



**ZytoFast**  
**human Ig-kappa Probe**  
**(Digoxigenin-labeled)**

REF T-1115-400  40 (0.4 ml)

For the qualitative detection of  
human Ig-kappa ( $\kappa$ ) mRNA  
by chromogenic *in situ* hybridization (CISH)



In vitro diagnostic medical device  
according to EU directive 98/79/EC

### 1. Intended use

The ZytoFast human Ig-kappa Probe (PF30) is intended to be used for the qualitative detection of human Ig-kappa ( $\kappa$ ) light chain mRNA in formalin-fixed, paraffin-embedded specimens, such as lymphomas, by chromogenic *in situ* hybridization (CISH).

The ZytoFast human Ig-kappa Probe is typically used in conjunction with the ZytoFast human Ig-lambda Probe (PF31) to assist in the distinction between polyclonal and monoclonal lymphoid proliferations.

The ZytoFast human Ig-kappa Probe is intended to be used in combination with one of the ZytoFast PLUS CISH Implementation Kits, either the ZytoFast PLUS CISH Implementation Kit AP-NBT/BCIP (Prod. No. T-1061-40), the ZytoFast PLUS CISH Implementation Kit HRP-DAB (Prod. No. T-1063-40), or the ZytoFast PLUS CISH Implementation Kit AP-Permanent Red (Prod. No. T-1151-40).

Interpretation of the results must be made within the context of the patient's clinical history with respect to further clinical and pathologic data of the patient by a qualified pathologist.

### 2. Clinical relevance

B cells (a.k.a. B lymphocytes) develop from lymphoid stem cells in the bone marrow. Each clone of B cells expresses a unique antibody molecule, composed of two identical heavy and two identical light chains, the latter either of kappa ( $\kappa$ )- or lambda ( $\lambda$ )-type. Determination of kappa-to-lambda ratio is useful to distinguish between neoplastic and reactive lymphoid proliferations. Polyclonal expression of  $\kappa$  or  $\lambda$  light chains is considered to reflect a reactive hyperplasia in contrast to the monoclonal expression in malignant lymphoma, the most common hematologic malignancy encountered in the Western world. Whereas detection of Ig- $\kappa$  and Ig- $\lambda$  by immunohistochemistry often results in excessive background staining, *in situ* hybridization has the advantage of a virtually background-free signal, allowing a safe and simple analysis of the clonality of a given lymphocyte population.

### 3. Test principle

The chromogenic *in situ* hybridization (CISH) technique allows the detection and visualization of specific nucleic acid sequences in cell preparations. Hapten-labeled nucleotide fragments, so called CISH probes, and their complementary target sequences in the preparations are co-denatured and subsequently allowed to anneal during hybridization. Afterwards, unbound and unbound probe fragments are removed by stringency washing steps. Duplex formation of the labeled probe can be visualized using primary (unmarked) antibodies, which are detected by secondary polymerized enzyme-conjugated antibodies. The enzymatic reaction with chromogenic substrates subsequently leads to the formation of colored precipitates. After counterstaining the nucleus with a nuclear dye, hybridized probe fragments are visualized by light microscopy.

### 4. Reagents provided

The ZytoFast human Ig-kappa Probe (PF30) is composed of:

- Digoxigenin-labeled oligonucleotides (~ 0.2 ng/ $\mu$ l), which target mRNA sequences encoding Ig-kappa light chain constant regions.

The ZytoFast human Ig-kappa Probe is available in one size:

- T-1115-400: 0.4 ml (40 reactions of 10  $\mu$ l each)

### 5. Materials required but not provided

- ZytoFast PLUS CISH Implementation Kit AP-NBT/BCIP (Prod. No. T-1061-40) or ZytoFast PLUS CISH Implementation Kit HRP-DAB (Prod. No. T-1063-40) or ZytoFast PLUS CISH Implementation Kit AP-Permanent Red (Prod. No. T-1151-40)
- Positive and negative control specimens
- Microscope slides, positively charged
- Water bath (55°C, 98°C)
- Hybridizer or hot plate
- Hybridizer or humidity chamber in hybridization oven
- Adjustable calibrated pipettes (10  $\mu$ l, 100  $\mu$ l, 1000  $\mu$ l)
- Staining jars or baths
- Timer
- Calibrated thermometer
- Ethanol or reagent alcohol
- Xylene
- Methanol 100%
- Hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>) 30%
- Deionized or distilled water
- Coverslips (22 mm x 22 mm, 24 mm x 32 mm)
- Rubber cement, e.g., Fixogum Rubber Cement (Prod. No. E-4005-50/-125) or similar
- Adequately maintained light microscope (100-200x)

### 6. Storage and handling

Store at 2-8°C in an upright position. Return to storage conditions immediately after use. Do not use reagents beyond expiry date indicated on the label. The product is stable until expiry date indicated on the label when handled accordingly.

