

**ab183289 –TripleStain
IHC Kit: R&R&M on
human tissue (DAB,
AP/Red & DAB/Ni)**

Instructions for Use

For the detection of Rabbit and Mouse Primary antibodies on Human Tissue.

This product is for research use only and is not intended for diagnostic use.

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1. Introduction

Abcam's TripleStain IHC Kit (ab183289) is designed to be used with user-supplied one mouse primary antibody and two rabbit primary antibodies to detect three distinct antigens on human tissue or cell samples. This kit has been tested on paraffin embedded tissue specimens, however, it also can also be used on frozen tissue or cell smears.

2. Principle of Assay

Triple staining uses traditional and non-traditional methods in immunohistostaining to reveal three distinct antigens and their co-expression on a single tissue. Abcam's TripleStain IHC Kit (ab183289) supplies polymer enzyme conjugates: Mouse HRP Polymer, Rabbit AP Polymer and Rabbit HRP Polymer with three chromogens, DAB (brown); Permanent Red (red); and DAB-Ni (Black). Abcam's TripleStain IHC Kit (ab183289) is a non-biotin system, avoiding non-specific binding caused by endogenous biotin. This kit has been optimized to have no cross detection when detecting two primary antibodies from the same host species using our unique blocking system. Simplified steps allow the user to complete triple staining within 5 hours (without antigen retrieval) or 6 hours (with antigen retrieval). The well tested protocol provides the user with the ability to permanently mount slides with coverslip.

3. Kit Contents

Item	Quantity (24 mL) (120 slides)	Quantity (72 mL) (360 slides)	Quantity (120 mL) (1200 slides)
Rabbit AP Polymer	6 mL	18 mL	60 mL
Rabbit HRP Polymer	12 mL	2 x 18 mL	120 mL
DAB Substrate	12 mL	2 x 18 mL	120 mL
DAB Chromogen (20x)	2 mL	4 mL	12 mL
Permanent Red Activator (5x)	3 mL	7.2 mL	2 x 12 mL
Permanent Red Chromogen (100x)	150 µL	360 µL	1.2 mL
Permanent Red Substrate	15 mL	2 x 18 mL	120 mL
Antibody Blocker (40x)	2 x 15 mL	50 mL	100 mL
Blocker A	12 mL	2 x 18 mL	120 mL
Blocker B	12 mL	2 x 18 mL	120 mL
Mouse HRP Polymer	6 mL	18 mL	60 mL
Hydrogen Peroxide (20x)	1 mL	2 mL	6 mL

Item	Quantity (24 mL) (120 slides)	Quantity (72 mL) (360 slides)	Quantity (120 mL) (1200 slides)
DAB-Ni Substrate (20x)	1 mL	2 mL	6 mL
Nickel Solution (7x)	3 mL	6 mL	18 mL
Aqueous Mounting Medium	15 mL	2 x 18 mL	120 mL

4. Storage and Handling

Store at 2-8°C. Do not freeze. The reagents must be returned to the storage conditions immediately after use.

5. Additional Materials Required

- One Mouse and two Rabbit primary antibodies
- Wash buffer: PBS-T - 0.01M pH7.4 PBS with 0.05% Tween20
- Wash buffer: TBS-T - 50mM Tris HCl, 150mM NaCl, 0.05% Tween20, pH 7.6
- Peroxidase and alkaline phosphatase blocking buffers
- 100% Ethanol
- 100% Xylene
- Hematoxylin

6. Recommendations

Read all protocol steps before starting staining experiment and follow each step carefully in the order given.

- 1. The volumes provided in this kit are sufficient for the number of slides indicated if 100 μ L are used.*
- 2. Fixation: To ensure the quality of the staining and to obtain reproducible performance the user needs to supply appropriately fixed tissue and well prepared slides*
- 3. Tissues must be adhered to the slide properly to ensure maximum quality staining*
- 4. Paraffin embedded sections must be deparaffinised with xylene and rehydrated with a graded series of ethanol before staining.*
- 5. Cell smear samples should be made up to as much of a monolayer as possible to obtain satisfactory results.*
- 6. Three control slides will aid the interpretation of the result: positive and negative tissue controls, reagent control (slides treated with Isotype control reagent).*
- 7. During IHC staining: DO NOT let specimens or tissues dry from this point on.*

8. *pH plays an important role for that reason use fresh hemotoxylin and only expose for 10- 30 seconds.*
9. *The more colors you use in multi-staining the more pertinent it becomes to keep the hemotoxylin as weak as possible to distinguish antigen staining better.*
10. *The fixation, tissue slide thickness, antigen retrieval and primary antibody dilution and incubation time affect results significantly. The Investigator needs to consider all factors and determine optimal conditions when interpreting results.*
11. *We recommend TBS-T to be used as the wash buffer to get the highest sensitivity and clean background. Phosphate in the PBS may inhibit the activity of the alkaline phosphatase.*
12. *The Mounting medium is water-based and is used as the permanent mounting medium for alcohol soluble chromogens. It does not need a coverslip, however, if you require a coverslip the dehydration steps must be shorter for optimal tissue structure and chromogen signal maintenance.*

Note: Please wipe off extra water and air dry slides before dehydration and clear.

