Cell-free DNA

Cell-free DNA (or cfDNA) refers to all non-encapsulated DNA in the bloodstream, urine, and saliva, and are not contained within cells. These fragments can be used in various diagnostic and research applications, such as non-invasive prenatal testing, cancer detection and monitoring, and organ transplant monitoring.

At present, changes in DNA sequence, methylation, or copy number are the most sensitive ways to detect the presence of cancer. To further increase the sensitivity of such assays with limited amounts of sample, it would be useful to be able to evaluate the same template molecules for all these changes.

Wang et al. report an approach, called MethylSaferSeqS, that achieves this goal, and can be applied to any standard library preparation method suitable for massively parallel sequencing. The innovative step was to copy both strands of each DNA-barcoded molecule with a primer that allows the subsequent separation of the original strands (retaining their 5-methylcytosine residues) from the copied strands (in which the 5-methylcytosine residues are replaced with unmodified cytosine residues). The epigenetic and genetic alterations present in the DNA molecules can then be obtained from the original and copied strands, respectively. They applied this approach to plasma from 265 individuals, including 198 with cancers of the pancreas, ovary, lung, and colon, and found the expected patterns of mutations, copy number alterations, and methylation. Furthermore, they could determine which original template DNA molecules were methylated and/or mutated. MethylSaferSeqS should be useful for addressing a variety of questions relating genetics and epigenetics. ¹⁾.

The technological advances in tissue profiling have also been applied to the study of cell-free nucleic acids, an area of increasing interest for molecular pathology. Cell-free nucleic acids are released from tumour cells into the surrounding body fluids and can be assayed non-invasively. The repertoire of genomic alterations in circulating tumour DNA (ctDNA) is reflective of both primary tumours and distant metastatic sites, and ctDNA can be sampled multiple times, thereby overcoming the limitations of the analysis of single biopsies. Furthermore, ctDNA can be sampled regularly to monitor response to treatment, to define the evolution of the tumour genome, and to assess the acquisition of resistance and minimal residual disease. Recently, clinical ctDNA assays have been approved for guidance of therapy, which is an exciting first step in translating cell-free nucleic acid research tests into clinical use for oncology.

In a review, Stewart et al. discussed the advantages of cell-free nucleic acids as analytes in different body fluids, including blood plasma, urine, and cerebrospinal fluid, and their clinical applications in solid tumours and haematological malignancies²⁾.

Profiling cerebrospinal fluid cell-free tumour DNA provides the opportunity to precisely acquire and monitor genomic information in real-time and guide precision therapies ³⁾.

see Liquid biopsy.

1)

Wang Y, Douville C, Cohen JD, Mattox A, Curtis S, Silliman N, Popoli M, Ptak J, Dobbyn L, Nehme N, Dudley JC, Summers M, Zhang M, Ho-Pham LT, Tran BNH, Tran TS, Nguyen TV, Bettegowda C, Papadopoulos N, Kinzler KW, Vogelstein B. Detection of rare mutations, copy number alterations, and methylation in the same template DNA molecules. Proc Natl Acad Sci U S A. 2023 Apr 11;120(15):e2220704120. doi: 10.1073/pnas.2220704120. Epub 2023 Apr 4. PMID: 37014860.

Stewart CM, Kothari PD, Mouliere F, Mair R, Somnay S, Benayed R, Zehir A, Weigelt B, Dawson SJ, Arcila ME, Berger MF, Tsui DW. The value of cell-free DNA for molecular pathology. J Pathol. 2018 Apr;244(5):616-627. doi: 10.1002/path.5048. Epub 2018 Mar 12. PMID: 29380875; PMCID: PMC6656375.

Seoane J, De Mattos-Arruda L, Le Rhun E, Bardelli A, Weller M. Cerebrospinal fluid cell-free tumour DNA as a liquid biopsy for primary brain tumours and central nervous system metastases. Ann Oncol. 2019 Feb 1;30(2):211-218. doi: 10.1093/annonc/mdy544. PMID: 30576421.

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