### 7. Warnings and precautions

- Read the instructions for use prior to use!
- Do not use the reagents after the expiry date has been reached!
- This product contains substances (in low concentrations and volumes) that are harmful to health and potentially infectious. Avoid any direct contact with the reagents. Take appropriate protective measures (use disposable gloves, protective glasses, and lab garments)!
- If reagents come into contact with skin, rinse skin immediately with copious amounts of water!
- A material safety data sheet is available on our homepage ([www.zytovision.com](http://www.zytovision.com)).

- Do not reuse reagents!
- Avoid any cross-contamination and micro-bacterial contamination of the reagents!
- The specimens must not be allowed to dry during the hybridization and washing steps!

#### Hazard and precautionary statements for PF30:

This probe is not classified as hazardous according to Regulation (EC) No. 1272/2008.

### 8. Limitations

- For *in vitro* diagnostic use.
- For professional use only.
- The clinical interpretation of any positive staining, or its absence, must be done within the context of clinical history, morphology, other histopathological criteria as well as other diagnostic tests. It is the responsibility of a qualified pathologist to be familiar with the CISH probes, reagents, diagnostic panels, and methods used to produce the stained preparation. Staining must be performed in a certified, licensed laboratory under the supervision of a pathologist who is responsible for reviewing the stained slides and assuring the adequacy of positive and negative controls.
- Specimen staining, especially signal intensity and background staining, is dependent on the handling and processing of the specimen prior to staining. Improper fixation, freezing, thawing, washing, drying, heating, sectioning, or contamination with other specimens or fluids may produce artefacts or false results. Inconsistent results may result from variations in fixation and embedding methods, as well as from inherent irregularities within the specimen.
- The probe should be used only for detecting target sequences described in 4. "Reagents provided".
- The performance was validated using the procedures described in these instructions for use. Modifications to these procedures might alter the performance and have to be validated by the user.

### 9. Interfering substances

The following fixatives are incompatible with ISH:

- Bouin's fixative
- B5 fixative
- Acidic fixatives (e.g., picric acid)
- Zenker's fixative
- Alcohols (when used alone)
- Mercuric chloride
- Formaldehyde/zinc fixative
- Hollande's fixative
- Non-buffered formalin

### 10. Preparation of specimens

Recommendations:

- Avoid cross-contamination of samples in any step of preparation as this may lead to erroneous results.
- Fixation in 10% neutrally buffered formalin for 24 h at room temperature (18-25°C).
- Sample size  $\leq 0.5 \text{ cm}^3$ .
- Use premium quality paraffin.
- Embedding should be carried out at temperatures lower than 65°C.
- Prepare 3-5  $\mu\text{m}$  microtome sections.
- Use positively charged microscope slides.
- Fix tissue sections for 2-16 h at 50-60°C.

### 11. Preparatory treatment of the device

The product is ready-to-use. No reconstitution, mixing, or dilution is required. Bring probe to hybridization temperature (55°C) and mix thoroughly before use.

## 12. Assay procedure

#### Specimen pretreatment

Perform specimen pretreatment (e.g., dewaxing, proteolysis) according to the instructions for use of the *ZytoFast* PLUS CISH Implementation Kits.

#### Denaturation and hybridization

1. Pipette 10  $\mu\text{l}$  of the probe onto each pretreated specimen.
2. Cover specimens with a 22 mm x 22 mm coverslip (avoid trapped bubbles) and seal the coverslip.

*We recommend using rubber cement (e.g., Fixogum) for sealing.*

3. Place slides on a hot plate or hybridizer and denature specimens for 5 min at 75°C.
4. Transfer slides to a humidity chamber and hybridize for 1 h at 55°C (e.g., in a hybridization oven).

