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## Hypoxyprobe™ Gemini Kit

### Kit Contents:

**Solid pimonidazole HCl (Hypoxyprobe™-1)**

**Solid CCI-103F (Hypoxyprobe™-F6)**

**Diluted Rabbit anti-pimonidazole antisera (PAb2627)**

**Diluted Rabbit anti-CCI-103F antisera (PAbF6)**

Applications: Use the Hypoxyprobe Gemini Kit to follow longitudinal changes in hypoxia in a single tissue sample by means of immunochemical detection including immunoperoxidase, immunofluorescence or flow cytometry. Kleiter et al have used immunoperoxidase analysis on consecutive sections (Kleiter et al., Int. J. Radiation Oncol. Biol. Phys. 64(2): 592-602, 2006) and Ljungkvist et al. (Int. J. Radiat. Oncol. Biol. Phys. 62(4): 1157-1168, 2005). have used immunofluorescence analyses of dual hypoxia markers on the same tissue section

Quantities:

- Hypoxyprobe™ Gemini Kits contain 100, 200 or 1000 mg each of the hypoxia markers, pimonidazole HCl and CCI-103F (Hypoxyprobe™-1 and -F6, respectively). Typically, a dosage of 60 mg/kg body weight of each marker is used in small animal studies.
- Each Kit contains diluted anti-pimonidazole and diluted anti-CCI-103F non-cross reacting rabbit antisera (PAb2627 and PAbF6, respectively) containing 0.09% sodium azide and 1% BSA as stabilizers. The 100 and 200 mg Kits contain one 200 uL unit of each antiserum; the 1000 mg Kit contains two 200 uL units of each antiserum. Optimal operating dilutions of the antisera are to be determined by investigators but 1/500 -1/1000 dilutions give strong immunoperoxidase staining when combined with peroxidase conjugated goat anti-rabbit secondary antisera. Lower dilutions of 1/50-1/200 might be more appropriate for dual marker immunofluorescence studies (Ljungkvist et al., Int. J. Radiat. Oncol. Biol. Phys. 62(4): 1157-1168, 2005).

Not supplied: Anti-rabbit secondary reagents or other immunohistochemical reagents (buffers, antigen retrieval agents, etc).

- Storage:
- a. Store Hypoxyprobe™-1 and -F6 in subdued light at 2-8 degrees C.
  - b. Store rabbit antisera at 2-8 degrees C.

### Detailed description of Hypoxyprobe™ Gemini Kit components

1) Hypoxyprobe™-1 (pimonidazole HCl) and Hypoxyprobe™-F6 (CCI-103F) are substituted 2-nitroimidazoles. Pimonidazole HCl has a molecular weight of 290.8 and high water solubility of 400 millimolar equivalent to 116 mg/ml. CCI-103F is a hexafluorinated 2-nitroimidazole with six magnetically equivalent fluorine atoms; a molecular weight of 337.2; and, a water solubility of 5.3 millimolar equivalent to 1.8 mg/ml. CCI-103F is typically administered intraperitoneally in a 10% DMSO/ peanut oil mixture (Ljungkvist et al., Int. J. Radiat. Oncol. Biol. Phys. 62(4): 1157-1168, 2005). Both pimonidazole HCl and CCI-103F are extremely stable when stored in subdued light.

Pimonidazole and CCI-103F are reductively activated in hypoxic cells. The activated intermediates forms stable covalent adducts with thiol (sulphydryl) groups in proteins, peptides and amino acids. Primary anti-pimonidazole and anti-CCI-103F antisera bind to these adducts allowing their detection by immunochemical means. See [www.hypoxyprobe.com](http://www.hypoxyprobe.com) for mechanism of action and frequently asked questions (FAQ) about the use of Hypoxyprobe™ markers in general.

2) Non-crossreacting rabbit antisera that bind to protein adducts of reductively-activated pimonidazole (PAb2627) and CCI-103F (PAbF6) are supplied as diluted antisera containing 0.09% sodium azide and 1% BSA as stabilizers. Tissues of interest can be studied by immunohistochemistry on formalin fixed paraffin embedded sections or frozen fixed sections; flow cytometry following tissue disaggregation; or, Western blotting. The antisera bind to protein, peptide and amino acid adducts of pimonidazole or CCI-103F in hypoxic cells but tissue processing for immunohistochemical assays washes out peptide and amino acid adducts so that immunohistochemical detection relies on protein adducts of pimonidazole or CCI-103F in hypoxic tissue.

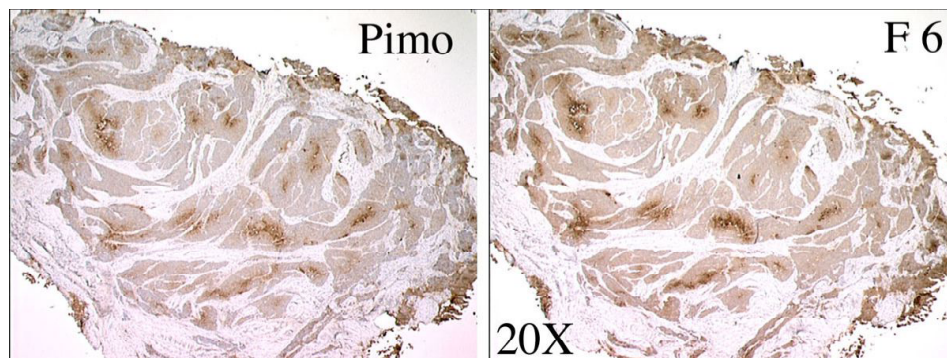
Immunoperoxidase analysis on consecutive, formalin-fixed, paraffin-embedded tissue sections involves incubating tissue sections with 100 microliters of a ca 1:500 dilution of either anti-pimoniidazole or anti-CCI-103F antisera. A chromogenic secondary goat anti-rabbit secondary is then applied to reveal the distribution of the hypoxia marker adducts. A detailed immunoperoxidase protocol is provided below as a general guide **but it is emphasized that Hypoxyprobe™ technology is robust and**

***investigator-initiated modifications are encouraged.*** Please see Ljungkvist et al., Int. J. Radiat. Oncol. Biol. Phys. 62(4): 1157-1168, 2005 and references therein for studies on frozen sections.

