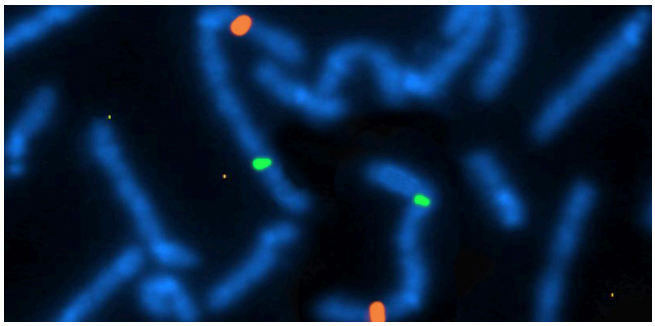
FISH Probes for Detecting Genetic Abnormalities

Fluorescent in situ hybridization (FISH) is a cytogenetic technique used to detect genes or chromosomal regions in a DNA sample. FISH probes are composed of a fluorescent tag attached to a DNA fragment complementary to the DNA sequence being targeted. When added to the sample, the probe will hybridize to its complementary strand, appearing as a fluorescent signal under the microscope.

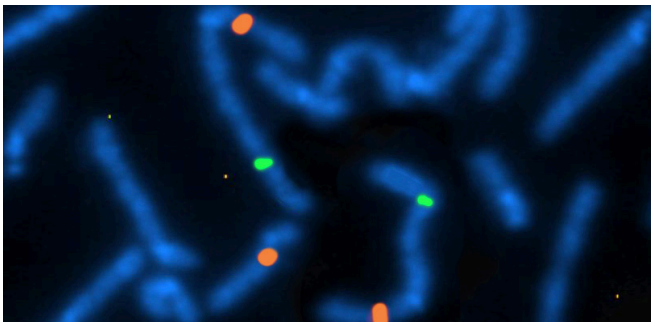
FISH probes can be used to detect multiple types of genetic aberrations. Depending on the abnormality present, FISH signals will appear differently:

Copy Number Variations

CNV probes are used to detect gene gains or losses. They're made of one probe designed to hybridize to a single locus.



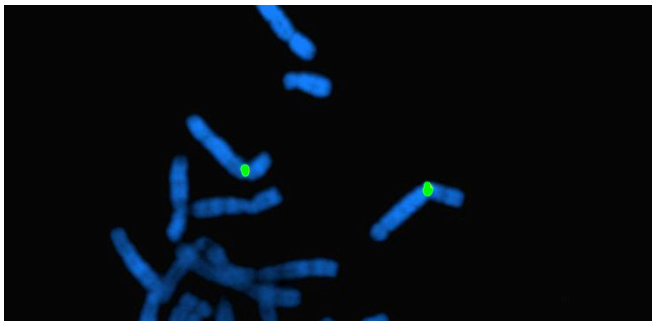
A normal sample will display two sets of signals. Above, the orange signals represent the target gene, while the green signals are telomeric controls.



An abnormal sample, bearing gene deletions or amplifications, will produce missing or extra target gene signals.

Controls

Control probes are used for both chromosome enumeration and verifying that CNV probes have hybridized to the correct chromosome.



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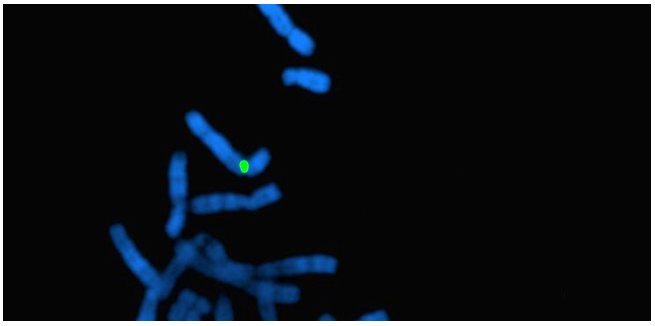