*It is essential that specimens do not dry out during the hybridization step.*

#### Post-hybridization and detection

Perform post-hybridization processing (washing, detection, counter-staining, mounting, microscopy) according to the instructions for use of the respective *ZytoFast* PLUS CISH Implementation Kit.

## 13. Interpretation of results

Using the *ZytoFast* PLUS CISH Implementation Kits, hybridized Digoxigenin-labeled oligonucleotides appear as dark-blue pattern when detected by alkaline phosphatase (AP) and NBT/BCIP, as bright red pattern when detected by AP and Permanent Red, or as brown pattern when detected by horseradish peroxidase (HRP) and DAB.

A positive reactivity in plasma B-cells is indicated by cytoplasmic staining.

In lymphoid tissue, the normal kappa-to-lambda ratio is roughly 2:1, an indication for monoclonality is given if the kappa-to-lambda ratio is  $>3:1$  or  $<0.3:1$ .

#### Please note:

- Visualization of signals should be performed at least at 100-fold magnification resulting in easily visible signals.
- Do not evaluate areas of necrosis, overlapping nuclei, over-digested nuclei, and nuclei with weak signal intensity.
- A negative or unspecific result can be caused by multiple factors (see chapter 16 "Troubleshooting").
- In order to correctly interpret the results, the user must validate this product prior to use in diagnostic procedures according to national and/or international guidelines.

## 14. Recommended quality control procedures

In order to monitor correct performance of processed specimens and test reagents, each assay should be accompanied by internal and external controls. If internal and/or external controls fail to demonstrate appropriate staining, results with patient specimens must be considered invalid.

**Internal control:** A plasma B-cell within the specimen should show either Ig-kappa or Ig-lambda staining pattern. Cells within the specimen not belonging to the B-cell type, e.g. fibroblasts, should show no staining pattern.

**External control:** Validated positive and negative control specimens.

## 15. Performance characteristics

The performance of the *ZytoFast* human Ig-kappa Probe was assessed by performing chromogenic *in situ* hybridizations (CISH) on light-chain restriction positive and negative tissue specimens. The *ZytoFast* human Ig-lambda Probe was used for the detection of Ig-lambda ( $\lambda$ ) mRNA. Light-chain restriction status of included tissue specimens was assessed by reference methods prior to this study.

**Analytical sensitivity:** The analytical sensitivity was calculated to be 100%.

**Analytical specificity:** The analytical specificity was calculated to be 100%.

## 16. Disposal

The disposal of reagents must be carried out in accordance with local regulations.

## 17. Troubleshooting

Any deviation from the operating instructions can lead to inferior staining results or to no staining at all.

### Weak signals or no signals at all

Possible cause	Action
Cell or tissue sample has not been properly fixed	Optimize fixing time and fixative
Proteolysis, hybridization, denaturation, stringency wash or antibody-incubation temperature not correct	Check temperature of all technical devices used, using a calibrated thermometer. Use always the same number of slides in solutions with critical temperature
Proteolytic pretreatment not carried out properly	Depending on multiple factors, e.g., nature and duration of fixing, thickness of sections, and nature of tissue/cells, different incubation times may be required. Ascertain the optimum time for pepsin incubation in pre-tests
Hybridization time too short	Hybridize for at least 1 h; extend hybridization time if necessary
Too low concentrated Wash Buffer	Check concentration of Wash Buffer
Old dehydration solutions	Prepare fresh dehydration solutions
Probe evaporation	When using a hybridizer, the use of the wet stripes/water filled tanks is mandatory. When using a hybridization oven, the use of a humidity chamber is required. In addition, the coverslip should be sealed completely, e.g., with Fixogum, to prevent drying-out of the sample during hybridization
Insufficient preparation of chromogenic substrate	If kit Prod. No. T-1063-40 or Prod. No. T-1151-40 is used: Instead of preparing the color substrates by dropping, use a pipette
Incubation temperature for color substrates not correct	Check temperature of all technical devices used, using a calibrated thermometer
Counterstaining time too long	The counterstaining time depends on the nature of the specimen and should be optimized accordingly. Avoid dark counterstaining, because it may obscure positive staining signals
No target sequences available	Use positive control probes, e.g., <u>ZytoFast 28S rRNA (+) Control Probe (PF50)</u> , to verify pepsin incubation time. Use verified positive tissue to confirm test performance
Bling of counterstain not carried out properly	If kit Prod. No. T-1063-40 or Prod. No. T-1151-40 is used: Use cold running tap water for bluing; do not use warm or hot water or bluing reagents

