



Hypoxyprobe, Inc.  
121 Middlesex Turnpike  
Burlington, MA 01803 USA  
[www.hypoxyprobe.com](http://www.hypoxyprobe.com)

## Hypoxyprobe™-1 PAb27 TIMES PLUS Kit

**HPI Catalog # HP22-XXX**

**Kit contents:** Solid pimonidazole HCl (Hypoxyprobe™-1), high titer affinity purified polyclonal rabbit anti-pimonidazole antibody conjugated to the fluorescent fluorescein isocyanate dye FITC (PAb27HAP-FITC), the anti FITC rabbit hrp, and the DAB hrp chromogen.

**Applications:** Immunochemical detection of cell and tissue hypoxia including immunofluorescence, immunoperoxidase; Western blotting; or, flow cytometry. Very low background in mouse tissues when the Hypoxyprobe™-1 PAb27-FITC is combined with an anti-rabbit secondary reagent (secondary reagent is supplied in the PAB27 TIMES PLUS Kit).

**Quantities:**

- Hypoxyprobe™-1 Omni Kits contain 100 mg, 200 mg or 1000 mg of Hypoxyprobe™-1 (pimonidazole HCl). A typical dosage of 60mg/kg body weight is used for small animal studies.

- One vial (100 and 200 mg Kits) or two vials (1000 mg Kit) of 200 microliters of high titer affinity purified anti-pimonidazole rabbit antisera tagged with FITC. It contains 0.09% sodium azide and 1% BSA as stabilizers. Optimal dilution of PAb27HAP-FITC is to be determined by each investigator but a 1/500 -1/2000 dilution has been found to give strong immunostaining in mouse tumor tissue when combined with the peroxidase conjugated goat anti-rabbit antisera.

- One vial (100mg and 200mg Kits) or two vials (1000mg Kit) of 200 microliters of Rabbit polyclonal Anti-FITC hrp.

- One vial (100mg and 200mg Kits) or two vials (1000mg Kit) of 500 microliters of Diamino benzidine (DAB) substrate solution. It provides a substrate for the horse radish peroxidase group (HRP) attached to the secondary antibody [ANTI-FITC-HRP]. The

resulting enzymatic reaction results in a brown color in the areas of hypoxic tissue. The brown color should overlap areas the green fluorescence of the primary antibody PAb27HAP-FITC. This overlapping technique of fluorescence signals versus visible chromogenic signals is very useful. Studies of encapsulation versus pinocytosis of the pimonidazole into the cells' cytoplasm or organelles like the mitochondria can be performed.

- Storage:**
- a. Store Hypoxyprobe™-1 solid at room temperature in the dark (can also be stored at 2-8 degrees C).
  - b. Store rabbit PAb27HAP-FITC, Anti FITC hrp, and the chromogen at 2-8 degrees C.

**Do not freeze**

### **Details of Hypoxyprobe™-1 HP27HAP-FITC TIMES PLUS Kit components**

1) Hypoxyprobe™-1 is a substituted 2-nitroimidazole whose chemical name and only ingredient is pimonidazole hydrochloride. Hypoxyprobe™-1 has a molecular weight of 290.8; a water solubility of 400 millimolar equivalent to 116 mg/ml; and, ultraviolet absorbance at 324 nm with an extinction coefficient of 7020 in 0.9% saline. The free base, pimonidazole, has a molecular weight of 254.3, a pKa of 8.7 and an octanol water partition coefficient of 8.5. See [www.hypoxyprobe.com](http://www.hypoxyprobe.com) for mechanism of action, frequently asked questions (FAQ) and applications for Hypoxyprobe™-1 kits.

Hypoxyprobe™-1 is chemically stable in both solid form and aqueous solution. For example, solid Hypoxyprobe-1 has been stored for two years at room temperature in subdued light without detectable degradation as assessed by UV and HPLC analyses. Hypoxyprobe™-1 solutions in 0.9% saline have been stored at a concentration of 100 gm/liter at 4°C for 4.5 years without detectable degradation (UV and HPLC analyses).

Pimonidazole is reductively activated in hypoxic cells. The activated intermediate forms stable covalent adducts with thiol groups in proteins, peptides and amino acids. The antibody reagent PAb27HAP-FITC binds to these adducts allowing their detection by immunochemical means. See

[www.hypoxyprobe.com](http://www.hypoxyprobe.com) for mechanism of action, frequently asked questions (FAQ) and applications for Hypoxyprobe™-1 kits.

2) PAb27HAP-FITC is a high titer affinity purified rabbit antibody preparation that binds to protein adducts of Hypoxyprobe™-1 in hypoxic cells. PAb27HAP-FITC contains sodium azide for added stability. Tissues of interest can be studied by immunohistochemistry of frozen fixed or formalin fixed paraffin embedded sections; Western blotting; or, flow cytometry following tissue disaggregation.