- a. 1x 80% Ethanol 20 seconds;
- b. 1x 95% Ethanol 20 seconds;
- c. 3x 100% Ethanol 20 seconds each;
- d. 1x 100% Xylene 20 seconds;

CAUTION: DO NOT dehydrate in xylene longer than 20 seconds! It will erase the Permanent Red staining.

7. Protocol

Unless otherwise stated all steps are performed at room temperature.

Tissue Preparation (Up to 70 minutes)

1. Incubate slides in peroxidase blocking reagent (3% H₂O₂ solution) and alkaline phosphatase blocking reagent (ie levamisole) for 10 minutes.
2. Rinse the slides using 2 changes of distilled water.
3. Heat induced Epitope Retrieval (HIER) may be required for primary antibody as suggested by manufacturer.
4. Wash three times with PBS-T or TBS-T for 2 minutes per wash.

Staining Protocol (Up to 230 minutes)

1. Apply 2 drops or enough volume of one mouse and one rabbit primary antibody mixture to cover the tissue completely. Incubate in a moist chamber for 30-60 minutes.

Note: Investigator needs to optimize dilution prior to triple staining. DO NOT combine the same host species primary antibodies together at this stage.

2. Wash three times with PBS-T or TBS-T for 2 minutes per wash.

3. **Preparation of Polymer Mixture:** Mix Mouse HRP polymer and Rabbit AP Polymer at a 1:1 ratio, mix well
Note: Do not mix more than needed for the experiment as the polymer mixture may not be as stable as non-mixed polymers.
4. Apply 1-2 drops (50-100 μ L) of the Polymer mixture to cover the tissue completely.
5. Incubate in a moist chamber for 30 minutes
6. Wash three times with PBS-T or TBS-T for 2 minutes per wash.
7. **Preparation of DAB Working Solution:** Add 1 drop of DAB Chromogen to 1mL DAB Substrate. Mix well. Store at 4°C and use within 7 hours.
8. Apply 1-2 drops (50-100 μ L) of Dab Working Solution to cover the tissue completely
9. Incubate for 5 minutes
10. Rinse slides in multiple changes of distilled water (3 times for 2 minutes per wash) or under running tap water for 2 minutes
11. Wash three times with TBS-T for 2 minutes per wash.
12. **Preparation of Permanent Red Working Solution:** Add 200 μ L of Permanent Red Activator to 1 mL of Permanent Red

Substrate and mix well. Then add 10 μL of Permanent Red Chromogen to this mixture and mix well.

Note: For fewer slides use half of the quantities given above

13. Apply 2 drops (100 μL) or enough volume of the Permanent Red Working Solution to completely cover the tissue.
14. Incubate for 10 minutes observing appropriate color development.
15. Rinse well with distilled water
16. **Preparation of Antibody Blocker:** Dilute 1 part Antibody Blocker with 39 parts distilled water and use a hot plate or water bath to heat to 80°C. Make enough volume to cover the tissue in beaker.

Note: For frozen tissues, a lower temperature of 65°C must be used during the Antibody Blocker step to prevent dissociation of the tissue from the slide. The Antibody Blocker will block the antibodies used in the previous steps preventing cross reactivity.
17. Put slides in heated Antibody Blocker for 10 minutes at 80°C (or 65°C).
18. Remove slides and cool for 5 seconds.
19. Rinse well with distilled water.

20. **Optional Step:** If antigen retrieval is required follow instructions on antibody manufacturer's datasheet.
21. Wash three times with PBS-T or TBS-T for 2 minutes per wash.
22. Apply 2 drops or enough volume of Blocker A to cover the tissue completely. Mix well on the slide.
23. Incubate in a moist chamber for 30 minutes
24. Wash three times with PBS-T or TBS-T for 2 minutes per wash.
25. Apply 2 drops or enough volume of Blocker B to cover the tissue completely. Mix well on the slide.
26. Incubate in a moist chamber for 5 minutes
27. Wash three times with PBS-T or TBS-T for 2 minutes per wash
28. Apply 2 drops or enough volume of the second rabbit primary antibody (user supplied) to cover the tissue completely.
29. Incubate in a moist chamber for 30-60 minutes
30. Wash three times with PBS-T or TBS-T for 2 minutes per wash.
31. Apply 1-2 drops (50-100 μ L) or enough volume of Rabbit HRP Polymer to completely cover the tissue.
32. Incubate in a moist chamber for 15 minutes.

33. Wash three times with PBS-T or TBS-T for 2 minutes per wash.

34. Preparation of DAB-Ni Working Solution:

- Add 1 drop (50 μ L) of DAB-Ni Substrate (20x) to 1 mL distilled water. Mix well.
- Then add 1 drop (50 μ L) of DAB Chromogen (20x) and 1 drop (50 μ L) of Hydrogen Peroxide (20x) to the solution and mix well.
- Now add 3 drops (150 μ L) of Nickel Solution (7x) to the solution and mix well.