### Signals too strong

Possible cause	Action
Proteolytic pretreatment carried out too long	Depending on multiple factors, e.g., nature and duration of fixing, thickness of sections, and nature of tissue/cells, different incubation times may be required. Ascertain the optimum time for pepsin incubation in pre-tests
Substrate reaction is too intense	Shorten substrate incubation time; do not heat substrate solution above the temperature given in the instructions for use

### Signals fade or merge

Possible cause	Action
An unsuitable mounting solution has been used	Use only the mounting solution provided with the kit or recommended by the instructions for use. Use solutions free of any impurities; do not use coverslip tape

### Uneven or in some parts only very light staining

Possible cause	Action
Incomplete dewaxing	Use fresh solutions; check duration of dewaxing
Reagent volume too small	Ensure that the reagent volume is large enough to cover the tissue area
Air bubbles caught before hybridization or during mounting	Avoid air bubbles

### Inconsistent results

Possible cause	Action
Insufficient drying before probe application	Extend air-drying
Too much water/wash buffer on tissue prior to application of pepsin, antibodies and/or color substrates	Ensure that excess liquid is removed from tissue section by blotting or shaking it off the slide. Small amounts of residual water/wash buffer do not interfere with the test
Variations in tissue fixation and embedding methods	Optimize fixation and embedding methods
Variations in tissue section thickness	Optimize sectioning

### Tissue morphology degraded

Possible cause	Action
Cell or tissue sample has not been properly fixed	Optimize fixing time and fixative
Proteolytic pretreatment not carried out properly	Optimize pepsin incubation time

### Noisy background

Possible cause	Action
Stringency wash temperature not correct	Check temperature of the technical devices used, using a calibrated thermometer. Use always the same number of slides in the jar. We recommend not to use more than eight slides per jar for heat incubation steps
Slides not thoroughly rinsed	Use fresh and sufficient wash buffer and deionized or distilled water where indicated
Sections dried out any time during or after hybridization	Avoid sections being dried out; use humidity chamber; seal coverslip properly
Prolonged substrate incubation time	Shorten substrate incubation time
Incomplete dewaxing	Use fresh solutions; check duration of dewaxing
Proteolytic pretreatment too strong	Optimize pepsin incubation time
Slides cooled to room temperature before hybridization	Transfer the slides quickly to hybridization temperature
Tissue-antibody interaction	Use negative control probes, e.g., <u>ZytoFast RNA (-) Control Probe (PF33)</u> , to ascertain tissue-specific background staining

### Overlapping signals

Possible cause	Action
Inappropriate thickness of tissue sections	Prepare 3-5 $\mu\text{m}$ microtome sections

### Specimen floats off the slide

Possible cause	Action
Unsuitable slide coating	Use appropriate (positively charged) slides
Proteolytic pretreatment too strong	Shorten pepsin incubation time

## 18. Literature

- Erber WN, et al. (1993) *Pathology* 25: 63-7.
- Hieter PA, et al. (1980) *Cell* 22: 197-207.
- Hieter PA, et al. (1981) *Nature* 294: 536-40.
- Marti GE, et al. (2005) *Br J Haematol* 130: 325-32.
- McNicol AM, Farquharson MA (1997) *J Pathol* 182: 250-61.
- Pringle JH, et al. (1990) *J Pathol* 162: 197-207.
- Wilkinson DG: *In Situ Hybridization, A Practical Approach*, Oxford University Press (1992) ISBN 0 19 963327 4.

Our experts are available to answer your questions.  
Please contact [helptech@zytovision.com](mailto:helptech@zytovision.com)



ZytoVision GmbH  
Fischkai 1  
27572 Bremerhaven/ Germany  
Phone: +49 471 4832-300  
Fax: +49 471 4832-509  
[www.zytovision.com](http://www.zytovision.com)  
Email: [info@zytovision.com](mailto:info@zytovision.com)

### Trademarks:

ZytoVision® and ZytoFast® are trademarks of ZytoVision GmbH.