

# Difference Between In Situ Hybridization and Immunohistochemistry

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## Key Difference – In Situ Hybridization vs Immunohistochemistry

Cancer and infectious disease diagnostics is a popular trend where novel [proteomics](#) and [genomics](#) based techniques are utilized for the purpose of identifying tumors or infectious cells, its proliferation and the sites of cell development and analyzing the genetic basis of most communicable and non-communicable diseases. This will result in accurate drug processing and designing and in developing customized therapies for diseases. In situ hybridization (ISH) and Immunohistochemistry (IHC) are two such widely used techniques in cancer biology and the key difference between in situ hybridization and immunochemistry lies in the molecules that are used in the analysis procedure. **In ISH, the [nucleic acid probes](#) are used in analysis whereas, in IHC, [monoclonal and polyclonal antibodies](#) are used for the diagnostic determinations.**

## What is In Situ Hybridization (ISH)?

In situ hybridization is a nucleic acid [hybridization](#) technique which is directly performed on a portion or section of tissue, in the entire tissue or in cells. The technique depends on the theory of Watson Crick complementary base pairing, resulting in either DNA-DNA hybrids or DNA-RNA hybrids which can detect mutated genes or identify the required gene of interest. Single stranded DNA sequences, double stranded DNA sequences, single stranded RNA sequences or synthetic oligonucleotide sequences are used as probes during hybridization technique, and these probes are labeled with a radioactive phosphorus at its 5' end for identification procedures upon autoradiography or labeled using fluorescent dyes. There are different types of ISH techniques available based upon the type of probe used and the type of visualization technique followed.

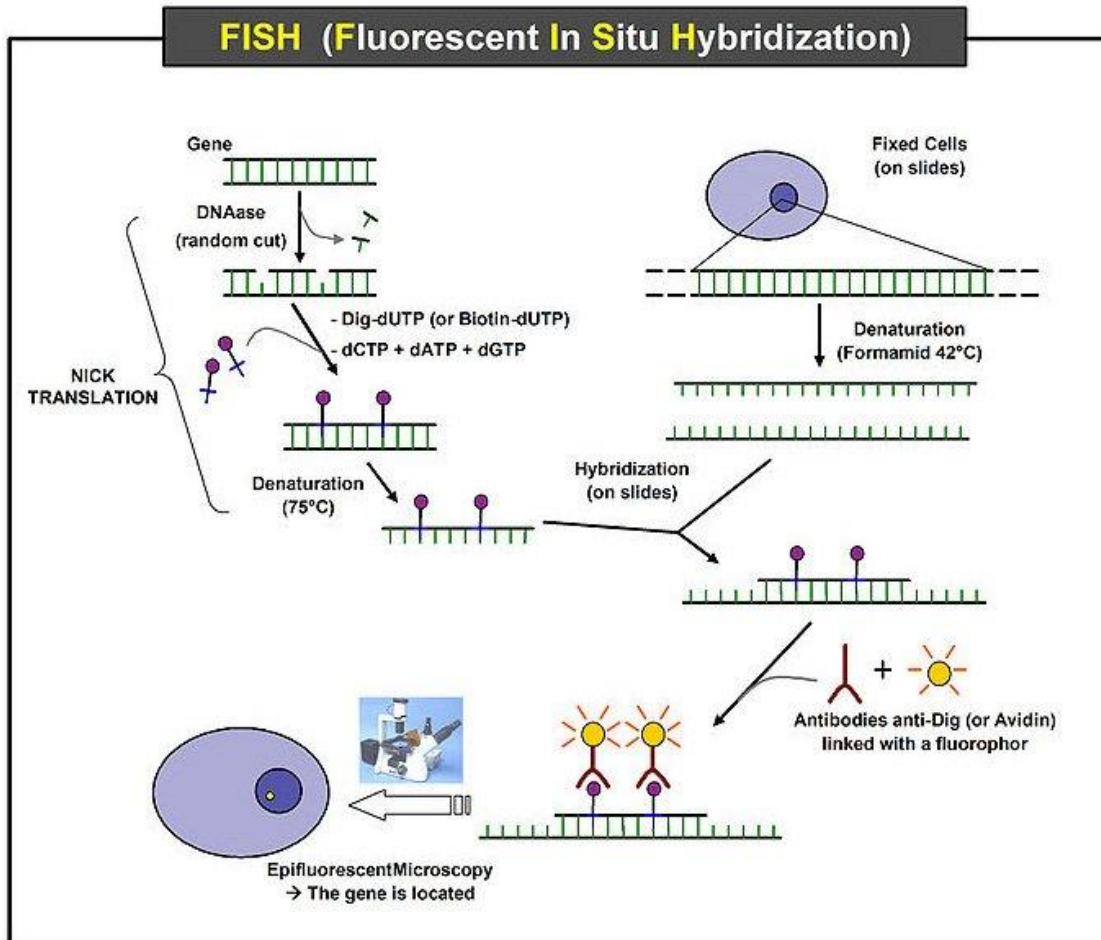


Figure 01: Fluorescent In Situ Hybridization

There are many applications of ISH, mainly in the molecular diagnostics of infectious diseases in order to identify the presence of pathogens and to confirm the pathogen via molecular diagnostics. It is also used in the fields of developmental biology, karyotyping and phylogenetic analysis and physical mapping of chromosomes.