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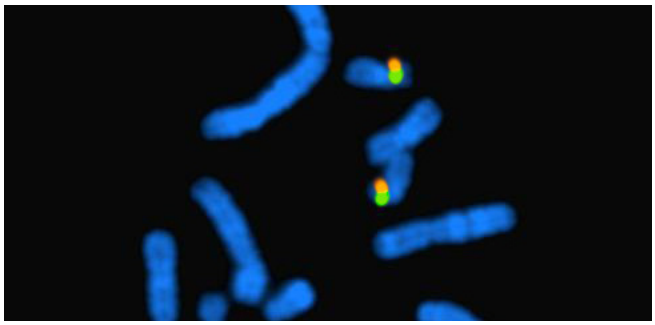
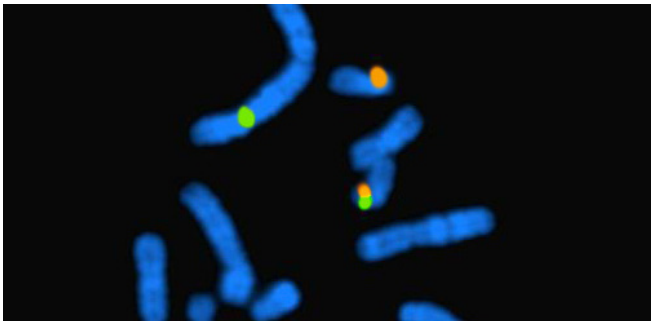
Translocations

Break-Apart probes are used to detect gene rearrangements. They're composed of two probes, each bordering one end of the gene.



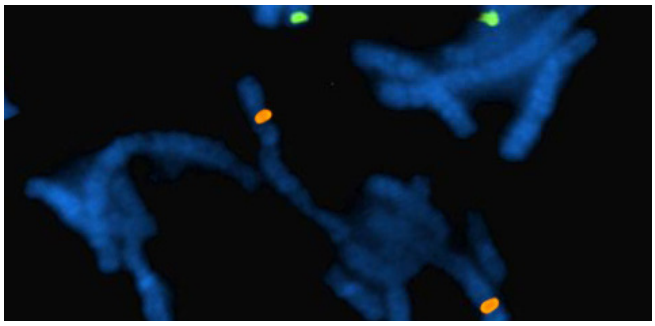
A normal sample will display a unified signal, made up of the two probes flanking the gene.



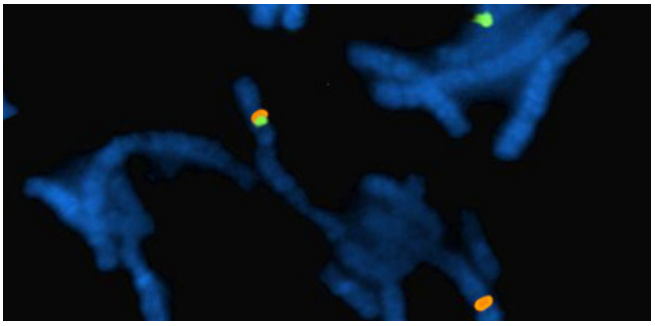
In an abnormal sample, rearrangement of the gene will cause the probes to split, appearing as two distinct signals.

Fusions

Fusion probes are used to detect fusions between two typically separate genes. They're made of two probes, each designed to hybridize to its respective gene.



A normal sample will show two distinct signals, one for each gene.



In an abnormal sample, fusion of the genes will cause the two probes to merge, producing one unified signal.

FISH has proven essential in the discovery of countless disease-specific mutations, paving the way for the development of targeted therapy to treat these diseases at their genetic source. At present, FISH is considered the gold standard cytogenetic method for the detection of diseased or malignant cells harboring genetic aberrations, and will continue to serve as an invaluable tool in biomarker discovery and validation.

EMPIRE GENOMICS
800.715.5880
3370 Walden Avenue Suite 114
Depew, NY 14043

FISH100
051625