# Fluorescent in situ hybridization

Fluorescent in situ hybridization (FISH) is a molecular cytogenetic technique that uses fluorescent probes that bind to only those parts of the chromosome with a high degree of sequence complementarity. It was developed by biomedical researchers in the early 1980s and is used to detect and localize the presence or absence of specific DNA sequences on chromosomes. Fluorescence microscopy can be used to find out where the fluorescent probe is bound to the chromosomes. FISH is often used for finding specific features in DNA for use in genetic counseling, medicine, and species identification.

FISH can also be used to detect and localize specific RNA targets (mRNA, lncRNA and MicroRNA) in cells, circulating tumor cells, and tissue samples. In this context, it can help define the spatial-temporal patterns of gene expression within cells and tissues.

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1p/19q co-deletion should be tested whenever oligodendroglial features are present or if oligodendroglioma is suspected on other grounds. This is tested using FISH (fluorescence in situ hybridization).

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Codeletion of chromosomal arms 1p and 19q, in conjunction with a mutation in the isocitrate dehydrogenase 1 or 2 genes, is the molecular diagnostic criterion for oligodendroglioma, IDH-mutant, and 1p/19q-codeleted. 1p/19q codeletion is a diagnostic marker and allows prognostication and prediction of the best drug response within IDH-mutant tumors. Brandner et al. performed a Cochrane review and simple economic analysis to establish the most sensitive, specific, and cost-effective techniques for determining 1p/19q codeletion status. Fluorescent in situ hybridization (FISH) and PCR-based loss of heterozygosity (LOH) test methods were considered as the reference standard. Most techniques (FISH, CISH, PCR, Real-time PCR, MLPA, SNP array, CGH, array CGH, next-generation sequencing, mass spectrometry, and NanoString) showed good sensitivity (few false negatives) for detection of 1p/19q codeletions in glioma, irrespective of whether FISH or PCR-based LOH was used as the reference standard. Both NGS and SNP arrays had a high specificity (fewer false positives) for 1p/19q codeletion when considered against FISH as the reference standard. The findings suggest that G-banding is not a suitable test for 1p/19q analysis. Within these limits considering cost per diagnosis, and using FISH as a reference, multiplex ligation probe amplification (MLPA) was marginally more cost-effective than other tests, although these economic analyses were limited by the range of available parameters, time horizon, and data from multiple health care organizations [1].

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Brandner S, McAleenan A, Jones HE, Kernohan A, Robinson T, Schmidt L, Dawson S, Kelly C, Leal ES, Faulkner CL, Palmer A, Wragg C, Jefferies S, Vale L, P T Higgins J, Kurian KM. Diagnostic accuracy of 1p/19q codeletion tests in oligodendroglioma: a comprehensive meta-analysis based on a Cochrane Systematic Review. Neuropathol Appl Neurobiol. 2021 Dec 26. doi: 10.1111/nan.12790. Epub ahead of print. PMID: 34958131.