## What is Immunohistochemistry (IHC)?

In the technique of IHC, the main molecule analyzed is the antigen. During IHC, monoclonal and polyclonal antibodies are utilized to determine the presence of antigens upon infection or malignant cell proliferation status. The technique is based on antigen-antibody binding, and enzyme labels are used for this technique; one such application is the [ELISA](#) (Enzyme linked immunosorbent assay). The markers can also be fluorescent tagged antibodies or radio labeled antibodies. IHC is widely used for cancer cell detection. The diagnostic procedures target the antigens present on the tumor cells to identify and characterize the tumor. The same procedure is incorporated

to diagnose infectious agents. Monoclonal and Polyclonal antibodies are also used to analyze different gene products by enabling the antibody-antigen binding reaction between the desired protein and the synthetic antibody administered.

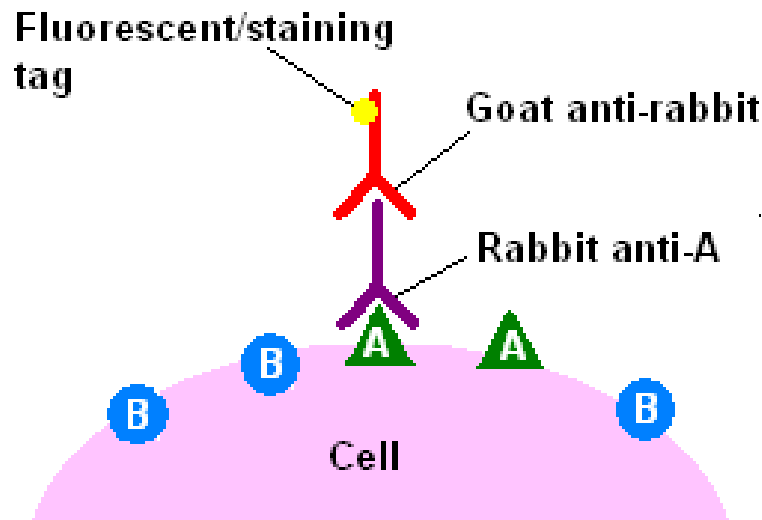


Figure 02: Immunohistochemistry

## What are the similarities between In Situ Hybridization and Immunohistochemistry?

- ISH and IHC are highly specific reactions.
- Both techniques are highly accurate.
- Both techniques can be used in diagnostics for cancer and infectious diseases.
- These techniques are performed in sterile in-vitro environments.
- Both are rapid techniques which provide reproducible results.
- ISH and IHC use detection methods such as radio labeling, and fluorescence techniques.

## What is the difference between In Situ Hybridization and Immunohistochemistry?

### In Situ Hybridization vs Immunohistochemistry

ISH is a nucleic acid hybridization technique which is directly performed on a portion or section of tissue or the entire tissue.

IHC is a technique where monoclonal and polyclonal antibodies are utilized to determine the presence of antigens, which are special protein markers placed on the cell surfaces.

| Type of Bio Molecules Analysed  |   |
|---|---|
| ISH analyses nucleic acids.   | IHC analyses proteins-antigens.                                     |
| Basis of Biochemical Reaction   |   |
| Complementary base pairing between DNA-DNA or DNA-RNA occurs in this technique. | Antigen-antibody interactions are involved in immunohistochemistry. |
| Enzyme-Linked Detection Methods   |   |
| Enzyme linked detection methods cannot be used in ISH.                          | Enzyme linked detection methods can be used in IHC.                 |

## Summary – In Situ Hybridization vs Immunohistochemistry

Molecular diagnostics are rapid and confirmatory methods that can be utilized to identify a non-communicable disease such as cancer or communicable disease such as HIV or Tuberculosis based on the molecular markers present on the cells which lead to the manifestation of the disease. Molecular markers can be present in the form of expressed proteins or at the genetic level based on which different novel techniques are introduced to increase efficiency and are less laborious, although there is a high cost involved with these techniques. Thus ISH depends on DNA-DNA or DNA-RNA hybrid formation, and IHC depends on the specific reactions between antibody and antigen. This is the difference between in situ hybridization.

### References:

1. Duraiyan, Jeyapradha, et al. "Applications of immunohistochemistry." Journal of Pharmacy & Bioallied Sciences, Medknow Publications & Media Pvt Ltd, Aug. 2012, [Available here](#). Accessed 24 Aug. 2017.
2. "In Situ Hybridization (ISH)." National Center for Biotechnology Information, U.S. National Library of Medicine, [Available here](#). Accessed 24 Aug. 2017.

### Image Courtesy:

1. "FISH (Fluorescent In Situ Hybridization)" By MrMatze – Own work ([CC BY-SA 3.0](#)) via [Commons Wikimedia](#)
2. "Immunohistochemicalstaining2" By Imoen at the English language Wikipedia ([CC BY-SA 3.0](#)) via [Commons Wikimedia](#)

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**APA:** Difference Between In Situ Hybridization and Immunohistochemistry. (2017, August 29). Retrieved (date), from <http://differencebetween.com/difference-between-in-situ-hybridization-and-vs-immunohistochemistry/>

**MLA:** "Difference Between In Situ Hybridization and Immunohistochemistry" *Difference Between.Com*. 29 August 2017. Web.

**Chicago:** "Difference Between In Situ Hybridization and Immunohistochemistry." *Difference Between.Com*. <http://differencebetween.com/difference-between-in-situ-hybridization-and-vs-immunohistochemistry/> accessed (accessed [date]).



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