Note: PAb27HAP-FITC binds to protein, peptide and amino acid adducts of pimonidazole in hypoxic cells but tissue processing for immunohistochemical assay washes out small molecule peptide and amino acid adducts so that immunohistochemical hypoxia detection relies on protein adducts of pimonidazole in hypoxic tissue.

## Assay Instructions

1. Investigations of normal or tumor tissue hypoxia begin with the intravenous infusion, intraperitoneal injection or oral ingestion of a Hypoxyprobe™-1 solution at a dosage of 60 mg/kg body weight. For a 25 gram mouse this amounts to 1.5 mg/mouse. Dosages up to 400 mg/kg have been used in mice without detectable toxicity or change in tissue hypoxia but 60 mg/kg gives good immunostaining at minimum cost. The solubility of Hypoxyprobe™-1 in saline is 116 mg/ml so that very small volumes can be used to administer Hypoxyprobe™-1.

Following injection or ingestion, Hypoxyprobe™-1 distributes to all tissues including brain but it forms adducts with thiol containing proteins only in those cells that have a oxygen concentration less than 14 micromolar -- equivalent to a partial pressure  $pO_2 = 10$  mm Hg at 37°C. In addition to tumors, normal tissues such as liver, kidney and skin possess cells at, or below, a  $pO_2$  of 10 mmHg. These normal tissues bind Hypoxyprobe™-1.

The plasma half-life of Hypoxyprobe™-1 in mice is approximately 25 minutes (see the FAQ link at [www.hypoxyprobe.com](http://www.hypoxyprobe.com) for references). For comparison, plasma half-lives for rats is 45 minutes, dogs 90 minutes and humans 300 minutes. Mouse tissues of interest may be harvested 15 to 90 minutes after

Hypoxyprobe™-1 administration. Hypoxyprobe™-1 residing in tissues at the time of harvest will be bound when dissected tissues go anoxic. However, the amount of residual Hypoxyprobe™-1 is very small compared to the amount that tissues are exposed to during a 15 to 90 minute experiment so that any non-specific binding due to residual Hypoxyprobe™-1 is undetectable.

In addition to animal studies, Hypoxyprobe™ kits can be used for cells in tissue culture (see Applications link at [www.hypoxprobe.com](http://www.hypoxprobe.com)). Typically, cell suspensions are incubated under hypoxia for 1 to 2 hours in the presence of 100 to 200 micromolar Hypoxyprobe™-1. The cells are harvested by cytopspin, fixed and then stained with anti pimonidazole PAb27HAP-FITC and then a chromogenic or a fluorescent secondary reagent.

### Suggested protocol for PAb27HAP-FITC immunohistochemistry

Kleiter et al., Int. J. Radiat. Oncol. Biol. Phys. 64: 592-602, 2006.

*Hypoxyprobe™ technology is robust and investigator-initiated modifications are encouraged.*

| Step | Procedure                       | Time, min. | Temp. | Reagents  | Notes |
|------|---------------------------------|------------|-------|---|-------|
| 1    | Warm paraffin tissue section    | 20         | 40°C  | None  |       |
| 2    | Dip and blot 10 times           | 2          | RT    | Clear-Rite 3  | 1     |
| 3    | "                               | 2          | RT    | 100% Ethanol  |       |
| 4    | "                               | 2          | RT    | 95% Aqueous ethanol                                 |       |
| 5    | "                               | 2          | RT    | 80% Aqueous ethanol                                 |       |
| 6    | "                               | 2          | RT    | 0.2% Brij 35 in distilled water                     | 2     |
| 7    | "                               | 2          | RT    | PBS+ 0.2% Brij 35                                   | 3     |
| 8    | Quench tissue peroxidase        | 5          | RT    | 3% H <sub>2</sub> O <sub>2</sub> in distilled water | 4     |
| 9    | Wash                            | 2          | RT    | PBS+ 0.2% Brij 35                                   |       |
| 10   | Antigen retrieval               | 20         | 90°   | Target retrieval reagent                            | 5,6   |
| 11   | Cool to RT                      | 20         | RT    | None  |       |
| 12   | Wash                            | 2          | RT    | PBS + 0.2% Brij 35                                  | 7     |
| 13   | Block non-specific binding      | 5          | RT    | Protein blocking agent                              | 8,9   |
| 14   | Rabbit PAb27HAP-FITC 1° reagent | 60         | RT    | PAb27HAP-FITC(1:50-1:200)                           | 10    |
| 15   | Wash                            | 2          | 0°    | PBS + 0.2% Brij 35                                  | 7     |
| 16   | Anti-FITC 2° reagent            | 20         | RT    | Anti-FITC polymer HRP                               | 11    |
| 17   | Wash                            | 2          | 0°    | PBS + 0.2% Brij 35                                  | 7     |
| 18   | Peroxidase chromogen            | 10         | RT    | DAB   | 12    |
| 19   | Wash                            | 2          | RT    | Running distilled water                             |       |
| 20   | Counterstaining                 | 0.5        | RT    | Hematoxylin   | 13    |
| 21   | Wash                            | 2          | RT    | Running distilled water                             |       |