## **Assay Instructions**

Dual marker investigations in rodents begin with an intravenous infusion or intraperitoneal injection of an aqueous solution of pimonidazole HCl at a dosage of 60 mg/kg body weight (ca 1.5 mg/mouse). The solubility of pimonidazole HCl in saline is 116 mg/ml so that very small volumes can be used. Fifteen to 90 minutes later, an intervention that changes the extent of hypoxia is applied. Then, CCI-103F dissolved in 10% DMSO/90% peanut oil (see Ljungkvist et al., Int. J. Radiat. Oncol. Biol. Phys. 62(4): 1157-1168, 2005) at a dosage of 60 mg/kg is injected intraperitoneally. Sixty to 120 minutes later, the tissue of interest is harvested. A dosage of 60 mg/kg for CCI-103F is less on a molar basis than that for pimonidazole HCl but this is compensated by a longer plasma half-life for CCI-103F ( $t_{1/2}$  = 90 minutes versus 25 minutes for pimonidazole in mice).

Following injection, Hypoxyprobe™ markers distribute to all tissues but form adducts with thiol containing proteins, peptides and amino acids 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. Normal tissues such as liver, kidney and skin possess cells at, or below, a  $pO_2$  of 10 mmHg and these tissues will bind Hypoxyprobe™ markers. Unbound Hypoxyprobe™ markers residing in tissues at the time of harvest will be activated and bind when dissected tissues go anoxic. However, residual Hypoxyprobe™ marker concentrations are very small compared to the amount that tissues are exposed to during a typical experiment so that any non-specific binding from residual Hypoxyprobe™ marker at the time of tissue harvest 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)).



**Figure.** Gemini Kit used to compare orally administered pimonidazole (Pimo, left hand panel) and intravenously administered CCI-103F (F6, right hand panel) in adjacent tissue sections in a single tumor biopsy from tumor bearing dogs. Non-cross reacting rabbit antisera to pimonidazole and CCI-103F adducts in the Gemini Kit permit an independent assessment of the binding of the two markers (Kleiter et al., Int. J. Radiation Oncol. Biol. Phys. 64(2): 592-602, 2006).

**Suggested protocol for immunoperoxidase analysis using dual hypoxia markers on contiguous sections of formalin fixed paraffin embedded tissue.**

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		RT	Clear-Rite 3	1
3	"		RT	100% Ethanol	
4	"		RT	95% Aqueous ethanol	
5	"		RT	80% Aqueous ethanol	
6	"		RT	0.2% Brij 35 in distilled water	2
7	"		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	40	40°	Target retrieval reagent	5,6
11	Wash	2	0°	PBS + 0.2% Brij 35	7
12	Block non-specific binding	5	RT	Protein blocking agent	8,9
13	Pimonidazole or F6 antisera	40	RT	Primary antisera (1:200-1:500)	10
14	Wash	2	0°	PBS + 0.2% Brij 35	7
15	Anti-rabbit 2 <sup>uh</sup> reagent	10	RT	DAKO anti-rabbit polymer HRP	11
16	Wash	2	0°	PBS + 0.2% Brij 35	7
17	Peroxidase chromogen	10	RT	DAB peroxidase substrate	12
18	Wash	2	RT	Running distilled water	
19	Counterstaining	0.5	RT	Hematoxylin	13
20	Wash	2	RT	Running distilled water	
21	Mount & dry slides	20	RT	Crystal Mount	14

**Technical Notes**

1. For deparaffinization (step 1), hydration (steps 2-7) and peroxidase quenching (step 8), slides are held vertically. ProbeOn plus slides (Cat# 15-188-52) and a MicroProbe Staining Station, both from Fisher Scientific, are suitable for these steps. Clear-Rite 3, a less toxic alternative to xylene, is available from Richard-Allan Scientific, Kalamazoo, MI (Cat# 6901).

*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).

5. Antigen retrieval agents such as Chemicon International Cat# 21545 or DAKO Cat# S2369 can be used.

6. Slides held vertically in slide incubator.

7. Slides washed with magnetically stirred PBS + 0.2% Brij 35 in a Coplin jar held on ice.

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

9. Slides held horizontally for steps 11-18 so as to limit non-specific, edge staining of the sections.

10. Rabbit antisera diluted 1:500-1:1000 in 10 mM PBS containing 0.2% Brij 35 or other suitable antibody diluant such as Chemicon International, Cat# 21544. Typically, 100 uL of diluted rabbit antisera 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 reagent is suitable including Chemicon International Cat# 20844.

14. Any commercially available mounting medium such as Fisher Scientific's Fluoromount (cat# OB100-01).

**Procedure for immunostaining dual Hypoxyprobe™ adducts in frozen, fixed tissues.**

Extensive fluorescence immunohistochemical studies of dual Hypoxyprobe™ markers has been published by Dr. A. J. van der Kogel et al from their laboratory in Nijmegen. For guidance please see Ljungkvist et al, Int. J. Radiat. Oncol. Biol. Phys., 62(4): 1157-1168, 2005 and references therein.