

NHGRI *fact sheet*

Fluorescence In Situ Hybridization (FISH)

What is FISH?

Fluorescence in situ hybridization (FISH) uses fluorescent molecules to vividly paint genes or chromosomes. This technique is particularly useful for gene mapping and for identifying chromosomal abnormalities.

How does FISH work?

FISH involves the preparation of short sequences of single-stranded DNA, called probes, which are complementary to the DNA sequences the researchers wish to paint and examine. These probes hybridize, or bind, to the complementary DNA and, because they are labeled with fluorescent tags, allow researchers to see the location of those sequences of DNA. Unlike most other techniques used to study chromosomes, which require that the cells be actively dividing, FISH can also be performed on nondividing cells, making it a highly versatile procedure.

What is FISH used for?

Scientists use three different types of FISH probes, each of which has a different application:

Locus specific probes hybridize to a particular region of a chromosome. This type of probe is useful when scientists have isolated a small portion of a gene and wish to determine which chromosome that gene is located on. They prepare a probe from the piece of the gene and observe which chromosome the probe hybridizes to.

Alphoid or centromeric repeat probes are generated from repetitive sequences found at the centromeres of chromosomes. Because each chromosome can be painted in a different color, researchers use this technique to determine whether an individual has the correct number of chromosomes or, for example, whether a person has an extra copy of a chromosome.

Whole chromosome probes are actually collections of smaller probes, each of which hybridizes to a different sequence along the length of the same chromosome. Using these libraries of probes, scientists are able to paint an entire chromosome and generate a spectral karyotype. This full color image of the chromosomes allows scientists to distinguish between the chromosomes based on their colors, rather than based on their dark and light banding patterns, viewed in black and white through traditional karyotyping. Whole chromosome probes are particularly useful for examining chromosomal abnormalities, for example, when a piece of one chromosome is attached to the end of another chromosome.