely used in immunology to study immune cell subsets, assess their activation states, and evaluate their functional properties. In precision medicine, flow cytometry can be employed to identify specific immune cell populations associated with disease states, monitor changes in immune cell composition during treatment, and assess the efficacy of immunotherapies [2].
- Next-Generation Sequencing (NGS) technologies have revolutionized the field of genomics and have significant implications for precision medicine. In the context of immunology, NGS allows for the comprehensive analysis of immune repertoires, including T Cell Receptors (TCRs) and B Cell Receptors (BCRs) [3]. This information is critical for understanding the diversity and specificity of immune responses, identifying disease-specific biomarkers, and developing personalized immunotherapies [4].
- Enzyme-Linked Immunosorbent Assay (ELISA) and multiplex assays are widely used immunoassays that enable the detection and quantification of specific proteins or biomarkers in biological samples. These assays are valuable tools for identifying disease-specific markers, assessing immune responses, and monitoring treatment efficacy [5]. In precision medicine, ELISA and multiplex assays can be used to measure cytokine levels, assess immune cell activation markers, and identify potential targets for personalized therapies.
- Immunohistochemistry (IHC) is a technique used to visualize and localize specific proteins in tissue sections using antibodies. It is commonly used in pathology and research to assess protein expression patterns and cellular localization [6]. In precision medicine, IHC can be employed to identify immune cell infiltrates in tumor tissues, determine the expression levels of immune checkpoint proteins, and guide the selection of immunotherapies for cancer patients [7].
- Mass cytometry, or CyTOF (Cytometry by Time Of Flight), is an advanced flow cytometry technique that utilizes mass spectrometry to measure multiple parameters simultaneously in single cells. It allows for the high-dimensional analysis of immune cell phenotypes and functions [8]. CyTOF has the advantage of being able to analyze a larger number of parameters compared to traditional flow cytometry. This capability is especially valuable in precision medicine, where a comprehensive understanding of immune cell heterogeneity and functional states is crucial for personalized treatment strategies [9].
- Single-cell RNA sequencing (scRNA-seq) is a cutting-edge technology that enables the profiling of gene expression patterns in individual cells. It provides unprecedented insights into cellular heterogeneity and dynamics within complex tissues [10-12]. In the context of immunology, scRNA-seq can be used to characterize the transcriptional profiles of immune cell subsets, identify novel cell types, and investigate gene expression changes in response to diseases or therapies. This information is valuable for developing personalized immunotherapies and understanding disease mechanisms at a single-cell level [13].

Immunological tools and techniques are essential for advancing precision medicine. Flow cytometry, next-generation sequencing, immunoassays, immunohistochemistry, mass cytometry, and single-cell RNA sequencing are just a few examples of the tools and techniques that provide valuable insights into immune system function, disease processes, and individual patient responses [14,15]. These tools enable the identification of specific immune cell subsets, the characterization of immune responses, and the development of personalized immunotherapies. As precision medicine continues to evolve, immunological tools and techniques will undoubtedly play a pivotal role in tailoring treatments to individual patients, leading to improved outcomes and patient care.

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Received: 15-May-2023, Manuscript No. IMR-23-24638; **Editor assigned:** 18-May-2023, PreQC No. IMR-23-24638 (PQ); **Reviewed:** 02-Jun-2023, QC No. IMR-23-24638; **Revised:** 09-Jun-2023, Manuscript No. IMR-23-24638 (R); **Published:** 16-Jun-2023, DOI: 10.35248/1745-7580.23.19.237

Citation: Bsteh G (2023) Immunological Tools and Techniques for Precision Medicine. Immunome Res. 19:237.

REFERENCES

1. Sun Z, Chen F, Meng F, Wei J, Liu B. MHC class II restricted neoantigen: a promising target in tumor immunotherapy. Cancer Lett. 2017;392:17-25.
2. Schumacher TN, Schreiber RD. Neoantigens in cancer immunotherapy. Science. 2015;348(6230):69-74.
3. Zhou Z, Ding Z, Yuan J, Shen S, Jian H, Tan Q, et al. Homologous Recombination Deficiency (HRD) can predict the therapeutic outcomes of immuno-neoadjuvant therapy in NSCLC patients. J Hematol Oncol. 2022;15(1):62.
4. Frey MK, Pothuri B. Homologous Recombination Deficiency (HRD) testing in ovarian cancer clinical practice: a review of the literature. Gynecol Oncol Res Pract. 2017;4:4.
5. Telli ML, Timms KM, Reid J, Hennessy B, Mills GB, Jensen KC, et al. Homologous recombination deficiency (HRD) score predicts response to platinum-containing neoadjuvant chemotherapy in patients with triple-negative breast Cancer HRD predicts response to platinum therapy in TNBC. Clin Cancer Res. 2016;22(15): 3764-3773.
6. Fugger K, Hewitt G, West SC, Boulton SJ. Tackling PARP inhibitor resistance. Trends Cancer. 2021;7(12):1102-1118.
7. Nallasamy P, Nimmakayala RK, Karmakar S, Leon F, Seshacharyulu P, Lakshmanan I, et al. Pancreatic tumor microenvironment factor promotes cancer stemness *via* SPP1–CD44 Axis. Gastroenterology. 2021;161(6):1998-2013.
8. Zhang C, Huang S, Zhuang H, Ruan S, Zhou Z, Huang K, et al. YTHDF2 promotes the liver cancer stem cell phenotype and cancer metastasis by regulating OCT4 expression *via* m6A RNA methylation. Oncogene. 2020;39(23):4507-4518.
9. Li T, Fan J, Wang B, Traugh N, Chen Q, Liu JS, et al. TIMER: a web server for comprehensive analysis of tumor-infiltrating immune cells. Cancer Res. 2017;77(21):e108-110.
10. Thorsson V, Gibbs DL, Brown SD, Wolf D, Bortone DS, Yang TH, et al. The immune landscape of cancer. Immunity. 2018;48(4): 812-830.e14.
11. Bonneville R, Krook MA, Kautto EA, Miya J, Wing MR, Chen HZ, et al. Landscape of microsatellite instability across 39 cancer types. JCO Precis Oncol. 2017;2017:PO.17.00073.
12. Mermel CH, Schumacher SE, Hill B, Meyerson ML, Beroukhim R, Getz G. GISTIC2. 0 facilitates sensitive and confident localization of the targets of focal somatic copy-number alteration in human cancers. Genome Biol. 2011;12(4):R41.
13. Malta TM, Sokolov A, Gentles AJ, Burzykowski T, Poisson L, Weinstein JN, et al. Machine learning identifies stemness features associated with oncogenic dedifferentiation. Cell. 2018;173(2): 338-354.e15.
14. Tagliamento M, Genova C, Rossi G, Coco S, Rijavec E, Dal Bello MG, et al. Microtubule-targeting agents in the treatment of non-small cell lung cancer: insights on new combination strategies and investigational compounds. Expert Opin Investig Drugs. 2019;28(6): 513-523.
15. Ferrara R, Pilotto S, Peretti U, Caccese M, Kinspergher S, Carbognin L, et al. Tubulin inhibitors in non-small cell lung cancer: looking back and forward. Expert Opin Pharmacother. 2016;17(8): 1113-1129.