Note: Use DAB-Ni Working Solution within 7 hours and store at 4°C keeping away from light during operation.

35. Apply 2 drops (100 μ L) or enough volume of the DAB-Ni Working Solution to completely cover the tissue

36. Incubate in an enclosed chamber at room temperature for about 5 minutes.

37. When appropriate color has developed rinse gently under tap water for about 1-2 minutes.

Counterstaining/Mounting

1. Apply 2 drops (100 μ L) or enough volume of hematoxylin to completely cover the tissue. Incubate for 10-15 seconds.

2. Rinse thoroughly with tap water for 2-3 minutes

3. Place slides in PBS until blue color shows (30-60 seconds).
4. Rinse well in distilled water.
5. Apply 2 drops (100 μ L) of the aqueous mounting medium to cover the tissue section when tissue is wet. Rotate the slides to allow the mount to spread evenly.
6. Place slides horizontally in an oven at 40-50 °C for at least 30 minutes or leave at room temperature until the slides are thoroughly dried.

8. General IHC Troubleshooting Tips

Problem	Cause	Solution
No Staining	The primary antibody and the secondary detection polymer are not compatible.	Use a primary antibody that was raised in a species that can be detected by the polymer detection system (e.g. goat primary antibody with Goat AP polymer).
	Not enough primary antibody is bound to the protein of interest.	Use less dilute antibody, Incubate longer (e.g. overnight) at 4°C.
	The antibody may not be suitable for IHC procedures which reveal the protein in its native (3D form).	Test the antibody in a native (non-denatured) WB to make sure it is not damaged.
	The protein is not present in the tissue of interest.	Run a positive control recommended by the supplier of the antibody.
	Deparaffinization may be insufficient.	Deparaffinize sections longer, change the xylene.

No Staining (cont.)	The primary/secondary antibody/amplification kit may have lost its activity due to improper storage, improper dilution or extensive freezing/thawing.	Run positive controls to ensure that the primary/secondary antibody is working properly.
	The protein of interest is not abundantly present in the tissue.	Use an amplification step to maximize the signal.
	Fixation procedures (using formalin and paraformaldehyde fixatives) may be modifying the epitope the antibody recognizes.	Use antigen retrieval methods to unmask the epitope, fix for less time.
	The protein is located in the nucleus and the antibody (nuclear protein) cannot penetrate the nucleus.	Add a permeabilizing agent to the blocking buffer and antibody dilution buffer.
	The PBS buffer is contaminated with bacteria that damage the phosphate groups on the target protein.	Add 0.01% azide in the PBS antibody storage buffer or use fresh sterile PBS.

Problem	Cause	Solution
High Background	Blocking of nonspecific binding might be absent or insufficient.	Increase the blocking incubation period and consider changing blocking agent. Abcam recommends 10% normal serum 1hr for sections or 1-5% BSA for 30 min for cells in culture.
	Incubation temperature may be too high.	Incubate sections or cells at 4°C.
	The primary antibody concentration may be too high.	Titrate the antibody to the optimal concentration, incubate for longer but in more dilute antibody (a slow but targeted binding is best).
	The secondary detection polymer may be binding non-specifically (damaged).	Run a secondary polymer negative control without primary antibody.
	Tissue not washed enough, fixative still present.	Wash extensively in PBS between all steps.

High Background (cont.)	Endogenous peroxidases are active.	Use enzyme inhibitors i.e. Levamisol (2 mM) for alkaline phosphatase or H ₂ O ₂ (0.3% v/v) for peroxidase.
	Fixation procedures (using formalin and paraformaldehyde fixatives) are too strong and modified the epitope the antibody recognizes.	Change antigen retrieval method, decrease the incubation time with the antigen unmasking solution.
	Too much substrate was applied (enzymatic detection).	Reduce substrate incubation time.
	The chromogen reacts with the PBS present in the cells/tissue (enzymatic detection).	Use Tris buffer to wash sections prior to incubating with the substrate, then wash sections/cells in Tris buffer.
	Permeabilization has damaged the membrane and removed the membrane protein (membrane protein).	Remove permeabilizing agent from your buffers.

Problem	Cause	Solution
Non-specific staining	Primary/secondary polymer concentration may be too high.	Try decreasing the antibody concentration and/or the incubation period. Compare signal intensity against cells that do not express the target.
	Endogenous peroxidases are active.	Use enzyme inhibitors i.e. Levamisol (2 mM) for alkaline phosphatase or H ₂ O ₂ (0.3% v/v) for peroxidase.
	The primary antibody is raised against the same species as the tissue stained (e.g. mouse primary antibody tested on mouse tissue). When the secondary antibody is applied it binds to all the tissue as it is raised against that species.	Use a primary antibody raised against a different species than your tissue.
	The sections/cells have dried out.	Keep sections/cells at high humidity and do not let them dry out.

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