|    |                       |    |      |                  |    |
|----|-----------------------|----|------|------------------|----|
| 22 | Cover tissue sections | 45 | 45°C | Aqueous CC/Mount | 14 |
|----|-----------------------|----|------|------------------|----|

### Technical Notes

1. Clear-Rite 3 -- a less toxic alternative to xylene -- is available from VWR (Cat# 84000-052). For dewaxing (step 2) and tissue rehydration (steps 3-7), ProbeOn Plus slides (Fisher Scientific; Cat# 15-188-52) are held vertically in a MicroProbe Staining Station (Fisher Scientific) in pairs with tissue sections facing each other. The paired slides are dipped in solvent allowing capillary action to carry solvents over the tissue sections. Solvent is removed by blotting the lower end of the slide pair on adsorbent filter paper. The dip and blot procedure is repeated a total of 10 times for each of steps 2-7.

**Note: These steps were designed for the MicroProbe Staining Station but other routine IHC procedures can be used.**

2. Brij 35 is enzyme grade polyoxyethylene(23)lauryl ether available from Fisher Scientific (Cat# BP345-500). Alternatives to Brij35 such as Tris buffered saline (TBS) available from Chemicon International, Temecula, CA (Cat# 20845) can be used as the rinse solution. It is recommended that Tween 20® be added to the TBS rinse buffer at a final concentration of 0.1%.

3. PBS is 10 mM phosphate buffered saline prepared from tablets available from Sigma (Cat# P-4417).

4. 3% H<sub>2</sub>O<sub>2</sub> is diluted Analytical Reagent grade 31.3% H<sub>2</sub>O<sub>2</sub> available from Malinckrodt Baker, Paris, KT (Cat# 5240). Commercial peroxidase blockers may be used.

5. Antigen retrieval agents such as AbD Serotec Cat# BUF025B; Chemicon International Cat# 21545; or, DAKO Cat# S2369 can be used. Pimonidazole protein adducts are very robust so that the antigen retrieval reagent can be chosen on the basis of requirements for other factors of interest in tissue sections.

6. Slides held vertically in slide incubator.

7. Slides washed with magnetically stirred PBS + 0.2% Brij 35 in a rectangular staining jar.

8. For example, serum free protein blocker from DAKO Corp. (Carpinteria, CA)(Cat# X0909).

9. Slides held horizontally for steps 13-20 so as to limit non-specific, edge staining of the sections.

10. PAb27HAP diluted 1:50-1:200 in 10 mM PBS containing 0.2% Brij 35 or other suitable antibody diluent such as Chemicon International, Cat# 21544. Typically, 100 uL of diluted PAb27HAP solution is applied to each tissue section.

11. For example, DAKO EnVision+System kit K4011.

12. For example, DAKO EnVision+System kit K4011.

13. Any commercially available hematoxylin counterstain is suitable including Chemicon International Cat# 20844.

14. CC/Mount (Sigma; Cat# C9368), a direct replacement for Biomedica's Crystal Mount, is an aqueous based permanent mount for immunostained sections. Alternatives include cover slipping with PermOUNT (Fisher Scientific; Cat# SP15-500).

### Procedure for immunostaining Hypoxyprobe-1 adducts in frozen, fixed tissues.

Most of the published work reporting fluorescence immunohistochemical detection of pimonidazole adducts is based on frozen sections (see for example, Ljungkvist et al, Int. J. Radiat. Oncol. Biol. Phys., 62(4): 1157-1168, 2005). The tumor or tissue specimen is collected and directly frozen in liquid nitrogen until cryosectioned into 4 um sections. The sections are then stored at -80°C until stained.

After thawing, the sections are fixed in cold acetone (4°C) for 10 min. Typically the sections would be rinsed and incubated overnight at 4°C with rabbit anti-pimnidazole antisera PAb27HAP diluted 1:20 in PBS containing 0.1% bovine serum albumin and 0.1% Tween 20 but investigators are encouraged to optimize dilutions for their particular application. The sections are then incubated for 60 min with FITC-conjugated goat anti-rabbit antibody or Cy2-conjugated donkey anti-rabbit F(ab')<sub>2</sub> (Jackson Immuno Research Laboratories). Between all steps of the staining procedure, the sections are rinsed three times with for 2 minutes in PBS.